# Locomotive Engineering.

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# LOCOMOTIVE ENGINEERING.

A Practical Journal of Railway Motive Power and Rolling Stock.

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## A Case of Doubt.

Here is a picture familiar to all railroad men of experience. This is no fancy sketch, but was taken from a photograph of a little circumstance on a New England road not very long ago. The graveyard in the background is very suggestive. The N. Y., W. S. & B. car was away from its home road,

It is doubtful if anybody was indicted for the casualty.

It is doubtful if the operating officer did not discharge some one to shield his office, and officially locate the responsibility—off of himself.

It is doubtful if the company allowed its employés to telegraph any particulars home.

It is doubtful if the brakeman didn't say

It is doubtful if he was really asleep after it happened.

It is doubtful if block signals would not have entirely prevented the mishap.

It is doubtful if this road don't have enough of this every year to pay for signals for a good part of the road.

It is doubtful if you can get the management to see this.

paper statement that the dear ones died a the post of duty—perchance with a han on the throttle.

It is doubtful if you don't get into a cas like this some time yourself.

It is doubtful if the same thing don happen again to-night or to-morrow.

It is doubtful if anything is done abou it if it does happen.


"IN CASE OF DOUBT TAKE THE SAFE SIDE."

laden with grain, but when it came to a case of doubt it took the safe side—in this case, the top side.

How many, many of these cases there are! Very often the engineer and fireman are killed; that's to be expected. It is doubtful if they escaped in this instance.

It is doubtful if this train had automatic power brakes.

It is doubtful if the brakeman of the first train was out the proper distance with a flag.

he was real sorry that the boys got killed, and that they ought to have jumped.

It is doubtful if he said he was not out far enough.

It is doubtful if all hands told the truth about speeds and distances.

It is doubtful if the conductor didn't swear that he ordered the flagman out more than the regulation distance.

It is doubtful if the conductor was really awake when it happened.

It is doubtful if the railroad commissioners did anything about it.

It is doubtful if the Legislature does anything to prevent accidents of this class.

It is doubtful if there won't be thousands more men murdered in these wrecks before legislation compels brakes, blocks and couplers.

It is doubtful if the families of the butchered men find any consolation in the news-

To clean your headlight keep a bottle of lamp-black and alcohol on your engine. Common wood alcohol is good enough. Mix about as thick as paint and apply with a small piece of waste. The alcohol evaporates at once and leaves the lamp-black dry, which, when wiped out, leaves a clean reflector without hard work.

Preserve this paper; the premium list will not appear again.

1635


iow many of the younger machinists and machinists' apprentices who read LOCOMOTIVE ENGINEERING, have, I wonder, thought how they would proceed, if given the task of laying out, drilling and putting in place a back cylinder head. Of course this would not be so difficult a job to do if jigs were available, to which the head could be drilled. But all shops do not have jigs, and a machinist may often be called upon to do work of this kind when very few tools are provided.

We will assume that we are working in the roundhouse at some division terminal, where the only machine tools provided are

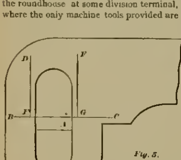


Fig. 5.

a drill press, a small lathe and planer, and that an engine comes in with the right back cylinder head badly broken. One is sent to us from the main shops, but it is only finished in the lathe and is not drilled for the studs or guide-blocks. How shall we lay it out properly?

Some one may say, "lay it out from the old head," but this is not possible to do in all cases. The old head may have been broken too badly, then too, the old head may not have been properly put up in the first place. The best way I think, is to have ideas of our own relative to these matters; then we are independent.

Now we know that the joints will have to be ground, so we will first remove all of the studs which fastened the head to the cylinder, then with two pieces of wood and two bolts make a clamp, like Fig. 1, and fasten it around the neck of the cylinder head. Then thread each end of a rod or use a bolt long enough to pass through the cylinder and head, when the head is in place. After applying oil and emery to the joints, fasten the head to place by passing the rod or bolt through a plate of iron, long enough to span the front end of the cylinder, then pass the rod through the cylinder and head, fasten it at the back end by passing it through a plate of iron, of sufficient length to span the stuffing-box in the head. The head can then be turned and ground by the use of the wooden clamp, previously adjusted. The necessary pressure can be given by tightening the nut on back end of rod.

After the joint is perfect we can easily determine which part of the head should go to the top of the cylinder by the position of the clearance space cast in it, for, with the head in place, this space should conform with the steam port in the cylinder.

Now dampen some lamp black with oil, (do not have it too thin) and apply a very light coat of the mixture all around the inner edge of the joint on the cylinder, also around each stud-hole and outer edge of the flange, and with the lamp black also make two fine lines, A B, Fig. 2, across the face of the flange, one at each end of the steam port. Now take a piece of stiff wrapping paper large enough to cover the end of the cylinder, and having the helper hold it firmly to place, rub the surface of the paper with your hand over all points where it touches the flange; this will give you on the paper a clear impression of all stud-holes, marks A B, etc.

Remove the paper now and cut out the center and outer circumference, being careful to cut close to the lines, then with a lead pencil make a dot in the center of each stud-hole impression. Now lay the template on the head, being careful to lay the side with marks on toward you, and

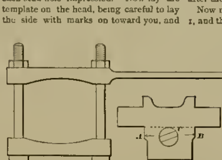


Fig 1.
Fig. 4

having the lines A B, one at each end of clearance space; then have the template held firmly to place while you with a fine center-punch, mark over each pencil dot a punch mark through the template into the head; remove the template and from the punch marks lay out the stud-hole .02" larger than the studs. Now drill them to the marks, replace the studs and you will find on trial that the head will slip to place nicely.

Fasten it to place with a nut at the top, bottom and each side, then on a stick or piece of flattened copper wire, driven firmly into the stuffing-box, get the center of same. Now place a straight-edge on top of the frames just back of the cylinder, of sufficient length to reach from frame to frame, and to this adjust a level; it does not matter if the engine is not exactly level, if care is taken to adjust the level to the straight-edge.

Fasten the level now on the top of a shorter straight-edge (being very careful not to reverse the level from its former position when adjusted to the long straight edge), and place the short straight-edge with the level on it against the face of cylinder-head flange to which the guides are attached, adjust the straight-edge until the level is correct, and along its top edge, through the center of the stuffing-box, scribe line A B, Fig. 3, and also through the center scribe line, C D, at right angles to line A B. These lines now form the foundation from which we will work, for we know that line A B is level with the engine and that line, C D is plumb with it.

Now the distance that the guide-blocks should be apart on the head might be determined from the position of those in the guide-yoke, but the yoke might also be broken, and we will consider such to be the case in the present instance, and that the entire head has been renewed, planed up and sent to us without having the holes drilled for the blocks.

We will now turn our attention to the crosshead and must bear in mind that when all parts are in place the center of the hole into which the piston-rod fits in the crosshead, must be exactly in line with the center of the stuffing-box in cylinder-head. So after centering the hole in crosshead we will span with our dividers from this center point to point A, Fig. 4, and from center of stuffing-box, Fig. 3, mark this distance to the *right* of center on line A B; then from this mark scribe line E F, parallel with line C D; now do likewise with distance from center point in crosshead to point B, Fig. 4, and scribe line G H, Fig. 3, parallel with line C D; then across the end of the crosshead and just flush with the lower bearing surfaces of each lug scribe dotted line C, Fig. 4, and from the center of hole set the dividers 1/16" *above* line C. This is to allow for a 1/16" liner between each bottom guide and block.

Now from points F and H, on line A B, Fig. 3, mark this distance on lines E F, and G H, and from the marks thus made, scribe lines I J and K L, parallel with line A B.

When the blocks are in place their inner edges should be flush with lines E F and G H, and their lower faces flush with lines I J and K L. All of the lines should be scribed lightly so they can be filed out after the holes are drilled.

Now mark the top of the outer block, No. 1, and the top of the inner block, No. 2, and from the inner edge of block No. 1, space the distance to the center of the lug by which it was secured to the head, and to the right of line E F, and parallel with it, mark this distance. Now get the distance from the bottom surface of the block to center of lug and above and parallel with line K L, mark the latter distance on the head. Proceed in like manner with block No. 2, only scribe to the left of line G H and above line I J. The points of intersection of the four lines last made are the points for the center of the holes for the block lugs, and the holes should be drilled and reamed to warrant a snug driving fit of the block-lugs.

The holes over the piston gland studs can now be located on line A B or C D, as the case may require, the head will then be ready to drill; but before removing it we will remove the center stick of the stuffing-box, bolt the yoke to place and run a fine line or wire through the cylinder and secure it to the yoke by hanging a weight to it after passing it over the stick A, Fig. 5, driven firmly into the slot through which the main rod plays; now center the line from the counter-bore in front end of cylinder and stuffing-box in back-head; then with the short straight-edge, with level on it, we will scribe on the forward side of the yoke, line B C, just flush with the line through the cylinder; then mark

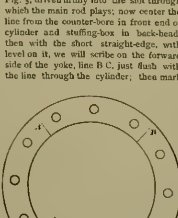


Fig. 2.

on stick A a point at which the line through cylinder rests on it; remove the line or wire and proceed to lay out the holes for the back blocks, in exactly the same manner as we did those for the forward blocks on the head, after which both yoke and head can be removed and drilled, and before replacing them, after the drilling is done, each block should be fitted to place, for when again put up they should remain in place. When both are finished and bolted to place we are ready to line up the guides, and upon this subject, perchance we will have something to say in the near future.

## The Life and Services of Isaac Dripps, the First Superintendent of Motive Power in America.

There are, perhaps, a hundred men in the United States, who bear the official title of Superintendent of Motive Power, and not less than five hundred who are Railway Master Mechanics, having in charge the thirty-odd thousand locomotives of our land and the crews that man them.

To all of these, we are sure, a brief outline of the life of the first man who bore the title of Chief of the Motive Power department of a railroad in this country will be interesting.

This man is Mr. Isaac Dripps, who still lives and watches the progress of locomotive engineering with interest, as he has watched it from its birth, now more than sixty years.

Mr. Dripps was born April 17th, 1810. When living in Philadelphia, while quite a young lad, he used often to visit the city water works and sit for hours, watching the pumping engines, especially the English engine with its large walking-beam, moving up and down, to him without any apparent cause. It was during these visits that the desire to know how to make and operate such machines, took forcible possession of his youthful mind.

At sixteen years of age, he apprenticed himself to Mr. Thos. Holloway, who at that time had the largest establishment in the city of Philadelphia for building machinery for steamboats.

During Mr. Dripps' apprenticeship, Mr. Holloway built the engines and machinery for quite a number of steamboats, both large and small. Among the number were the "Albany" and "New Philadelphia" for the Stevens New York and Albany line; the "New Castle," "William Penn," "Wilmington" and "Robert Morris" for the Delaware River lines, and a number of ferry-boats for the ferry between Camden and Philadelphia.

Mr. Dripps had full charge of fitting up and erecting the machinery of the "Wilmington" and "Robert Morris."

He had also charge of the erection of the machinery of the steamboat "Kensington," and of its management before and during the trial trip of the boat. Steam was raised in the boilers and the engine revolved under his direction while yet the steamboat was on the ways, and, as soon as launched, she made her trial trip, under steam, up the river. It is believed that this is the first time such an occurrence ever took place.

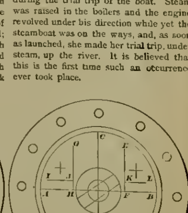


Fig. 3.

The last work done by Mr. D. as an apprentice was in New York, in charge of extensive repairs to the machinery of the steamboat "Swan." Upon the completion of this work in April, 1821, he was twenty-one years old.

In the month of August, 1831, Mr. Robert L. Stevens, President of the Camden & Amboy R. R. Co., engaged him to take charge of the locomotive "John Bull," which had just arrived at Philadelphia from England. Mr. Dripps had the locomotive put on board a sloop, taken to Bordentown, N. J., and then hauled by wagon to a piece of railroad track, about three-fourths of a mile long, near Bordentown. Here the locomotive was placed beside the track and a shed built over her.

Here Mr Dripps put the machinery of the old "Johnny Bull," together." He had never before seen a locomotive and had no drawings or other directions to guide him, but he studied the details out successfully

The engine was not provided with a tender, and for this purpose our mechanic found a small four-wheeled car. To the platform of this car he fastened a small whisky cask, that he had purchased at a Bordentown grocery. For a hose to connect the tank and engine, he called in the services of a shoemaker, who made a leather pipe for this purpose. Thus equipped, the little engine was ready for service.

In November, 1831, the members of the Legislature of New Jersey were invited to Bordentown to be convinced that a locomotive would actually pull cars on a rail.

They accepted, and on November 12th, 1831, Mr. Dripps had the cars and engine ready, and ran back and forth on the track built, carrying the Solons of the State and many interested citizens. This was the first time that a train of cars had been moved by steam in New Jersey, and the event was celebrated on November 12th, 1891, by the unveiling of a monument on the spot where Mr Dripps and the "John Bull" first started on their careers—60 long years before.

The following winter Mr. Dripps went to the company's shops at Hoboken to take charge of the building of new locomotives. During the summer and winter of 1832-33 they built three locomotives, and in March, 1833, Mr. Dripps took these locomotives to South Amboy, where a portion of the road was completed. During the summer these engines were used to haul materials, and as a school to teach men to run and care for them. Firemen runners hadn't been made then.

During the latter part of the year four more locomotives were turned out of the New York and Hoboken shops, and were put upon the rails at South Amboy, making eight engines that the road owned. Late in the fall of 1833 the company commenced to haul passenger trains by steam; previous to this they were hauled between Bordentown and South Amboy, a distance of thirty-five miles, by horses. From this time on Mr. Dripps was superintendent of machinery of the Camden & Amboy road, and also had charge of all repairs to the steamboats of the company on the Delaware river. He also made most of the experiments for the famous Stevens' Steam Battery, and was generally in the confidence and mechanical adviser of Mr. R. L Stevens.

One of the locomotives sent out from the New York shops was the "Monster" (fully illustrated in our issue of February, 1890). This engine had a boiler designed for burning anthracite coal, but she was a poor steamer. Mr. Dripps rebuilt her, raised her grates, put grates in her combustion chamber, firing it from the side, he used a circular box exhaust; this box was full of small jets, designed to fill the stack, and a tapered open stack was adopted; this arrangement increased the steaming capacity of the engine very satisfactorily.

In 1845 Robt. L. Stevens, president of the C. & A. R.R. Co., visited England and there saw locomotives with very large driving wheels; on his return home he ordered Mr. Dripps to design a locomotive with driving wheels eight feet in diameter, with a boiler burning anthracite coal and capable of making forty miles per hour.

The drawings were completed and approved in 1847, and the engine was built by Richard Norris & Sons, of Philadelphia. The cylinders were 13 inches in diameter and the stroke 34 inches, the single pair of drivers were eight feet in diameter and located behind the fire-box. This was the first time that hard coal was used for high speed engines. This engine had a six-wheeled truck in front. (Illustrated in our issue of February, 1889.)

When this locomotive had been in use for some time Mr. Dripps saw very clearly that one pair of wheels with the light load carried did not give sufficient adhesion to haul the heavy passenger trains then running, and opposed the further use of the class, but was overruled, and several more of the class were built.

In 1852 Mr Dripps designed a boiler for one of these eight-footers, with cylinder 14 x 38 inches, which had a device under the throttle in the dome to prevent carrying water over into the cylinders; this was very similar in its operation to the modern centrifugal separator, the water was thrown off a curved plate or deflector and returned to the boiler.

This boiler also had two sets of tubes with a combustion chamber between them, almost identical with the very latest boiler turned out by Mr. Webb, of the London & Northwestern. The smoke box of this engine also had a modern deflecting plate and a high nozzle, designed by Mr. Dripps.

Mr. Dripps designed, built and used, on engine No. 2, in June, 1833, the enlarged stack, with a cone and inside pipe.

To Mr. Dripps, also, belongs the credit of designing and making the first successful single screw for propelling vessels. This screw was put in place of a double screw made by John Ericsson, in England, in 1839, and imported by Commodore Stockton This single screw of Mr Dripps had six blades. It was used with entire success for many years, and was, practically, the screw now in use This screw was shown and its history was told in these columns in January, 1891

In 1853, Mr. Dripps resigned as Superintendent of Motive Power and Machinery of the road, a position he had held for twenty-two years, and became one of the partners in the Trenton Locomotive and Machine Works, at Trenton, N. J., but in 1858 the company dissolved owing to financial difficulties.

In 1856, while at Trenton, Mr. Dripps designed for the Belvidere & Delaware R. R Co., the wide-tread wheel for running on tracks of either 4 feet 8½ inches or 4 feet 10-inch guage

In 1857, at the same works, he designed and built for the Lehigh Valley R. R Co., an iron freight-car truck, the first of the well-known diamond-framed trucks, now almost universally used on freight cars in this country.

In January, 1859, J. Edgar Thompson, President of the Pennsylvania Railroad, offered Mr Dripps the position of Superintendent of Motive Power and Machinery of the P., Ft. W & C. Ry. Co., and he took charge the following month.

The road at that time was, financially, in a very bad condition, and soon after went into the hands of a receiver. Upon its reorganization it was determined to operate the mechanical department in two divisions, and Mr. Dripps was given the Western Division with headquarters at Ft. Wayne, Ind.

No man ever took charge under more adverse circumstances, the road was not earning operating expenses, the shops were old and full of dilapidated tools from an old car shop; the road had been laid with mud sills on prairie soil without ballast, and the locomotives were of old style and pretty well worn out.

After the reorganization, affairs brightened gradually and better facilities were provided accordingly. Subsequently, new shops and a large roundhouse, all of Mr. Dripps' designs were built at Fort Wayne. These shops were fitted out with the best and most modern of tools, especially in the car shops, where the frames of cars were finished by machinery so perfectly as to be interchangeable. The tools for this purpose were all of Mr Dripps' design and were built in the shops there These shops had the reputation at that time, far and near, as being far in advance of anything in the country—the model shops

In 1869, after a service of ten years, Mr Dripps retired from the position on full pay. When the Pennsylvania R R. Co. leased the Fort Wayne road, President Thompson appointed Mr Dripps "Inspector of Shops, Tools and Machinery of the Main Line and Branches of the P R R System, and all lines owned, operated and leased by it."

Mr Dripps made many minor changes in the shops and in shop methods, so as to bring the same system and the same uniformity of work into practice in the shops He closed up the shops at Mifflin, Pa, as unnecessary, and removed the tools to other shops, and generally concentrated the work

He had charge of erecting the new car shops and iron foundry at Altoona and in selecting the tools, these were then the most extensive railroad shops in the coun-

try On the Panhandle system he equipped the new shops at Logansport, Ind, with new tools.

When Mr A J. Cassatt became General Superintendent of the P. R R, Mr. Dripps was appointed General Superintendent of the M P & M, with headquarters at Altoona The arduous duties of this office, combined with that of superintending the erecting of the new shops, very seriously im- ed his health and caused his resignation resident Thompson, not wishing to his services, gave him lighter work perform, and sent him to the Northern Central to assist J N Du Barry, General Superintendent, in erecting new shops at Baltimore

While in this service Mr Dripps made some very valuable experiments, at the request of President Thompson, with three classes of locomotives—eight-wheeled, ten-wheeled and consolidation to ascertain the amount of frictional resistance of each class in passing around a curve The dynomometer used in making these experiments was designed by Mr Dripps The final experiments were made with engines belonging to the Philadelphia & Erie Road, upon the Shintown curve, near Renovo, Pa., this is a 4-degree curve, 1,432-foot radius.

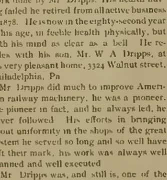
These engines are now the standard freight locomotive of the P R R., and are known as class *R*.

These experiments constituted the last work done by Mr Dripps. His health having failed he retired from all active business in 1878. He is now in the eighty-second year of his age, in feeble health physically, but with his mind as clear as a bell He resides with his son, Mr. W A Dripps, at his very pleasant home, 3324 Walnut street, hiladelphia, Pa

Mr Dripps did much to improve American railway machinery. he was a pioneer. e pioneer in fact, and he always led, he never followed His efforts in bringing about uniformity in the shops of the great system he served so long and so well have left their mark, his work was always well planned and well executed

Mr Dripps was, and still is, one of the most modest and retiring of men, claiming nothing for himself Had he taken out patents for his numerous inventions, for both locomotives and steamboats, he might have made an immense fortune

All over the land there are old railroaders who served under Isaac Dripps, and we are sure that one and all of them will be glad to see his face here and join us in wishing the grand old mechanic a merry Christmas and a happy New Year, and in expressing the wish that he may live to see a round hundred of them



No. 1.

## Stuck Inside a Boiler.

The story is told of a misanthrope who confessed on his deathbed that life to him had been a failure, because his hopes of seeing a great train wreck were never realized He dwelt beside a railroad where there was a sharp curve over a deep ravine, and day after day he spent watching for the passenger train that would jump the track on that curve and make devastation in the chasm. The train never jumped the track and the old man went to his grave disappointed.

"I must confess to a feeling something akin to that of the man of that story," said John Pastor the other day, while paying a visit to this office. "I once spent a night in a boiler because the hole seemed to get smaller after I got in, and I have been waiting to hear of some unfortunate getting incarcerated for life in one of those iron prisons. I have just heard of a case which is likely to be as near what I have been waiting for as anything is likely to be

"The experience came to Daniel Donlin, engineer of the Colonnade Hotel, New York City, who went into the boiler to do some work He fattened on the job, and when he tried to come out he stuck. The people tried to pull him out, but he could not come, except by pieces. The end was that boilermakers had to be sent for, and they cut a strip out of the manhole, making it large enough to let Donlin slip through."

## Testing Car Roofs.

There is now being conducted at the C B & Q Laboratory, at Aurora, tests of the several plastic car roofs in the market

There are two samples of each, about 4 feet square These have been weighed and been put down on the roof of the building One piece exposed to rain and shine, the other with a covering of boards the same as in service These pieces will again be weighed when taken up

Another way of testing is this They have taken a small section of each roofing material, weighed it, and put it in a jar of water separately, where it will be kept and any action will be noted. These will also be weighed when taken out.

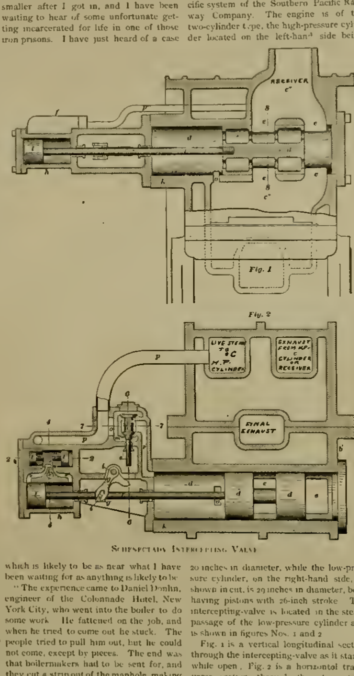
Their engineer of tests is also by chemical analysis determining just how much pure asphalt or coal tar there may be in the material

This test was instituted November 1st, and it is not known just when it will be concluded, but not until superior merit is demonstrated

About six or seven manufacturers have contributed to this test.

## Schenectady Compound Twelve-Wheeler.

The accompanying engraving illustrates a heavy twelve-wheel compound locomotive recently built by the Schenectady Locomotive Works for service on the Pacific system of the Southern Pacific Railway Company. The engine is of the two-cylinder type, the high-pressure cylinder located on the left-hand side being




SCHENECTADY INTERCEPTING VALVE

20 inches in diameter, while the low-pressure cylinder, on the right-hand side, as shown in cut, is 29 inches in diameter, both having pistons with 26-inch stroke The intercepting-valve is located in the steam passage of the low-pressure cylinder and is shown in figures Nos. 1 and 2

Fig. 1 is a vertical longitudinal section through the intercepting-valve as it stands while open, Fig. 2 is a horizontal transverse section through the intercepting-valve, and showing also the auxiliary mechanism employed for operating the valve and for regulating the admission of high-pressure steam to the low-pressure cylinder. The intercepting-valve D D is operated direct by the piston valve L. In both the figures the intercepting-valve is shown open, with the steam passages E E unobstructed, and therefore in the position it occupies when the engine is working compound. When the valve is in this position there are no means for live steam to pass into the low-pressure cylinder.

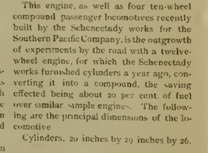
In starting, the operation is as follows The pipe P is connected at C with the steam-pipe leading from the boiler to the high-pressure steam chest On the throttle valve being opened, steam passes through the pipe P into a small supplementary steam chest, which leads it into the auxiliary steam chest N between the pistons T T. The piston T in this steam chest, being of greater area than the piston T, the valve V is moved to the right, opening the left port X The steam passing through that port pushes the piston L to the right, moving in the same direction the intercepting-valve D D, and closing the steam passages E E In moving to the right, the piston-rod of the intercepting-valve operates the elbow-lever G, which strikes the rod of the puppet-valve V and admits live steam through the port O and passage P into the cylinder D', and hence through the port O to the steam chest of the low-pressure cylinder. The intercepting-valve, as before stated, being now closed, the tendency of the live steam is to push it up against the seat, closing the receiver.

The changing from simple to compound working is done automatically. When a certain pressure is attained in the pipe that leads the exhaust steam from the high-pressure to the low-pressure cylinders (that is in the receiver), the steam passes through the pipe P (fig. 1) to the supplementary valve already mentioned, and being sufficient to overcome the force exerted by the high-pressure steam on a smaller surface, moves the valve back and opens the passage that admits steam to the right of piston-head T of the auxiliary valve This is forced to the left, admitting steam to the right of the piston L, which is moved to the position shown in the illustrations. At the instant the intercepting-valve and its connections move to the right the elbow-lever G lets the puppet-valve V drop, and direct steam is cut off from the intercepting-valve and the low-pressure cylinder. The actual operation is much simpler than the description.

Two, from a number of indicator cards taken from the engine while pushing trains up a sixty-foot grade on the New York Central Railroad out of Schenectady, are given, showing a very even distribution of power in the two cylinders. The cut-off is somewhat earlier in the high-pressure cylinder than in the low-pressure cylinder, the proportion of cut-off being as 40 to 50 at half-stroke. Card No. 1 was taken when the engine was making one hundred and thirty-six revolutions per minute, representing a piston speed of 589.3 feet. The boiler pressure was 195 pounds and the horse-power developed was 820. The other card was taken at 96 revolutions, boiler pressure 145 pounds. The cards show a remarkably good distribution of steam

This engine, as well as four ten-wheel compound passenger locomotives recently built by the Schenectady works for the Southern Pacific Company, is the outgrowth of experiments by the road with a twelve-wheel engine, for which the Schenectady works furnished cylinders a year ago, converting it into a compound, the saving effected being about 20 per cent. of fuel over similar simple engines. The following are the principal dimensions of the locomotive

Cylinders, 20 inches by 29 inches by 26.



No. 2

Valves (Richardson-Allen), $5\frac{1}{2}$ inches travel

Steam port, high-pressure, 2x18 low-pressure, 2x20

Exhaust ports, high-pressure, $3\frac{1}{2}$x18; low-pressure, $3\frac{1}{2}$x20

Bridge, high-pressure, $1\frac{1}{4}$, low-pressure, $1\frac{1}{4}$.

Outsid [illegible] n-pressure, $\frac{7}{8}$-inch, low-pressure [illegible]

Inside [illegible], high-pressure, $\frac{1}{4}$-inch, low-pres [illegible] inch

Boiler—Wagon-top, 60 inches diameter at smoke-box end; shell, 9-16-inch steel; fire-box, 104 inches long, 43 inches wide, 61 inches deep, tubes, 270, 2 inches diameter, 12 feet 8 inches long.

Heating surface—Tubes, 1,779 sq. feet, fire-box, 156 square feet, water tubes, 12 square feet, total, 1,947 square feet. Grate surface, 31 square feet.

Working pressure, 180 pounds of steam per square inch.

The engine has swing-bolster truck, with journals 5 inches by 9 inches, drivers, eight-coupled, 51 inches diameter, outside of tire, the second and fourth pair being flanged, while the first and third pair are plain. The driving-journals are 7½ inches by 8½ inches. Total wheel-base of engine is 23 feet 7 inches; driving-wheel base, 13 feet 9 inches, rigid-wheel base, 9 feet 2 inches, total wheel-base of engine and tender, 49 feet 1 inch. Tank capacity for 4,000 gallons of water. Weight of locomotive in working order, 138,800 pounds of which 116,800 pounds is on the drivers.

If the superintendent of each locomotive shop in this country was obliged to get on to one of his own locomotives, going at the rate of ten miles per hour on a dark night, it would result in the immediate adoption of larger and better designed steps—or some funerals. The little, oval, cast-iron, pad on the end of a rod, often loose, stuck under the tank frame, made in such shape as to collect ice and coal, is a trap. The usual step hung on the tail piece of the engine frame is only useful to strike something and get bent. Little, cast, cab handles such as would be put on a barn door are not big enough or good enough for cabs—too much depends on them. All handles should be long, at least four inches from the cab and extending below the corner of it. Steps should be located on the tender frame, have double supports and be at least two feet long; have a back to prevent the foot from going over it and the bottom of open work to prevent the collection of snow, ice or coal. Men's lives depend upon these little things. A bent pancake turner don't make a good step for a locomotive.

For the first six months of 1891, there were 583 persons killed and 5,656 injured on British railroads, but of this number, 36 were killed and 3,280 injured by other causes than moving trains.


Compound Twelve-wheeler, for the Southern Pacific.

## The Purification of Water for Locomotives.

BY GEORGE GIBBS.

That this question comes up periodically for discussion by those interested in railway motive power is testimony to the vitality of the causes, at least, if not to the value of the results obtained from the numberless "processes" advanced. Each time the subject is before a railway club or master mechanics' association more or less desultory discussion is indulged in and stories told of hard times with the "worst water in the country," samples of scale exhibited. It is difficult to understand, from all accounts, how their locomotives are kept in condition to pull trains and yet, when remedies in the form of "purges," "scale-looseners" or "compounds" are proposed, interest in the subject flags and the man who advocated the deadly (?) "chemicals" feels that he has been sat upon.

Now, master mechanics are thoroughly alive, as a rule, to opportunities for saving a small portion of the coal and repair bills, and there seems to be a pretty general impression that these items are not a little increased by the use of bad water, how then, does it happen that all hesitate to take up some of the rational processes proposed for the purpose? The reason seems to be in the somewhat mysterious action of the device, and a doubt, arising from unintelligent trial, whether it will accomplish the purpose. The question of cost is not discussed, as a rule, few being able to place the value of a clean boiler in actual figures.

There seems to be two legitimate headings under which to consider the subject. First, Will the process accomplish its purpose? Second, Will it result in a net saving to the road?

It is impossible, in this short article, to fully enter into the complicated chemical reactions involved in water purification. It will suffice for an understanding of the theory to say that the trouble most generally complained of is scaling tendencies. This scale is formed by the depositing, in a crystalline form of lime compounds, which are present in solution, in a greater or less degree, in all waters. This deposition takes place from the destruction of the solubility of the compounds by the heat in the boiler. Certain chemicals may, however, be introduced into the water, which will act upon the lime to form other and non-crystalline precipitates. It is these chemicals which constitute the so-called "purges" or boiler compounds. The lime is precipitated by their action in a granular or mud-like form, which does not adhere to the sheets, unless baked on by carelessness in drawing off the water while the sheets are hot, and which may be readily blown or washed out as a slime.

Now, as to the first point in the efficiency of the "compounds." Will they accomplish their purpose? This can be definitely answered in the affirmative. There are many cheap and harmless chemicals which thus act upon lime-salts in water, and always in known and calculable proportions. The precipitate is further formed, as above, as a sludge, and not as a scale. It is also beyond question that a boiler may be kept perfectly clean by the proper use of these agents.

As to the second heading of the problem, will the treatment pay? It would seem that this offers the rational point of attack for opponents of experiment in this direction.

The expense of the cleaning process is made up of several items, and may be quite definitely ascertained. Thus, we have, first, cost of chemicals for engine mile, including all expenses of making up and handling, second, cost of extra washing-out entailed, third, cost of fuel wasted by reason of frequent washing-out and the blowing-off on road. All of the above are on the wrong side of the ledger. Against these we have the saving effected. This is likewise made up of several items, but unfortunately their money value is seldom definitely, or quickly, at least, ascertainable. They are: First, saving in coal on account of better evaporation in boiler uncoated with scale, second, saving in boiler repairs, third, saving in delays on the road from leaking flues, etc.; fourth, obtaining increased hauling capacity by reason of better condition of boiler and the increased evaporation resulting from clean sheets, fifth, fewer days per year in shop for repairs—the monetary value of which is at times very great, sixth, absence of obstruction to careful interior examination of boiler as to the condition of its plates. It is not my purpose to work out this equation of expenditure and saving. To be applicable, it must be done for each individual case with the data best at hand. I have merely attempted to point out the elements to be considered, and attack the position which has been heretofore almost exclusively taken by master mechanics, that it does not pay to consider these processes, because they will not effect the object of keeping the boiler clean.

While it may be gathered from my remarks, here and elsewhere published, that I favor the intelligent use of a "boiler compound," I am not sanguine that we shall be able to show much or any coal saving through it. Many attempts have been made to figure the loss in evaporation caused by incrustation on the surface of the plates. "Wilson" cites one observer as stating that 15 per cent. more fuel is required with 1-16 inch scale than with clean sheets, 60 per cent more with ¼ inch and 150 per cent more with ½ inch scale. These results have the appearance of being arrived at from the relative heat conductivity of metal and scale, or if from a test at all, they are certainly absurd for locomotive practice.

If specific conductivity of different substances, within reasonable limits, has much meaning in boiler practice, we should certainly expect a very large increase in coal economy by the use of copper instead of iron or steel fire-boxes. Yet who has heard of a serious attempt to prove this the case? Poorer conductivity means simply raising the plates to a higher temperature in order to transmit a given quantity of heat, and consequently a rejection of the smoke-box gases at a somewhat greater temperature and with some resulting loss.

They tell a laughable story on two freight handlers on the Central Road in this city. They were sent up in the yard to get out "one roan horse," and boldly breaking open the seal and throwing the door back one of them climbed in, but fell out in a hurry and broke for high ground. His partner hurriedly shut the door and then went and "pecked" in the end grating to find that the occupant of the car was a rhinoceros, consigned to Barnum's circus. They had a four-horse van come up for the critter, and then found out that it was stuffed.

There is a very simple form of tool-grinding machine made by the Gisholt Machine Co., Madison, Wis., which is highly spoken of by those who use it.


[When you are reading articles of especial merit from the pen of a co-worker, it adds to the interest to know something about the man

Harris Tabor was born near the city of Buffalo, N. Y., in 1843

At the age of sixteen he entered a machine shop at Tioga, Pa., as an apprentice, where he worked a year.

On the breaking out of the Civil War he enlisted, May, 1861, and served through the struggle.

After the war he went into the machine shop of S W Payne, Troy, Pa., where he worked one year under instructions In 1867, he went into the shops of B W Payne & Sons, of Corning, N. Y., now of Elmira, as journeyman, and remained with this concern for some fourteen years, having in the last years served as general foreman This firm built steam engines of all sizes, especially small ones, and have probably turned out as many as any concern in the country

In 1876, in conducting experiments with steam engines, Mr Tabor saw the need of a better indicator than was then made for high speed engines, and made the first of the now well-known Tabor indicators, these instruments are made in this country by the Ashcroft Mfg Co at Bridgeport, Conn and in Europe by John Musgrove & Sons, Manchester, Eng

In 1883, Mr Tabor accepted the position of Superintendent of the new shops of the Westinghouse Machine Co then perfecting the inclosed, single action Westinghouse engine This position Mr. Tabor held for two years.

Since that time he has been with the Tabor Mfg. Co., who make a specialty of sand-molding machines for metal castings. He is the inventor of the molding machine illustrated in our November paper The machines are manufactured at Elizabeth, where Mr. Tabor resides.—Eds ]

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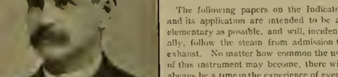
The following papers on the Indicator and its application are intended to be as elementary as possible, and will, incidentally, follow the steam from admission to exhaust. No matter how common the use of this instrument may become, there will always be a time in the experience of every man, when its mechanism and purpose will be new, it is to this period these papers are addressed.

As its name would suggest, its office is to determine the action of steam, doing work in the cylinder of a steam engine, or, in other words, to outline on a piece of paper, called the "card" or "diagram," a map of the various pressures exerted against the piston throughout the entire revolution An indicator card may be compared to the surveyors' profile or map of a railroad in its manner of conveying information. each has its base line from which calculations are made, and in each case the base line may be called zero. On the surveyors' profile, the zero or base line is a line representing sea level, or no altitude, and from this line all grades and elevations are estimated This map is drawn to a reduced scale, whereon an inch represents a much greater distance, perhaps miles, which is marked on the drawing so that one may take an ordinary rule and by measuring from the base line to the grade or elevation, readily find the exact height of any point on the road




The base line on an indicator card is called the vacuum line, or line of no pressure, which, at sea level, is 14 7 below the average pressure or weight of the atmosphere At greater elevations the air is lighter, and consequently the vacuum line is a trifle higher, but 14 7 lbs., is ordinarily used In analyzing an indicator card, this line must be considered, especially in dealing with a card from a non-condensing engine, where the pressure of the air is largely reduced by the condenser There is still another line on the indicator card which may also be considered as a base line, and which is quite as important as the vacuum line this is called the air or atmospheric line, and represents no effective pressure on a card from a non-condensing engine this line on the card is traced by the indicator pencil when air is on both sides of the indicator piston, and the spring in the indicator is under no tension

All the indicator springs are made to a known scale, that is, they are made so as to allow the pencil of the indicator to represent a given number of pounds of steam pressure for each inch of vertical movement, and, as in the case of the surveyors' map, one may put a scale on the card and accurately measure the pressure on the engine piston at any point in the stroke. He may also measure the back pressure or resistance due to the atmosphere. The air and vacuum lines are independent of any lines made by the indicator, and the condition of the engine or steam pressure has no influence on them

The lines on the diagram which are made by the steam are

First The admission line (sometimes called the lead line because it is the steam which passes through the valve lead which makes it) which is made by the upward movement of the pencil when steam is admitted to the cylinder through the opening of the main valve at the beginning of the stroke, when the valve has so much lead that it opens the port before the piston has reached the end of its stroke, the admission line will not be vertical, but will incline slightly outward; if the valve have lap, or negative lead, when the piston is on the center or at the end of its stroke, the admission line will incline inward, but if the main valve opens just as the piston begins its movement, the admission line will be vertical

Second The steam line is that line marked by the pencil after the piston has commenced its stroke and the steam is passing through the port; this line leaves at nearly a right angle from the admission line, and continues along the card until the cut-off takes place, that is, when the main valve has moved across the port and back again, shutting off the steam from the cylinder during the remainder of the piston's stroke; this line depends largely upon port opening and steam-pipe connections, and the velocity of the piston, when the port and pipes are ample, and the piston velocity not too great, the steam line is parallel to the air line, but in the majority of cases these conditions do not exist and this line falls off perceptibly, so much in some cases that the point of cut-off is hardly discernible on the card.

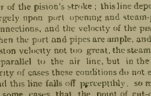
Third The expansion line is what its name would suggest, viz that line which is made by the indicator, after the cut-off has taken place, and the steam is doing work expanding, this line takes the form of a hyperbolic curve, and falls to a lower pressure, just in the ratio that the steam is expanded. (Cuts 1 and 2 illustrate the hyperbolic curve ) There is no line on the indicator card that posesses the interest of the expansion curve, it is the index of steam economy, and represents work done by the piston after the steam has been shut off, when compared with an engine that takes steam throughout its entire stroke, it means work done without cost It should be well studied, for it indicates good or bad performance in a steam engine

Fourth The release or exhaust line (often called the back pressure line,) follows the expansion line, in fact the expansion line runs into it the same as the steam line runs into the expansion line It is formed by the opening of the exhaust port and the flow of steam to the atmosphere in a non-condensing engine, and to the condenser in a condensing engine It takes a rounded form while the engine is passing the center, then makes a line nearly straight, and nearly parallel to the air line, until it is lost in the compression line or curve; its proximity to the air line depends upon pipe and port openings and piston velocity. This is also an important line showing loss of power It is always well to have this line approach the air line as nearly as possible, as the greater the distance between the two makes the loss greater.

Fifth When the exhaust valve is closed on the return stroke the steam remaining in the cylinder cannot escape, and the movement of the piston forces it into a smaller space, compressing it to a higher pressure; in some cases, where an engine is linked up, or the clearance is very small, even higher than the pressure in the boiler. This line runs into the admission line and it is sometimes difficult to tell where the compression line ends and the admission begins.

Fig No 3 is an indicator card showing very clearly all the lines on the diagram In considering this it must be kept in mind that the air and vacuum lines are not a part of the diagram made by the steam pressure

The pressure of a perfect gas, when confined, varies inversely with its volume, that is, its pressure decreases in direct proportion as its volume increases. This may be graphically illustrated by the cylinders, fitted with air-tight pistons, shown in sketch. If we could get a piston that had neither weight nor friction and put it in cylinder No. 1, it would remain in the position shown, because it has air above and below it. If we put a weight on the piston, it will go down in the cylinder until it has compressed the confined air equal to the weight, and a balance between the two forces has been established; if we again put a weight on the piston, there will be another downward movement, but less than the first, because the air beneath the piston is under greater pressure due to the first weight; we may continue to add weights and we will find that each succeeding weight will force the piston down less When the piston has reached the position shown in number two, it has passed through $\frac{4}{5}$ of the volume and has compressed the air five times, or atmospheres, making the pressure 90 lbs above vacuum and 75 above atmosphere; its volume has been decreased five times and its pressure multiplied by that number. If we now take off the weights the piston will take an upward movement corresponding to the downward If an indicator had been attached to the cylinder before the weight was taken off, and a piece of paper put on the drum, the pencil would have marked on the paper a line representing the pressure throughout the whole movement of the piston, and this line of pressures would have been the curve marked hyperbola An examination of the curve will show that the increase in pressure is precisely the reverse of the decrease in volume This diagram resembles a card from an engine without clearance or



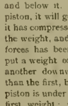


FIG. 1

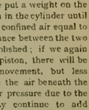


FIG 2

compression, cutting-off at ⅛ of the stroke, with an initial pressure of 75 lbs. above atmosphere.

This law of expansion is commonly known as Marriotte's, from the fact that it was discovered and published by him. The hyperbolic, or expansion line, is sometimes called Marriotte's curve

Steam is not a perfect gas, but is nearly so. When steam expands, doing work, it parts with a portion of its heat, causing condensation and loss of pressure For the sake of convenience and simplicity it will be treated as a perfect gas in these papers. For the same reason the pressure of the atmosphere was assumed to be 15 lbs. in plotting the accompanying pressure curve

Harris Tabor

## Passenger Trains for Passengers Only.

The article on "How to Accelerate Passenger Trains," from Mr John Player, Superintendent of Motive Power of the Atchison, Topeka & Santa Fé, which we publish this month, contains some suggestions that ought to receive serious attention from the railroad managers who contemplate increasing the speed of their passenger trains. Never in the history of the country was there such a tendency to accelerate trains as exists at present. Passenger business is increasing everywhere, and in all quarters preference is shown for the road that runs its trains through on the shortest time. The Empire Express on the New York Central and the special run made on that railroad, when the 436 miles between New York and Buffalo were passed over at the rate of a mile a minute, have demonstrated that exceptionally high speed can be maintained successfully on our lines, and has roused the craving of the public for faster trains. During the Columbian Exposition there will be great competition among railroads to secure the enormous passenger business to and from Chicago, and every effort will be made to offer superior inducements. The attractions of luxurious finish of cars, vestibule trains, barber shops and bath rooms in cars are losing their novelty, and nothing will equal the offer to consume the shortest time on the journey.

Mr. Player, recognizing the fact that there is great loss of time at every stopping place by handling the mail, express and baggage carried on most passenger trains, proposes to carry these loads on separate trains and confine passenger trains to cars carrying passengers only. The change seems a radical one at first, but on reflection and consideration it will be found that there is no absolute necessity for adding baggage, express and mail cars to those carrying passengers. This arrangement has been a convenient one, and on that account has been adhered to; but the passenger-carrying business of the country has now gone beyond this on a great many roads. There is a great deal of freight, such as fruit and other perishable material, that has to be pushed through as rapidly as express matter, and there is no reason why fast-freight trains, composed of the dead-weight impedimenta usually hung upon passenger trains, and perishable or other urgent goods, should not be formed into separate trains, permitting those carrying passengers to go on without delay.

Locomotive Engineering has received a nice club from Engineer Alexander S. Steele, engineer on the Government railway at Jamaica The men on this road are keeping up with the times, and intend to be posted on current events, even if they are isolated.

The Mexican government have issued an order that no passenger trains shall cross the border after ten o'clock at night.

## Mechanical and Other Conditions of our Time.

[James E. Phelan was born in Michigan in 1857, and at the age of 16 went firing on the Lake Shore Road, continuing in this service some three years At an early day, on the Northern Pacific, he took service there as a fireman and was promoted at the age of 23. He ran on the road for some seven years and was then made road foreman of engines for the whole system In December, 1889, he was made division master mechanic at Mandan, N. D., and a year later was selected as Superintendent of the Missouri Division of the great road, a position that he holds to-day J. E. Phelan always took an active part in the affairs of the Brotherhood of Locomotive Engineers, of which body he is still an honorary member. He represented his division in the Chicago convention In 1888, Mr. Phelan commenced a series of articles on "Air-brake Practice" in *The Locomotive Engineer*, that attracted the attention of the railroad world. These articles were afterward published in book form, and to show how they appreciated the work, the Westinghouse Co. took one thousand copies of the first edition. The work is now in the fourth edition, several hundred copies have been sold in Australia, where the air-brake is used. Mr Phelan resides at Dickinson, N. D., and has under his charge a long and difficult divison of road, across the bad lands of Dakota and Montana. J. E. Phelan is a typical American locomotive engineer; keen, bright, studious, he went up because he tried to better the condition of himself and his fellows, he was confident that his study of brakes, etc., could benefit other enginemen if known, and he made it known. The Northern Pacific saw that he was a leader, an educator, and promoted him. If they had not, some other road would.—Eds.]

Who in this age is to become famous by writing a history of mechanics pertaining to railroad service?

Who will "rise and explain" in simple and sensible language the evolution of railway appliances, condensed and boiled down, in a way to catch the eye and inoculate the senses of the busy railroad man, with undying principles pertaining to practical operation without occupying too much time with the process of inoculation?

Among the rank and file of railway employés, is it not a fact that the most urgent demand for reading matter, pertaining to railroading, comes from the small systems where men have time for labor, time for recreation and study, and time for sleep?

Is it not a fact that very little demand for reading matter, pertaining to railroading, in comparison to the number employed, comes from the great railroad systems of this age, especially when such systems are rushed with business, and every individual in the chase after the mighty dollar, regardless of sleep and the other luxuries and minor necessities of a well proportioned existence?

In the magnitude of present railroading master-minds find more scope in governing conditions and accomplishing results than was ever comprehended by the ordinary political Governors or Kings.

In our school days the gleaming of historical knowledge nearly all pertains to political conditions, Presidents, Governors, Generals, and the like.

A scepter of knighthood awaits the genius who will write entertainingly of industrial science and development, as some of our noble and noted historians have written of political events.

In this month of January, eighteen hundred and ninety-two, Locomotive Engineering takes a fresh start into this field, to be cultivated by the furrowing pens of genius, in energetic development of proper principles, designed for the upbuilding and preservation of railroad property, to the end that railroad property may first pay dividends to the owners of the property, with corresponding prosperity—sharing, by all employés, great or small, to the edification and satisfaction of the patrons of railroad interests. Then the Millenium—Paradise found forevermore.

The volumes yet to be produced by Locomotive Engineering will stand as garnered crops—results and experience to assist our future *great* historian

Various conditions now existing must be helped to favorable results or left in the by-way of progress

Recently we rode in a train on a railroad where the train was heated by the steam from the locomotive The weather outside ranged about thirty-five degrees above zero. The state of the weather within the car would have delighted an inhabitant of Africa wearing summer clothes We slept with the window up all night. Later, on the same railroad, we rode on the train having all pipe connections for heating from the locomotive Weather outside zero or lower, steam was not turned on from the locomotive, excepting for the cylinders, where it was evidently all required for pulling the train. We slept comfortably with the windows closed; less ventilation, but enough, no waste of heat.

Heat in the winter time costs money This is an unsettled problem, we leave its development to be recorded by the future historian.

Power brakes, yet in the field of development, but who can gainsay the splendid success achieved in this direction. History unrecorded, unwritten statements without number, testify to the wealth saved to the owners of railroad property by prevention of wrecks, and expedited passenger and freight service. But one necessary condition in this direction railroads nearly complete in this line should hasten to full equipment of all rolling stock with power brakes. Railroads behind the times, and backward about applying power brakes to all equipment, should hasten in this direction as far as consistent with funds available.

Automatic couplers are gaining ground rapidly, considering all hampering conditions. That was an interesting report emanating from proceedings before the political commission somewhere in the East recently, reading between the lines the story reads like this

The seers among the managers, car builders and mechanics, who have been able to look into the future and comprehend conditions in advance of the average mind, have taken strides in this direction beyond the anticipation of the many. As the snow flakes descend in quiet atmosphere, so have the automatic couplers appeared along the railroad landscape, until we are confronted with a mixing of the beautiful with the unrefined, annoying to many discouraging to some, but freighted with evidence of results accomplished and yet to come, we must have considerable more snow before we can enjoy smooth sleighing.

Was ever a period of transition not laden with hope and fear, anticipation clouded by ungainly facts?

The representatives of the switchmen, regarding the coupler question, while apparently unreasonable are fair in their desires, they either want good wheeling or smooth sleighing. Who can blame them for objecting to a mire of slush?

The seers and advance guard doing battle for correct principles can hold courage in this direction, close automatic couplers are as inevitably necessary in economical operation—as indispensable as power brakes.

The compound locomotive has made its share of noise in the mechanical world recently, notwithstanding the reduced echo from low pressure in the exhaust; while the compound is in progress of development, indications of economy are as sure as the fact that a given amount of energy, once generated and nearly all utilized, produces better results than when half wasted The development of compound locomotives should not be stayed while waiting on electricity to revolutionize motive power.

Electricity—the word has a charm for hopeful minds, as our imagination shapes our faith in the hereafter by that which we most hope for, so our intelligence is guided in judgment and anticipation for the future by all that has been accomplished to date It all depends on what returns may surely be expected from money invested The mighty dollar rules the destiny of electricity, may the field be fruitful

There must come a time when direct principles of railroading will be as irrevocable as the rules of war or the science of government While successful government comes from an intelligent discernment of the will of the people, successful railroading must come from an intelligent discernment of conditions and appliances best suited to produce revenue and favor economical practice

For the benefit of all branches of railroading, more students are necessary, else more time allowed the studious officers and employés in service to demonstrate principles. The most valuable lessons are not learned from books.

Phelan

## The Baldwin Compounds.

The Baldwin compound locomotives now in use on the Pennsylvania Railroad are said to be doing the same work as the simple locomotives of the same size with perfect ease and with a material saving in fuel The very heavy loads are pulled through the long, slow drags of mountain service with eminent success.

About half of the work now going on in the Baldwin Locomotive Works is on compound locomotives.

The boilers for compound locomotives are all made with a factor of safety of 4½ when carrying a pressure of 200 pounds to the square inch. This is done to inspire confidence in the high pressures and to insure the use of at least 180 pounds working pressure, thereby obviating the use of larger cylinders to do the necessary work.

These compounds are becoming noted as successful spark-preventers, and some of the railroad officers, who care little about fuel-saving, and therefore have no interest in the compound principle, are greatly pleased with the habit the engines have of leaving the sparks in the fire-box instead of throwing them around to burn up the country.

All the engineers, hostlers and firemen on the Staten Island Rapid Transit Railroad receive Locomotive Engineering, and the company pay for it General Superintendent Frank S. Gannon says it is a paying investment.

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## The Air-Brake Situation.

American railway companies have always placed great reliance upon brakes as a means for securing the safe operating of trains. About fifteen years ago, when the air-brake had become a recognized necessity for all passenger trains, railroad men interested in the faster movement of freight began to recognize the fact that before long power-brakes would become as much a necessity for freight trains as air-brakes were for passenger trains. Few of the persons most in favor of power-brakes for freight trains contemplated that railroad companies would ever decide to incur the enormous expense of equipping all cars with air-brakes. A few companies had applied the Westinghouse Automatic Air-brake to all or a portion of their freight-car equipment, but these were regarded as exceptional cases.

There were several forms of mechanical brakes coming into service, mostly operated by compression of the buffer-springs, and some of them worked fairly well. The strongest recommendation possessed by this form of brake was that it could be put on cheap.

If brakes of this character were to be the freight brakes of the future, it was of the utmost importance to railroad companies that uniformity should be secured to the extent of all the brakes working together when mixed in a train. The discussion of this subject, in the technical press, cultivated railroad opinion rapidly. The result was that in 1883 a committee of the Master Car Builders' Association was appointed to investigate and report on the subject of automatic freight-car brakes. The first report made was very discouraging, but the following year a new committee was appointed and a disposition was shown to settle the question permanently. Mr. G. W. Rhodes, who was a member of this committee, eventually took the lead in arranging for and carrying out the most thorough tests of air-brakes that ever has been made—a test that has supplied reliable information on brakes to all the railroad companies in the world.

The first report of this committee was made in 1885. Although the members were evidently appalled at the expense of air-brakes for freight cars, they had learned something about buffer-brakes in the course of their investigations that deterred them from advocating that form. They recommended that a series of comparative tests should be carried out to demonstrate the value of the different brakes. This recommendation was adopted.

The fact had become apparent by this time that a brake to be satisfactory for controlling freight trains must be capable of working smoothly on very long trains. Acting on this knowledge the committee in arranging the terms of the competitive tests made the condition that all the brakes should be used on trains of fifty cars. The trials took place in July, 1886, at Burlington, Ia. It is needless to go into the particulars of these well known tests. There were many surprises both to brake companies and to railroad men. Air, vacuum and compression brakes were tried. It was shown conclusively that compression brakes were worthless as a means of controlling long trains. The old Westinghouse automatic and the vacuum brakes did fairly well in controlling the long trains when time was given so that they could be applied slowly, but if they were thrown on suddenly, violent and dangerous shocks were experienced at the back end of the train. With the old triple valve it took 17 seconds to apply the brakes on the last car of a fifty-car train, and the vacuum brake was even slower. The committee reported that the performance of all the brakes was unsatisfactory and the brake companies were recommended to make improvements and try again. A second trial was arranged to be made in May, 1887.

The vital question now to be settled was a brake that would act so quickly in cases of emergency that the brakes in the hind part of the train would be applied in time to prevent the cars from crashing upon those in front. Most of the brakes presented for competition at the second test were provided with electrical apparatus that in emergency stops applied all the brakes simultaneously. When this was done a fifty-car train could be stopped without any shocks. The Westinghouse Company had effected improvements on their brake that reduced the time of application to the last car of a fifty-car train from 17 to 6 seconds, but that increased velocity of action was not sufficient to make a satisfactory emergency stop. In the report made on these trials the committee favored the use of electricity as an auxiliary for making emergency stops. Air alone did not seem to admit of sufficiently rapid action.

Electricity had been found so unreliable for all purposes connected with trains that railroad men were extremely reluctant to employ it for braking purposes, and great disappointment was experienced with the result of the brake trials. Shortly after the second trial the Westinghouse Air-Brake Company affected another improvement on their air-brake, by which the time of reaching the last brake in a fifty-car train was reduced to two and one-quarter seconds. It was found that the brake thus improved made emergency stops as smoothly as brakes applied by electricity. The committee, reporting on the performance of this brake, said that "it could be relied on for any condition of train service, that brakes can be simultaneously applied without electricity throughout a train of fifty cars. Among conditions which the Master Car Builders' committee prescribed for a freight-train brake were, "that it shall work without shock on a train of fifty cars, and that it shall stop a train of fifty empty cars, running twenty miles an hour, within two hundred feet on a level."

It was demonstrated by numerous public tests that the Westinghouse improved brake fulfilled these conditions, and many railroad companies proceeded to equip their freight cars with this brake. Competitors have lately entered the field, and three or four other air-brakes are now offered to railroads, with the claim that they are quick-acting brakes, capable of meeting the Master Car Builders' requirements, and interchangeable with the Westinghouse brake. The mere assertion of parties interested in a brake ought not to be accepted as conclusive. Tests of the brakes on fifty-car trains should be required before railroad companies begin putting upon their cars brakes of doubtful efficiency. If a brake meets the requirements it is no hardship to require the company owning it to demonstrate the value of the brake in actual service. A shop-test or a test on a short train of cars proves nothing. Let brakes offered to handle fifty-car trains under all conditions of service be tried on trains of that size.

## Inspection as a Preventive of Accidents.

The people in Great Britain are ahead of us in the systematic inspection of every appliance used that is liable to jeopardize human life. Mines and railroads and factories and steamers and boilers are all subject to very rigid inspection by experts. The system no doubt greatly reduces the number of dangerous accidents, yet, with the greatest care casualties of a serious nature happen occasionally in all the departments named. One of the most valuable features about the inspection system is that when an accident does happen, experts are required to make a thorough investigation and the true cause of the accident is made public. This publishing of all the facts connected with railroad accidents has had a powerful influence in causing railroad companies to adopt the best appliances for the promoting of safety.

Railroad accidents have been unusually numerous in this country during the last month and nearly all the loss of life, injury to persons and destruction of property could have been prevented had the proper appliances for promoting safety been employed. If officials thoroughly familiar with railroad operating were required to investigate these accidents and report plainly on the cause, public sentiment would gradually work round to the demanding of remedies. There is great need for the imparting to the public of exact information as to the cause of accidents. Where there is so much material and mechanism subject to the severe service of heavy fast train operating there are many links in the chain of mechanism liable to break and cause accidents, so that safety can be maintained only by constant vigilance in watching the gradually weakening or wear that ends in breakage. But by far the most common and most disastrous accident of to-day is the collision. Collisions happen because proper means are not employed to keep the trains apart. There has been too much dependence put upon the means of stopping a train after the engineer sees an obstruction on the track. Good brakes are a great auxiliary in preventing accidents, and they can safely be depended on in the hands of careful men where trains are few, but many railroads are becoming too much crowded with trains to be operated safely without a system of signals that keeps trains a certain distance apart. If competent Government inspectors had investigated all the collisions that happened during the month, and reported the truth in most cases that the accidents happened because signalling systems capable of preventing the trains from coming together were not in use, a valuable educational work would have been done.

## Doctoring Feed Water.

When a man is sick with any complaint that is difficult to cure, he is very liable to fall into the hands of pretentious quacks, who presume to have a cure for everything.

We have often thought of this when listening to the list of compounds that have been tried for softening feed-water for locomotive boilers. A locomotive boiler uses such an enormous quantity of water that a small percentage of solid matter forms a big deposit at the end of a month. This soon gives trouble and raises the demand for a remedy. The proper remedy calls for some knowledge of chemistry, and that is a science little studied by the ordinary railroad man.

Under these circumstances the man responsible for keeping boilers in running order is a ready victim of quacks in doctoring feed water. The man having a compound that acts to precipitate lime is the least dangerous of the large tribe that tell of remedies for prevention of scale in boilers. All kinds of vegetable substances and many mineral compounds have been put into boilers with little success. Some of the ingredients used do some good, others are hurtful. Corn, starch, potatoes, sorghum, bran and compounds of petroleum are a few of the ingredients used on some roads. All these substances act on the scale and tend to soften it, but they form a sort of mild homeopathic remedy that is permissible because it is not likely to do much harm. It is safe to say that a few pounds of caustic soda would be much more efficient than any of the compounds mentioned.

Some of the companies that sell boiler compounds prepare their mixtures to suit the water to be treated. Where this practice is followed it indicates intelligent dealing with a difficult malady. If a railroad company has an analysis made of the water on each division, and gets a chemist or manufacturer of boiler-purge to prepare a mixture to suit the water, benefit is certain to result from the treatment. But it is of the utmost importance that the medicine should be taken regularly. The leading cause of the failure of good compounds has been neglecting to put them in the feed water.

## The Indicator Articles.

We doubt not that the A, B, C articles on indicating locomotives that commence in this issue will be appreciated by many men who want to be able to read a card, but who do not expect to take them. Plainly put, an indicator card is a photograph of the work done in one end of a steam engine cylinder—a picture—and when one gets the idea into his head of just what causes the different parts to be drawn, a card tells the whole story—admission, point of cut-off, expansion, exhaust-opening, back pressure, compression, lead, pressure, etc., etc. It is the language of the steam engine; learn it.

If you remember that all the lines made vertical, or *up and down*, are caused by the steam pressure in the cylinder raising and lowering the pencil, and all the lines made horizontal, or *back and forth*, are caused by the drum moving the paper under the pencil, and that this drum represents on a reduced scale the movement of the piston, you have gone a long way toward understanding the card. Harris Tabor, the inventor of the Tabor Indicator, and one of the most expert steam engineers in the country, will make the matter plain to you if you follow his articles. He is not going to write for experts, but for men who do not understand the instrument at all. He is going to confine himself entirely to locomotive indicating, in which he has had long years of experience. He will make a card for you, line by line, showing the exact location of the piston and valve for each line, and will give many object lessons on cards actually taken from locomotives in different kinds of service and under different conditions, ending up with cards from compound locomotives.

One of the best and most reliable mechanical papers that comes to this office is the journal *Industry*, published at San Francisco, Cal. It is edited by John Richards, a mechanic who has made his name known at home and abroad. The paper is valuable, because it is published to give value received to subscribers, and not solely for advertising. Next year it will be issued in magazine form.

## Train Accidents.

Some of the Eastern railroads have been noted during the last month for the number of train accidents. The New York & New England has been peculiarly unfortunate in smashing trains. The New York Central had two bad wrecks by express trains running into trains at stations, and the Philadelphia & Reading killed three persons through an express train running into a gravel train. In all cases, the usual excuses were made that the accidents were caused by the carelessness of the trainmen. We think that all the accidents were due to inexcusable looseness in the methods of operating, and to the lack of proper appliances for protecting trains.

When an express train runs into a train standing on the main line, it may safely be concluded that it is a common thing for stray trains to be on the track when an express train is due. The system that permits this dangerous method of train operating has no right to run trains at a speed greater than twenty-five miles an hour. The way to prevent accidents to fast passenger trains is to have no excuse for any train intruding upon the track when an express train is due. Strict discipline is necessary to make all concerned understand that taking chances will be considered as serious when nothing happens as when an accident results. We are aware that this is not the usual way of looking at the matter. When a conductor of a freight train or a train dispatcher saves a few minutes by running dangerously close to an express or other fast train, he is excused and considered zealous. It is only when the smash comes which is brought about by this kind of operating, that the delinquent is blamed for reckless conduct. Railroad men do not properly recognize the fact that it takes 1,000 feet under the best conditions to stop a train running 60 miles an hour, and that it takes twice that distance with defectively braked trains and bad rails.

The first reform necessary is to make all concerned understand that fast trains must have clear track. The next one is the providing of a signal system that will keep trains apart. All our railroad companies are slow to perceive that good management requires the most perfected appliances for operating trains safely, and that a block signal system is as urgently wanted on many of our crowded lines to-day as good brakes were needed twenty years ago. The expense of one bad accident would go a long way toward equipping a road with good block signals. To neglect this is like neglecting insurance, with the added objection that it is subjecting the traveling public and trainmen to dangers that are criminal.

## Power of Knowing Things.

A general manager who rose by the line of the scoop, throttle and master mechanic's office to the exalted office he now holds with dignity and ability, lately remarked to the writer: "There is no mistake but the engineer is every day becoming a more important person.

"When I was on the road the engineer received no consideration compared to that extended to the conductor. If there was a very important train to be run, where the making of time was of unusual consequence, the best conductor on the road was selected and upon him devolved the responsibility of getting the train along. If the weather was bad or snow deep and unusual difficulties were looked for in getting trains over a division, the conductor was regarded as the man who would do the most in getting there.

"Since there came to be so much mechanism on locomotives and cars that the engineer alone is likely to understand, he is getting to be looked upon as the man responsible for everything connected with the safe and prompt movement of the trains. When there is anxiety to get a train through under difficulties nowadays, we never concern ourselves about who is conductor. If the engineer is a man whose record gives confidence, we know that everything will be done that knowledge, judgment and ability can accomplish.

"We have two or three conductors who know more about air-brakes, heating pipes and valves, signals, etc., than the average engineer, and these men are valued accordingly. Knowledge is power, and to no class does this apply more practically than to railroad trainmen. A significant sign of the times is that you can hear young trainmen making fun of the engineer who does not understand all the details of train mechanism."

## Strength and Weakness of Boilers.

It is almost impossible to make the ordinary boiler user realize that a boiler which has been worked for years with safety is gradually or rapidly approaching a condition when it will be dangerous to be near. When a man first gets a boiler into his premises, he is nervous every time he hears the steam blow off lest the noise means a coming explosion, but familiarity gets him over that feeling, and then it breeds the contempt which ignorance is ever so ready to embrace. Most of our States are painfully in want of laws to regulate the control and inspection of steam boilers; but public opinion is slow in making the demand that leads to the necessary lawmaking, although the examples of killed and wounded from boiler explosions are sufficiently numerous to stir people with feelings of humanity to demand a remedy.

Laws requiring a thorough investigation of all boiler explosions by expert inspectors, and the publication of the facts, would do a great deal to prepare the way for effectual remedies. It is not necessary that expert inspectors are men who must be brought from outside the works where a boiler is stationed or is cleaned. A boiler maker employed by a firm on other work may acceptably act as an inspector when boilers have to be examined. The Railroad Commissioners of the State of Massachusetts, who are noted for the conscientious way they perform their duties, recommended some years ago the enactment of a law requiring all locomotive boilers to be periodically inspected and tested. Most of the railroad companies considered this law a hardship at first, but most of them now recognize that it was a blessing in disguise. The boilers are inspected regularly at trifling expense, and defects of a dangerous character are frequently discovered. The mechanical head of one of the railroads in Massachusetts made the public statement after the inspection law was in force for some time, that he would rather quit the road than return to the loose practices that prevailed before rigid and systematic inspection became imperative. If the system enforced in Massachusetts were practiced in all States of the Union, there would be fewer explosions of locomotive and other boilers.

There are many people who still cling to the delusion that there is some kind of mysterious force at work that causes boilers to explode. This belief is held with child-like faith especially among people who are using boilers and have ignorant and unskillful men in charge. It is their interest to make believe that accidents to boilers are mysterious dispensations of Providence.

Two well-known facts give strong testimony in favor of the value of inspection. One of the weakest forms of boilers, owing to its awkward shape, is the Scotch marine boiler; one of the strongest forms of boiler naturally is the locomotive. Although the Scotch boiler is used in nearly all the ocean steamers carrying high pressures, no boiler of that type, inspected under the rules of the British Government, has ever exploded. The boiler that explodes most frequently in this country is the portable locomotive boiler, used with threshing machines. Inspectors never disturb the comfort of the owners of the latter boilers.

Boilers explode only when the pressure of the steam inside is too great for the strength of the material holding in the pressure, just the same as an elevator falls when the weight is too heavy for the strength of the cable doing the lifting. The greater portion of a cable or a chain used in lifting may be strong enough to raise four or five times the weight successfully, but there happens to be one weak spot which gives way and disaster follows. The same is the case with boilers. A boiler is not safe unless it has strength to bear four or five times the amount of working pressure. This is called the "factor" of safety. If any spot of a boiler is weak, that spot is the measure of the safety of the boiler, for if it causes a sudden rupture, the effect is as bad as if the whole of the boiler was weak. The weak spots in locomotive boilers are generally broken stay-bolts or corroded sheets. Systematic, regular and thorough inspection is the only means of preventing this weak spot from becoming a source of danger. If you take a piece of wire and keep bending it to and fro, it will soon break. Certain stay-bolts of a locomotive fire-box are constantly subjected to a bending action, and it is only a matter of repeating the bending often enough till the bolt breaks. The means of detecting breakage ought always to be as active as the agencies at work to cause accident.

We have completed arrangements that will enable us to offer ambitious young men a chance to get almost any tool, instrument, book or model they may want, for getting us a few subscribers. The best papers in the world do this, and we will be among the best. There will be no prizes or fakes of any kind, but drawing instruments, fine tools, valve-motion models and books will be given for certain numbers of subscribers, not to one, but to as many as want them. These goods will be shipped direct to the men from the makers just as if cash had been paid for them. Don't fail to preserve our premium list sent out with the January number.

## NEW BOOKS.

THE ENGINE RUNNER'S CATECHISM. By Robt. Grimshaw. John Wiley & Sons, New York. Price $1.50.

This is the most useful of all the Grimshaw Catechisms; there is little if anything new in it, but it illustrates, describes and explains the peculiarities of all the well known stationary engines used in this country. For young engineers or men in charge of strange designs of engines or isolated plants, it contains a great deal of useful information about the adjustment of the valve, gear, etc., and the care of the engine. It is something better than a bound and indexed collection of engine builders' catalogues, for it treats more of the things the man in charge wants to know, instead of what the buyer wants to know. It is handsomely bound and of a handy size, 4 by 6 inches.

THE HISTORY AND DEVELOPMENT OF STEAM LOCOMOTION ON COMMON ROADS. By Wm. Fletcher. E. & F. N. Spon, 12 Cortlandt St., New York. Price $3.00.

This work is on the present locomotives in use on the common roads of England. The work is divided into six parts as follows: Period of Speculation, Period of Experiment, Period of Successful Application, The Modern Period, Practical Notes on the Design and Construction of Road Locomotives and Traction Engine Low. The road locomotive has reached a high development in England, but the roads of that little country have reached a higher development, that has made the road locomotive possible. The book is profusely illustrated, and we notice that almost every builder's latest effort is a compound engine. The work is very useful and complete.

## WHAT'S GOING ON.

The New Jersey & New York are in the market for three passenger cars.

The Minneapolis and St. Louis Railroad are in the market for some new locomotives.

An order for 500 freight cars has just been placed for the Savannah, Florida & Western.

The Chicago & Northwestern have just ordered from Schenectady, 25 ten-wheel locomotives.

The Cleveland, Cincinnati, Chicago & St. Louis have finally decided to order the passenger cars that have been talked of so long.

The West Shore have ordered 25 mogul locomotives from Schenectady, of the same pattern as those used for freight on the New York Central. They have also ordered 650 new freight cars.

The Richmond Locomotive Works are busy on orders for different Southern roads. The Chesapeake & Ohio have recently ordered more heavy 19 x 24 inch engines. Those previously built are reported to be giving perfect satisfaction.

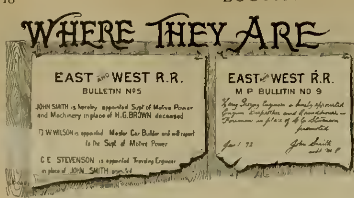
The Baltimore & Ohio Railroad shops at Mt. Clare, Baltimore, are turning out a few new baggage, express and caboose cars to take the place of cars destroyed. An earnest effort is making at all the shops on the system to get the passenger equipment into first-class shape.

The Mexican National is getting ten new engines. Six of them will be plain ten-wheelers and four Vauclain compounds. This is a narrow-guage road, and the standard engines have the wheels inside of the frames and cranks on the ends of the axles. This admits of the use of a wide fire-box.

The Pennsylvania & Northwestern Railroad Company has contracted with the Baldwin Locomotive Works for ten locomotives to be used in hauling coal. All are to be of the consolidation type and of the four-cylinder Vauclain compound pattern. The line on which they are to work has maximum grades of 158 feet per mile and curves of 18 and 22 degrees.

During a recent visit to the Baldwin Locomotive Works we found the place full of compound locomotives of all sorts and sizes. Over half the orders now on the books are said to be for compounds. Several of the compound decapods for the Erie were in the erecting shop, and they are huge machines, the heaviest road engines ever built. Business is supposed to be a little dull, but these works are turning out two big locomotives every day.

The Pullman Palace Car Company have recently received orders for the following equipment: One passenger coach for the Wichita Valley Railway Company, one baggage car for the Denver & Rio Grande Railway Company, twenty chair cars for the Chicago, Burlington & Quincy Railroad Company, one combination passenger and baggage car for the New York, Lake Erie & Western Railroad Company; ten first-class passenger and ten suburban coaches for the Chicago & Eastern Illinois Railroad Company; one vestibuled combination passenger and baggage car for the Old Colony Railroad Company; one narrow guage passenger and baggage car for the Fremont, Elkhorn & Missouri Valley Railway Company; one hundred Pullman standard twenty-five-ton coal cars for the Du Quoin Transportation Company, one combination baggage and mail car for the Toledo, Columbus & Cincinnati Railway Company, two passenger coaches for the Toledo & Ohio Central Railway, ten first-class passenger coaches (five of which are to be equipped with vestibules) for the Chicago, Rock Island & Pacific Railroad Company,




At the January meeting of the New England Railroad club, the subject of locomotive boilers and their attachments will be discussed

The General Manager of the Fall Brook Coal Co , has made the request to the directors, for permission to buy six new consolidation locomotives

Mr R C Blackall, Superintendent of Motive Power of the Delaware & Hudson Canal has been elected president of the New York Railroad Club

Mr Geo E. Stevens has been appointed purchasing agent of the East Tennessee, Virginia & Georgia, in place of Mr J E Wilcox, resigned. Mr Stevens has been for several years with the Ohio & Mississippi.

Rumors are current that General Manager Saul, of the Chicago & Eastern Illinois, is about to resign Resignations have been so common on that road since Mr. Saul took hold that it is about time his own turn was come

The announcement has been made that Mr James McNaughton, Superintendent of Motive Power of the Wisconsin Central, will have his jurisdiction extended over the Northern Pacific and Chicago & Calumet Terminal Co.'s motive power.

Some of the Cincinnati papers circulated report that Mr C H Hudson, General Manager of the East Tennessee, Virginia & Georgia was about to resign, and that numerous official changes on the system would follow. We are authorized to say that these reports are without foundation.

L. W Rogers, the soul of the *Railroad Trainmen's Journal* has retired from the editorship and will establish the *Age of Labor* Rogers is able, honest and consistent He suffered being frozen out of a $2,000 job rather than indorse a wrong because his order had committed it.

In his annual report Mr G R Brown, of the Fall Brook Railroad, mentions that when men and derrick cars are required for a wreck, the shop whistle is blown three sharp toots four times. They find that this practice enables them to start off the wrecking outfit very promptly.

There is no class of people in America so poorly paid as division master mechanics and the master mechanics of small roads. An engineer who is a machinist is very often the man selected for such a position, yet he is expected to accept increased responsibility with less pay Curious line of promotion

Superintendent Reasoner, of the Delaware, Lackawanna & Western, has been under the weather lately and has not been able to leave his room "Pap," as the boys call him, is an unbending type of the old school of railroad men. But few railroad officers have a firmer hold on the affections of the men under them

Mr A M Waitt, Assistant General Master Car Builder of the Lake Shore Railway, who contributes an article in this issue, was raised on the locomotive side of the fence, and still retains a lively interest in everything relating to engines He worked out the designs of the first successful extension smoke-box applied to a locomotive.

Mr J. W Allen, of the Hartford Steam Boiler Insurance Co., who is one of the best authorities in this country on boilers, has been lecturing lately on riveted joints, and intends taking up the subject again. He believes that great ignorance prevails about the designing of boiler seams and that danger results often from faulty design.

It was noticed that an engineer running one of the Baldwin compound locomotives ran the engine with direct steam a great part of the time On being questioned about his reason for doing this, he said that she spoke out with better voice when working that way. Some men think an engine cannot be doing anything unless she is making great noise. This is a decided case of great cry and little wool

No improvement lately applied to locomotives has jumped into popularity so rapidly as the Leach sanding apparatus. The inventor is Mr H L Leach, Jr , Master Mechanic of the Cheshire division of the Fitchburg Railroad, who evidently knew what was wanted to relegate the old crude methods of sanding into the realm of antiquities A very timely demand for this device is reported, one railroad company having ordered 37 sets last month

A remarkable feature of locomotive budding last year, has been the number of compound locomotives constructed. The Baldwin Works have up to the time of writing, built 101 compound locomotives, the Schenectady Works 13, Rhode Island Works 12, Brooks Works 1, the Chicago, Burlington & Quincy 1, the Old Colony 1 and the Lehigh Valley 1 All the other locomotive works of any standing are preparing plans for compound locomotives.

The following is a specimen of the bulletin notices to be seen on the Fall Brook Railroad "A car of wheat was put in a train at Newberry and brought to Corning as an empty. The instructions require the conductors to look into every box car to see for certain that it is empty. This is a matter of record If it happens again the services of the conductor will not be wanted any longer." No names are given in notices of this kind The hint is generally sufficient.

On the 10th of last month Mr J H Agnew, Superintendent of the South Carolina Railroad, left the service of the company. Mr. Agnew went to the road as master mechanic three years ago, and was so successful in operating the mechanical department that he was made general superintendent The company will be the greatest loser by the change While extremely active in preventing waste and in running the road economically, Mr. Agnew was very popular with high and low on the system.

A man walked into the office of Russell Sage one day last month and demanded the modest sum of $1,200,000 When the money was not forthcoming, he exploded a bomb, killing himself and a clerk in the office The man was no doubt mad The first evidence of this is the asking for such a large sum, and the other is that he should ask Russell Sage for anything Russell is one of the millionaries who became rich by not spending anything that could be saved. His closest friends belie him if he ever spent a cent in doing a generous deed.

Blocking frogs and switches costs little and is almost a certain preventive of that horrible kind of accident that results from switchmen getting their feet caught. Yet this provision for safety is frequently neglected, and we are constantly reading of accounts like the following, which was headed Norwalk, Conn., James Dugan, aged 35, an employé of the Housatonic road at Wilson's Point, met a horrible death last night. He had left the switcher to unhook three cars when his foot caught in a frog and held him. Three cars and an engine went over his body.

Mr George E. Todd, Superintendent of the Concord Division of the Boston & Maine, has been granted leave of absence for six months and has gone to Europe in hopes that the change will repair his broken health Mr. Todd was for years General Superintendent of the Concord Railroad, and was considered one of the ablest railroad men in New England. Some of his warm admirers now say that he had few equals in the United States But he settled down to the drudgery of watching the details of a small road and has expended energies capable of much wider scope on a limited field.

Senator Callum has introduced a bill into the Senate, providing for a uniform freight car coupler. All the railroad companies are to be permitted to vote for the coupler, on the basis of the number of cars owned, and the railroad employés will be entitled to one-third as many votes as the railroad companies. If one coupler receives 500,000 votes, it will be declared chosen. In case no choice is made the President will appoint five commissioners to make the selection. An attempt will be made to purchase the patents on the coupler selected. This plan of settling the car coupler question appears to be a good one, but it is certain to meet with great opposition.

The trainmen of the B. C R. & N are mourning the loss of a friend. For years a curious old Scotchman, John B Coathill, has kept a rooming house in Cedar Rapids, Ia , for the accommodation of trainmen None other need apply. Old Jack, as he was familiarly called, acted like a mother toward his boys, washed and mended their clothes, saw that they responded to the caller's summons, and did his best to keep them out of mischief. When a worthy man got into trouble Jack wrestled with manager, superintendent or master mechanic till forgiveness was secured. Jack fell dead in his rooms one day last month and he leaves a vacancy that is not likely to be filled

In the opening address made before the Society of Mechanical Engineers, President Hunt said "The Bessemer process was a failure for all but the higher purposes until Mushet's invention, and while Sir Henry honored himself by settling an annuity upon Mushet, who at that time had made nothing from his invention, still I, for one, would have had my already profound respect increased if Bessemer had even mentioned Mushet's name in his letter, giving the history of his process, which was read at the Pittsburgh meeting of the Iron and Steel Institute" Most of our readers will understand that the Mushet mentioned was Robert Forester Mushet, inventor of the process for making the well known tool steel.

Secure safety by taking no fool chances in the regular working of trains, is the motto held up to his men by Superintendent Brown, of the Fall Brook road The following is a recently posted notice "A South-bound train passed the semaphore at Middlebury and pulled in the side track, after which they came back for orders. This is strictly forbidden. Under no circumstances must locomotives pass a semaphore until they know what the orders are. You will doubtless remember two or three years ago that a train came down Tioga hill too rapidly, and collided with a train pulling out of the switch, causing one man to lose his life. Other similar things are liable to occur unless the rule is complied with."

The Chicago *Herald* lately published a long article on Mr. T. B Blackstone, President of the Chicago & Alton Railroad, accompanied by a very good portrait. Although Mr Blackstone is comparatively little heard of in railroad circles, he is one of the ablest and most progressive railroad managers in the country. He began railroad work as a civil engineer, and is particularly well posted on mechanical matters. His invention for coupling passenger cars makes a train free from the danger of telescoping, no matter what may happen. His policy as a manager is Get the best of everything, men and machinery. The road has always paid good dividends. The sleeping-car and the dining-car both first attained success under the management of Mr. Blackstone.

We have received from Mr. W. P Brady, Superintendent of the Decorah Division of the B. C. R. & N., on account of a curious accident that happened to one of their passenger trains. A large stone, weighing about a ton, slipped from a car of a freight train, and fell between the rails without causing a shock sufficient to let the train men know that anything was wrong. A passenger train came along shortly afterward, running at a high rate of speed and was nearly up to the stone, before it was discovered by Engineer Cary. The pilot struck the stone and threw it 94 feet, but the engine was thrown off the track and went over a small embankment. Engineer Cary remained at his post, and when the passengers went forward, expecting to find his mangled body, they found him drowning out the fire

Colonel Haynes, of the Plant Railroad System, who is president of the Railroad Association, is an excellent speaker and greatly given to story-telling about railroading of the days before the war. In a recent speech he gave a humorous account of the consternation that overcame the officers of a certain railroad when they found it was necessary to change time to make a new connection which required the principal passenger train to be accelerated two hours. A box of pencils was purchased, cigars put in stock and all the officers retired to a room for consultation, and remained there for most of a week. The decision arrived at was to put the time of all the trains on the road ahead two hours. When the change took place all the men engaged in making this sagacious arrangement sat up all night to watch if the trains could run on the new time card

Brother William E. Meade, for a number of years in the service of the Boston and Maine Railroad, representative of Boston Division, No. 61, to the San Francisco Convention, and State Representative to the Massachusetts Legislature for the city of Salem, for the past two years, was elected at the late election State Senator. Honors, thick and fast, of late, have come to the members of our Brotherhood. As the debris of the late election is cleared away, we are informed that in many localities members of the B. of L. E. have been elected to serve in official capacities, not only in municipal but State affairs. In this we are also pleased to mention that at the late election held in the city of Detroit, in a district noted for its close vote and often in daubt, Brother Charles Baker, of Detroit Division, No. 1, was elected alderman by one of the largest majorities ever given a candidate in that city This is but two of the many who will serve not only their constituents with honor, but the B. of L. E.—*Locomotive Engineers' Journal.*

## How to Accelerate Passenger Trains.

BY JOHN PLAYER

The question of making fast time with passenger trains is always one of absorbing interest to all travelers, also to those whose business it is to get the trains over the road with safety and dispatch. The road that can accomplish the greatest distance in the quickest time, is usually the popular route, other things being equal, so far as the comfort of the passengers is concerned. Dining cars have been added stops at eating-houses curtailed; flag stations, where stops are made only on signal, and many other things instituted to gain the end of making the shortest possible time. In view of all this, is it not well to ask where, in the handling of passenger trains, is most time lost? We have reached the point where it is possible to run almost continuously, so far as the motive power and rolling stock is concerned, for hours at a stretch, stopping only for water and maintaining, when running, a speed from forty to sixty miles an hour Still, the desire of high average speed is not accomplished, and 'tis still said we are too slow.

Granted we could run faster than previously indicated, and doubtless we could, it would then become a question of roadbed, so far as safety for higher speed is concerned, especially on curves. Rolling stock and motive power is equal to faster running, and in many places the road bed is good for it; then the question is asked, Why not quicken the time of passenger trains. The answer may be given and correctly · We loiter too much on the way. Almost every train, running any distance, stops and gathers up mail, express and baggage; not only gathers it up, but distributes the same at its destination and wastes no end of time in the operation. Some roads run mail trains, doing mail work exclusively, which is a move in the right direction. Some may run mail and express, some express and baggage exclusively. Would it not pay, and be far more comfortable for the traveling public, if the baggage, mail and express cars were run as perhaps it should be in a baggage, mail and express train exclusively? By so doing, would it not be possible to make quicker time with passengers? Some long distance trains are made up of one or two mail cars, one or two baggage and express cars and one for straight baggage. When they are loaded, as only an expert can load them, these five cars, so far as weight is concerned, make a fair load for an ordinary engine to haul at fifty miles an hour. After taking away this dead weight and delay portion, what may be termed the regular passenger train portion—smoker, ladies' coach, chair car, one, two, three or more sleepers, which would be a good train—could be rushed along with small delay at stations. This part could be handled as it should be if the baggage, mail and express portion was run independently, as it would seem proper to do.

Here is a question that is of great importance for the transportation and passenger departments to consider. First One baggage, mail and express train could do the business for two or three passenger trains, without in any manner, delaying the weary traveler. One baggage, mail and express train could be manned by men familiar with that particular part of the business. Station men could also help, together with all others whose business it is to handle the baggage, mail and express The question of cost of running such a train will be the first question arising, but when the same is considered in connection with the advantages to be derived from the separation of passengers and luggage, so far as speed and convenience is concerned, the question is worth consideration.

If this proposal were carried out, would it not be merely a step in the natural line of train development? The first railroad train was mixed, composed of freight and passenger cars. Then came the second stage, the mixed train composed of passenger, baggage, mail and express cars. Is it not now time for the third period of passenger cars alone? To men wrestling with the problem of getting overloaded trains over the road on express time, it seems that another start in the forward movement is due.

## A Unique Design of Suburban Engine Showing Remarkable Service.

At this day and age, when the average railroad mechanic is thoroughly impressed with the idea that a locomotive, for suburban service, should have as much weight as possible on her drivers and the latter of small diameter, in order to start trains promptly, it is interesting to run across a practice that is successfully carried on, which ignores the set beliefs.

Our engraving was made direct from a photograph and represents a type of engine that was "evoluted" from old, light, 8-wheelers, by Master Mechanic T J. Hatswell, of the Flint & Pere Marquette Road.

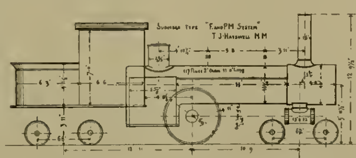
This company has a belt line at Saginaw, Mich., that has developed a large suburban business which is successfully handled by this type of engine.

That we should expect to find single coupled engines in some other service goes without saying, but the remarkable showing by this engine on a "start and stop" job with a fairly heavy train, is, to say the least, something for the opponents of the single express engine to think about. This engine was made from an old 15x22 passenger engine, having a 64-inch wheel, her frame was lengthened to carry the tender and a single truck placed under it

Fig 2 is an outline giving all the principal dimensions.

The great economy of this engine is well illustrated by the following figures taken from the performance sheets

| | Total | Per mile |
|---|---|---|
| Miles run.. . . | 72,870 | |
| Cost of oil, waste and tallow ............ | $190 58 | 0.262 |
| Cost of fuel .. .. . | 3,109 77 | 4.267 |
| Cost of repairs. . .... | 1,116 72 | 1.532 |
| Wages, engineers and firemen . ....... | 3,842 00 | 5.272 |
| Wages of cleaners | 480 00 | 0.659 |
| Total . . .. | $8,739 07 | 11.992 |




No. 2

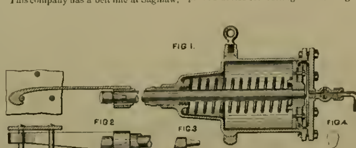
| | | | |
|---|---|---|---|
| Total weight.. . | 80,000 lbs | Grate area . . | 13 square feet |
| On drivers | 40,000 " | Heating surface of fire-box | 96 " |
| On forward trucks . | 14 000 " | Tubes. . | 684 " " |
| On rear trucks ... .. | 26,000 " | 60 sq feet of heating surface to 1 sq foot of grate surface | |
| Capacity of tank 1,300 gallons of water and 4,000 pounds of coal | | | |

Average miles run—

| | |
|---|---|
| To one pint of lubrication oil . . | 33 |
| " " valve oil. .. | 93 |
| " " head-light oil .. .. | 46 |
| To one ton of coal .. .. .. ... | 49 |

## Power Stay-Bolt Cutter.

The cut on this page represents an improved device for cutting or breaking out old stay-bolts from fire-boxes by the use of compressed air or steam.




As will be seen, a cylinder similar to an air-brake cylinder is used, a spring employed to keep the piston at one end of the stroke To an extension of the front of the cylinder, which acts as a guide for the rod, there is a sleeve, terminating in a hook. The end of the piston rod carries a cutting-head that is removable. The cylinder is suspended by a ring that passes entirely around the forward flange and has an eye-bolt in it By this arrangement the piston very nearly balanced horizontally and can be turned to any angle

Fluid pressure is supplied through a rubber hose, and controlled by a suitable valve located near the cylinder.

In operation the hook is put over a stay-back of one to be cut, and the tool thrown against the victim with force enough to shear it off next to the sheet, another blow next the opposite sheet cuts the stay out entirely This tool is the invention of Richard W Bayley, of Pittsburgh, Pa

## Uniform Method of Keeping Motive Power Accounts.

BY J B. BARNES

I hope the question of keeping accounts and recording expense in all departments of railroad work, especially the motive power and machinery, will be agitated by the Master Mechanics' Association, until some formula or rule is promulgated and adopted by every road of importance in the States and Territories, so that presidents, general managers and directors can readily ascertain how the money is being expended, and not only that, but it will have a tendency to affect those directly in charge and spur them on to extra effort in securing the desired results at the least possible expense.

For instance, the reports furnished showing the cost per mile run on locomotive repairs, are supposed to contain all labor and material chargeable to that account. A large number of roads carry what is called a betterment account, to which is charged all new parts, such as new tires, new driving-axles, new air-pumps, and in fact, all new attachments bought and placed, whether they replace old devices removed or not. This of course is misleading Other channels are used to divert a percentage of the expense which is chargeable direct to locomotive repairs.

On the Wabash, the system has been in vogue for many years of charging to locomotive repairs, every hour of labor and every dollar's worth of material which is used in rebuilding and repairing locomotives, less the amount received for scrap material removed from the locomotives The labor and material used exclusively in building new engines throughout is charged to the betterment account, and does not enter the expense for cost of operating locomotives, from the fact that the new engines are not operated until completed and in service.

If some such system as this was inaugurated on all lines, the evidence would be plain as to who was the most efficient manager in charge of the respective departments

This subject has been on my mind for a long time, and is more forcibly brought before me in persuing the articles being published by Mr Forney, in relation to the comparisons of English and American locomotives.

In these articles, you will note the Wabash stands well to the front in average mileage and cost of repairs, and I take considerable comfort to myself as I conclude that the other lines represented have not included in the figures they furnish any accounts not included in the Wabash system, to make up the averages as shown. However, if it was known to a certainty that each line carried into these accounts the same expense, the evidence would be still more gratifying

With the compound locomotive, the lever, even at high speeds, is left nearly in the corner This will give some of the present full-stroke fiends a chance to do fairly good work without changing their habits.

The Paulista Railway of Brazil has given an order for four Baldwin compound locomotives, duplicates of some already in use there.

## The Education of Locomotive Engine-men.

[In presenting to our readers the following article from the pen of Eugene V Debs, the editors of Locomotive Engineering cannot refrain from adding a word about the man, not a nauseating, goody-goody fable, but an outline map of his busy life Eugene V Debs enjoys the confidence and esteem of more organized wage-earners than any man in America This he has secured in a decade, and people like to know how a poor boy can step from the shades of obscurity to such an enviable position in ten years.

Mr Debs was born at Terre Haute, Ind., on November 5th, 1855, his father being a grocer in that then little village Like other boys, he passed through the village schools, the city high school and the commercial college. In 1870 he went to work in the paint shop of the Vandalia Road, and in 1871 went on the road as a fireman He took an active part in the organization of the local lodge of the Firemen's Brotherhood, but left the road, after three years' service, to go into a wholesale house in his native city He was elected clerk of the city for two terms In 1880 the affairs of the Grand Lodge of the B of L F. were found to be in bad condition, owing to the acts of the secretary The grand master removed this man and appointed in his stead the subject of this sketch. At that time the association consisted of some sixty lodges and was $6,000 in debt This debt was guaranteed by Debs' personal surety, and he went to work At the end of the year the affairs of the order were so promising that he was re-elected by acclamation by the annual convention, and has been at every convention since The order now comprises 470 lodges and 27,000 members, and has a reserve fund of something like $75,000 Mr Debs was elected to the Legislature of his State in 1884, and was tendered the nomination to the National Congress on a "sure-thing" basis, but refused it The intrigues of politics were distasteful to his open and above-board nature

In the eleven years of his guardianship the order has collected from its members, according to the last report of the board of trustees, the sum of $2,767,717 72 and paid out $2,704,935 99 Over $1,800,000 of this has gone out in death and disability claims. When we think of the good done by such a sum, the suffering it relieves, the burdens it makes lighter, we say at once that to be the custodian of such a fund is honor enough for one man.

In addition to his duties of secretary and treasurer of the order, Mr. Debs is editor of the *Magazine*, the official organ of the order and the best publication of its class.

Eugene V. Debs lives and preaches the doctrine of humanity, his motto is to do all the good he can on earth and leave the hereafter to the hereafter. He is an eloquent speaker, because he speaks from the heart. He never offers advice to his readers or his hearers that he does not believe is for their interests He never says to the men in his order "go," but always "come." Can it be wondered that such a man in such a place would make a name and a reputation, and be known far and near as a friend and a brother?—Eds ]

In discussing the subject suggested by the caption of this article, I am required, at the very outset, to say that the term "education" conveys an idea that some other word in our vocabulary might better express.

The term education involves the idea of thorough training in schools We say a "common-school education," an "academic education," a "college" or a "university education," and a "liberal education."

Necessarily, in discussing the education of locomotive engine-men, I do not propose referring to the so-called "higher education."

I shall have little to say about academic and university curriculums—nevertheless, the more book-education an engine-man may have, if it is familiarity with a certain class of books, the more certain he will be to advance in his calling; to use a phrase, "to get on top."

Primarily, a locomotive engine-man should have a thorough common school education. He should be a passable reader, he should understand orthography, and be exempt from too frequent "bad spells", he should know enough of English grammar to write the language approximately correct He should understand arithmetic, and if he is commendably ambitious, he will master such studies; indeed, if he is aspiring, eager for superiority and distinction, he will do more than I have suggested. He will learn—and "learning," that is "to learn" to get a thorough knowledge of one's business, acquire skill in one's vocation, more accurately expresses my idea than the term "education."

We say "learn a trade," and "study a profession" We say "master mechanic," "master builder", why not use the term "master fireman"? It would involve far more than knowing how to break coal and shovel it in a fire-box It would mean, that the "master fireman" had husbanded his resources and utilized his opportunities in *learning* everything pertaining to his chosen calling It would mean that his leisure hours had been devoted to study, to investigation of reasons why, and it would mean that the master mechanic had set his seal of approval upon his habits of study and sifting research, and had marked him for promotion.

I am not inclined to indulge in impracticable demands upon engine-men, in the matter of education or learning, my own experience teaches me the propriety of modesty in this regard I am not disposed to be speculative, or to offer any fanciful theory of education for engine-men I advocate only the feasible, the attainable, for the men of the present and of the future who are to have charge of locomotive engines

As a general proposition, the men who start in to fire locomotives are not proficient in common school studies, they are lacking in reading, writing and arithmetic. In saying this I do not mean to assume that the young men are entirely responsible for their deficiencies Their opportunities may have been limited, their surroundings unfavorable, the necessities of their situation such that their ambition was not excited, their associations may not have been of a character to awaken anxieties for knowledge, their mental development did not keep pace with their physical growth, and when forced to enter the army of workers, their educational equipment was defective I do not, therefore, hold them entirely responsible for their inadequate attainments. They are lusty fellows, generous hearted, strong of body and will, and thousands of them ambitious to advance in their chosen calling Here the question arises, What will specially contribute to their success?

The great organizations of locomotive engine-men insist upon good moral character as a prerequisite, soundness of body and mind, fidelity to obligation, honorable dealing with associates and with all men. Dead-beatism is not tolerated. In a word, the ethical requirements in such matters are strictly and unbendingly orthodox, and any member of the organizations mentioned who violates the constitutions and the laws designed to keep the orders morally healthy and upright, is summarily "fired." I am, therefore, relieved, even if I were so inclined, of any necessity for forcing upon the readers of Locomotive Engineering any views touching upon moral questions, the engine-men themselves having grasped and solved such problems.

Locomotive engine-men are to be required at an early day to undergo examinations that will put to the test their rudimentol, their elementary, education—they will be required to read, write and cipher; succinctly stated, be fair, common school scholars. The verdict has been rendered that illiteracy on the part of locomotive engine-men will not longer be tolerated, and it will only aggravate the situation to appeal from it, or to "strike" against it. The reason for this is based upon facts that are conclusive

The educational facilities which surround every young engine-man are such that a reasonable excuse for ignorance cannot be urged. If he is deficient in elementary education, it is proof positive that he is supine, inert, unambitious, and therefore totally disqualified for promotion. He who does not see this is blind, he who does not hear the ringing demand for superior educational equipment in the department of locomotive engineering is deaf

The question arises, are the obstacles in the way of reasonable educational equipment insuperable? If such an excuse were presented, the engine-man would at once be required to state the character of the obstruction Such a request would only increase his embarrassment, and his silence would serve to emphasize his confusion. And this would result from the fact that, if he had the will, a thousand avenues are open to him for improvement Text-books are cheap. A week's wages would supply him with a choice library of elementary works I make no reference to "learned blacksmiths" and others who, "self-taught," have achieved fame, claiming only that locomotive engine-men who are willing to be awakened to the reasonable demands which their calling imposes can, if they will, fully equip themselves for the most exacting investigation, and stand up and stand forth, ready for the most responsible positions of their calling, and worthy of confidence and promotion.

In numerous instances, locomotive engine-men have been required, *in writing*, to answer certain questions submitted to them, relating to their vocation. This they decline doing, chiefly, because of a deficient education whereby they were disqualified for the task Orally, they were equal to the requirement, but being deficient in elementary education, they dared not trust themselves when it came to putting their knowledge on paper.

It is not to be denied that in a vast majority of instances, these men were qualified engine-men; they understood the machine, signals, etc., to the end of the chapter, and yet, they were less than their calling required, and for the deficiency, the excuse, had it been honestly stated, would have been anything but agreeable to them and their friends.

In these regards there is to be a new departure. Its initial steps have been taken. The locomotive engine-man has become, by universal admission, one of the important factors in the railroad enterprises of the country, than which not one is more conspicuous The eyes of the nation are fixed upon him with an earnestness that attaches to no other class of wage-workers. If, therefore, he is to respond to reasonable expectations, he must be educationally equipped and since such preparation is within his reach, excuses will not be tolerated

I do not entertain a doubt regarding the future of locomotive engine-men. They have all the brains required, they have courage, will-power, tenacity of purpose; their only deficiency being that mental discipline which qualifies men for patient investigation and takes them far beyond mere routine drill. Manifestly, a new era has dawned—old practices are passing away—new demands are made to which I am confident, locomotive engine-men will respond with alacrity.

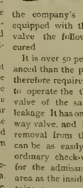
The locomotive firemen of the present are to become the locomotive engineers of the future. Is that goal, when reached, to be regarded as the limit, the *ultima thule* of their ambition? Are there not other positions in the railway service to which they may rightfully aspire? I think there are. Why may not locomotive engine-men become the master mechanics or superintendents of motive power? Indeed, why may they not become superintendents, and finally climb to the top round of the ladder? In replying to such questions my investigations fail to discover any reason why the answers should be discouraging, aside from the fact that the great body of engine-men are not educationally prepared for such positions; and I am persuaded that it is within their power to largely overcome such barrier, and advance, step by step, to the highest positions.

Fortunately, men are so constituted that once the mind begins to expand, the horizon that bounds its vision recedes. The thirst for knowledge increases. Every faculty is brought into play. The intellect triumphs over the animal, and as thoughts multiply, aspirations become more exacting and demand a wider and higher range.

This being universally true, it becomes not a fancy, but a fact in my mind that with a proper appreciation of study, of investigation, of familiarity with books, with the elements of science, the future of the locomotive engine-men of America, is one of far reaching possibilities and gratifying triumphs.

Eugene V. Debs

## Pendry Throttle-Valve for Locomotives.



The annexed illustration shows the Pendry throttle-valve, as used on the Baldwin and Hinkley locomotives, on the Chicago & Grand Trunk Railway system, where these valves have been applied and used for four years and over, under the severest tests, with such results that about 300 of the company's locomotives have been equipped with them By the use of this valve the following advantages are secured

It is over 50 per cent more nearly balanced than the present throttle-valve, and therefore requires less than half the power to operate the throttle than the ordinary valve of the same size. No liability to leakage It has only one seat It is a straight-way valve, and is easily repaired without removal from the dome. The valve-seat can be as easily ground as the seat of an ordinary check-valve The only opening for the admission of steam is of the same area as the inside of the dry-pipe It contains no more parts than the ordinary throttle-valve, and the cost of maintenance is decidedly less. Many of these valves have run years without leaks.

This valve is made by the Detroit Lubricator Co., Detroit, Mich.

The Chicago & West Michigan are receiving six eight-wheeled, 17x24, engines, having 61-inch wheels, weighing 90,000 pounds and carrying 160 pounds of steam, and two ponies, 16x22, all of the Rhode Island build.

## How to Prevent Leaky Flues.

At a recent meeting of the New York Railroad Club, Mr. F. A. Stinnard read a paper on the above subject. The leading causes of leaky flues he held to be, inferior material, poor workmanship in repairing and setting, bad water and want of proper care

The metal for flues, he said, should be

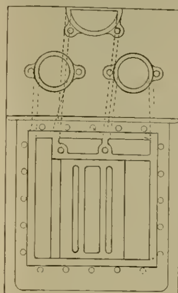


Fig. 2.

homogeneous, devoid of phosphorus or any other substance which would tend to make it brittle. Considered it should be ductile enough to bear expanding without fracture, but still not too ductile.

To prepare the flue for setting, the end should be annealed and reduced in a die, so that it would fit the opening when surrounded with a copper thimble of No. 18, W. G. In setting, he preferred to bead the flue at both ends. Thought that while being beaded, a flue should be held rigidly so that the blow struck will be transmitted horizontally. To meet this requirement, he used plugs or mandrels that are slightly tapered, these are driven into ends of the flue and the ends beaded around them.

He was opposed to the use of the heel-tool. The paper continued: Bad water, that has more or less lime, alkali, salt, or other sediment in it, that may be deposited and incrustate itself upon the surface, is to a great extent the cause of leaky flues. It is a well known fact that the largest amount of incrustotion is developed on the lower flues, while the upper ones will be comparatively clean and free from it, and what is the result? Unequal expansion, the

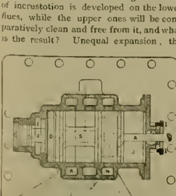


Fig. 3.

flues become what is commonly called mud burnt, the ends will chip or break off, and the flue becomes loose in the sheet. This trouble can to a great extent be obviated by washing the boiler out thoroughly and as often as necessary in order to prevent incrustation with all its attendant evils, for it is an old and true saying that an ounce of prevention is worth a pound of cure. When flues are covered with incrustation and commence to leak, you endeavor to stop them by expanding, rolling, calking, and ten chances to one you will have to repeat the operation before the engine has made two trips over the road. The only remedy for flues in that condition, is to take them out, clean them and reset them.

A reprehensible practice, and one that should be curtailed as much as possible, is running with the furnace door open and allowing cold air to pass through the flues, which, accelerated by the action of the exhaust, will very soon cause them to leak. The furnace door was not made or ever intended to be used as a damper. Engineers should avoid as much as possible pumping water into the boiler when not using steam, in fact, they should guard against anything that would have a tendency to cool off the flues suddenly, thereby causing a sudden contraction of the metal while under pressure, which if repeated a few times will very soon loosen them in the flue-sheet.

The engineer should see that the flues do not get stopped up with ashes and dirt, when 40 or 50 flues get choked up, the process of boring them out is liable to start them leaking. When flues are in this condition, the fireman has to work a great deal harder to keep up steam, and the harder he has to work the more fuel he wastes.

## New Design of Two-Cylinder Compound.

There is now building at the Pittsburgh Locomotive Works a two-cylinder compound locomotive of novel construction, the design of Henry F. Colvin, of Philadelphia.

As will be seen by the detail engravings shown herewith, the cylinders are very plain and simple, there being only one extra core, and that a very short one in the high-pressure saddle. The intercepting-valve and reducing-valve are simple pistons and located in the high-pressure steam-chest cover.

This is certainly the simplest form of compound yet devised and could probably be built cheaper than any of them. It must certainly be some advantage to have the valves away from the heat and separate from the saddles.

This intercepting-valve is not automatic, but is at all times under the control of the engineer, who can start his train and work it as long as he cares to with a plain or single expansion engine. When he gets it into motion he can compound by moving a simple lever instead of hooking his lever up. He can change his engine at will

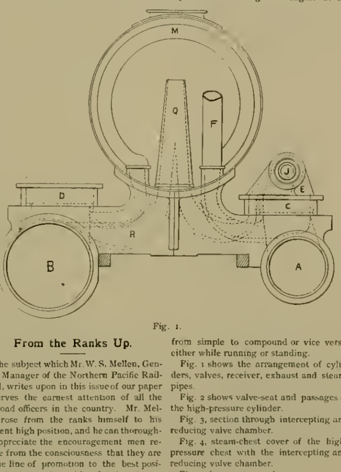


Fig. 1.

from simple to compound or vice versa either while running or standing.

Fig. 1 shows the arrangement of cylinders, valves, receiver, exhaust and steam-pipes.

Fig. 2 shows valve-seat and passages of the high-pressure cylinder.

Fig. 3, section through intercepting and reducing valve chamber.

Fig. 4, steam-chest cover of the high-pressure chest with the intercepting and reducing valve chamber.

Fig. 5, intercepting-valve.

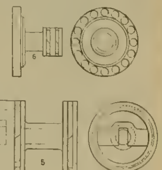
Fig. 6, reducing-valve.

In figure 1. A represents the high-pressure cylinder, B the low-pressure, C the high-pressure steam-chest, D the low-pressure steam-chest, E the intercepting and reducing valve chamber, F steam-pipe from boiler to the high-pressure steam-chest, J intercepting-valve, M receiver, and Q exhaust-pipe.

When the engine is to be run as a single-expansion engine the intercepting-valve is placed in position to allow the exhaust steam from the high-pressure cylinder in the chamber to pass into opening, N, Fig 3, to the exhaust-pipe, Q. While the intercepting-valve is in this position steam from the chest passes up to reducing-valve, raises it from its seat and flows into passage K, through receiver, M, to the low-pressure steam chest, where it is used in the usual manner, and is exhausted through pipe Q. The reducing valve regulates the pressure of steam so that the two cylinders will perform the same amount of work regardless of their different diameters. This valve is controlled from the steam-pipe side and will give the big cylinder the proper pressure to enable it to do the same work the smaller cylinder does with a higher pressure.

When working compound, the intercepting-valve is moved in position shown in Fig. 3. This shuts off the steam from the reducing-valve to passage K, also the exhaust from passage N and opens it to passage K, where it goes through the receiver M to the low-pressure steam-chest, where it is used the same as steam from the reducing-valve when working as a single expansion engine.

In this arrangement there are no valves to keep up, that depend on being ground to seats, when the intercepting-valve is moved to the compound position, it is held by the pressure and it in turn holds the reducing-valve to its bearing.



Figs. 5 and 6.

The valve motion, etc, are not disturbed and the arrangement of the engine is, excepting the cylinders, just the same as at present.

We believe that the principal advantage of this system will be found in the fact, that the man in charge can use his engine simple or compound, just as he wants to

Mr Colvin is a present general manager of the Rue Manufacturing Co, makers of injectors, etc., but he put in half a life-time running locomotives and in the service of the Rhode Island Locomotive Works.

## From the Ranks Up.

The subject which Mr. W. S. Mellen, General Manager of the Northern Pacific Railroad, writes upon in this issue of our paper deserves the earnest attention of all the railroad officers in the country. Mr. Mellen rose from the ranks himself to his present high position, and he can thoroughly appreciate the encouragement men receive from the consciousness that they are in the line of promotion to the best positions in the service, with a fighting chance for getting there. When a railroad company shows by practice that its own men will be advanced to the higher positions, there is always a good loyal feeling among those employed. On the roads where no men are considered worthy of being promoted, there we invariably find discontent, lack of heart and lack of discipline rampant. By all means let us have civil service rule and spirit in the railroad service.

The delays of the law, especially in the deciding of patent cases, are proverbial, but the process is somewhat like the mill of the gods, which grinds slowly but gets there with grim certainty in time. A suit of interest to many power users, has just been decided in the United States Circuit Court at New York, relating to the hot air engine, invented by Captain Ericsson. Robert Deeley & Co., were sued for infringing the patents, and the case dragged very slowly, but it has been finally decided against the infringers.

A practice has been introduced on the Chicago & West Michigan by Mr. W. S. Morris, superintendent of motive power, that is said to be working well in securing desirable men for the position of firemen Every applicant for this position has to file a certificate of eighth grade scholarship, signed by the superintendent of schools. Without this his name cannot be entered on the list. This is not a test of scholarship which any American ought to object to, yet it will insure the hiring of men who have education enough to learn without

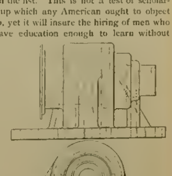


Fig. 4.

difficulty the rules and principles of their business that every engineer and fireman ought to know.

Band saws are now used in some English machine shops for cutting rough forgings to approximate shape They are said to be used very successfully in locomotive building shops. Our machine men have found the milling machine superior to the saw for all classes of iron work, but we do not think that band saws have been tried.


### Alex. Cunningham on His Own Break-Down.

*Editors*

It is again necessary for me to call the brothers to order. I stated in the November ENGINEER the particulars of the only piston I ever had to break. It was when I was pulling out of Rives station, thirty miles from Columbus. Mr. Custis, general superintendent, and Mr. Miller, division superintendent, were on the train, Sam Smith was the conductor. They came out to the engine while I was disconnecting. Mr. Custis asked me what was the matter. I told him that something broke in the left cylinder. He asked me what I was going to do, and I told him I was putting her on one side, which I did in fifteen minutes, went on and made up my lost time. The next morning I took off the cylinder-head, took follower-wrench and piston-head turned in cylinder. I pulled out the piston-head and found the piston broke off close up to the piston-head. There was no machinist working at Columbus then; they did not even have a shop there. They built a small roundhouse soon after and the old man McGinnis, who washed boilers, and two or three wipers were all the men employed there up to 1876. I was running engine No. 71—14x22 cylinder and 5-foot wheel. There was no counter-bore in the cylinder sufficient to fasten the packing. The switch engine pushed me up the hill that night with a train of five cars and I went to Jackson on time. I put her away in the roundhouse and reported on the book a new piston-rod for the left side, and that is all there was about it.

"Engineer" is right about the master mechanic and foreman at Jackson, but they do not know any more about this circumstance than what I have told them. Will "Engineer" at Jackson please sign his name next time he uses mine so very conspicuously, so I cannot see where the puzzle comes in?

If you wish, I will at some future time give you the details of a certain accident which happened to me while I was running the same engine that no one will believe, except two or three that were on the train at the time. I can prove part of it, and the other part I will swear to.

ALEX. CUNNINGHAM.

*Pine Bluff, Ark.*

[Send along your break-down story, Alex., all the boys will be glad to see it.]

### Let the Electric Locomotive Come.

*Editors*

In the *Engineers' Journal* for November there is an article giving an account of an interview with the Wizard of Menlo Park, relative to the substitution of the electric motor for the steam locomotive. The writer intimates that the change would not be popular with the B. L. E. Now if not, why would it not be?

Suppose for instance that every road in the country begin at once and effect the change mentioned. Who is going to manage the motor that has from thirty to fifty heavy loads behind it? Not the street-car motor man, with his experience in stopping and starting electric cars. Not the electrician who thoroughly understands the machine and is familiar with the method of producing and controlling the subtle force that drives it.

Does any one mean to say that a man without railroad experience is to be entrusted with its charge? The train drawn by electricity will have to be handled by a man who "knows how," who is familiar with the grades, crossings, yards, etc. No more trains than are needed will be run, and the man who pilots the electric train of the future, stops it at meeting points, keeps the couplings intact, keeps the head end away from the hind end when it breaks in two, guides it safely over our crowded tracks through rain, fog or snow, must not be color blind—or whisky blind either.

He must be just as good a man as the engineer of to-day—as well informed on train rules, orders, etc., prompt to act. As a writer in the same magazine says of the man who pulls the flyer, he must have "sand." The B. L. E. has nothing to fear from this change, if it ever comes.

If there is to be but one man to "act as pilot and watch the brake," he will of necessity be a good one. The speed will be much greater, and the need for good men as great as it is now. Does anyone imagine the pay will be less? I don't.

They tell us now that it requires a cool head and quick nerve to be a good air-brake man. Won't it then?

So boys don't worry about this and don't oppose progress. Tom Edison can't beat us out of our jobs.

We hear a good deal about progress nowadays, and some people who throw coal seem to think they have a monopoly of it, and that a gray headed old fellow of fifty isn't in it with them at all. We want the electric engine and we want it bad. There will be no headlight to light on windy nights, no injector to freeze up or give out when the mercury goes out of sight, no poor steamers to swear at, no clouds of steam enveloping the engine and cutting off our view of switch and other signals, no coal to make us dirty or delay us in taking it on, no water to take or make close runs for.

We can be comfortably and completely housed in a well lighted pilot house, and the companies will save so much by the change, that no doubt they will raise our pay of their own free will. All that hinders some of them from doing it now, is that they can't afford it.

Now please, Mr. Edison, get a hustle on you, don't be backward on my account in producing this machine.

A MAN FROM PEORIA.

*Green Bay, Wis.*

### What Ailed this Old Roger?

*Editors:*

Seeing the puzzle about Alex. Cunningham's engine, brings to mind an experience of the "fifties," when I was firing a Roger engine, a wood burner on a mountain run, with the grades varying from 75 to 86 feet to the mile, and from 17 to 20 miles long.

One winter afternoon when nearing the top of the mountain, the engine began to get "lame" and in a short distance she was so bad I could only hear two good exhausts, and two others that did not amount to much in the exhaust line.

I said to my old man, "Bill, an eccentric has slipped," and he said to me, "Don't you know what the matter is?"

"Yes, it is the valve out on your side."

With that he laughed at me, which always did make me feel good, and then he said "I thought you was better posted on engines than that."

When the door was opened to put in wood, I would listen and try to solve the mystery, but could not seem to locate the trouble.

The engine began to fail for steam, and after a long struggle we managed to get to a wood-pile and took on a full tank of it, then we waited for the engine to get hot, and while the brakemen were putting on the wood I went under the engine.

I took a lantern and examined the eccentrics and found them all right (they were not keyed on), so that theory was knocked out.

The old man sat on the seat and waited for me to report, and when I did so he had the laugh on me, and he said "Now are you satisfied about that?"

I gave it up and asked him to tell me what the trouble was. He said it was the packing on his side, that had gone down (it was brass ring packing set out with springs). "You ought to have known that, much yourself," he said.

But I did not, and it seemed to me that if it was the packing, there would be a *blow* that I could hear, but he was so well satisfied that he did not take the trouble to get off of his seat and listen at the fire-box door.

He reported "packing on the right side" and was happy.

When I got to the roundhouse the next morning I found the packing had not been looked at, so I took off the cylinder head, and by that time the old man had arrived.

He held the follower wrench while I unscrewed the bolts, and when the follower head came off, he looked at the rings and they were O. K.

Then I felt *good*, and if I had not been overbashful, should have said something to him about knowing all about it, etc.

After he had satisfied himself that the rings were all right, he looked up at me and asked if I was sure the eccentrics were all right. The expression on his face paid me well for all that he had said to me the night before, about not knowing what the trouble was. I said to him, that I *thought* they were right but he had better see for himself, so he did, and found them all right.

When he came out from under the old mill the imprint of agony was still visible on his once genial face. While he was still under the engine, a ray of inspiration glanced my way, so it was very easy then for me to tell him what the trouble was. My bashfulness having departed for the moment, I spoke up real loud, so some of the others could hear, saying, that "the nozzle had come out of the right hand exhaust pipe." "That's so," said he, "we both ought to have thought of that before, ought to have known that much."

We opened the smoke-box door and reached up (this engine had high exhaust pipes that were very near the bottom of the stack), and felt for the lost nozzle and found it in good shape, just as it should be.

You ought to have seen his face at that time, there never has nor probably ever will be another like it.

Now I would like to have some of your readers tell what the trouble was with this old Roger engine. EX.-FIRE BOY.

*Genesee, N. Y.*

### Leaking Off of Brakes—The Tricks of the Emergency Check Valve—A Kink.

*Editors:*

I see in your December number that one of our air-brake friends advocated letting all the air out of the train-pipe in testing brakes. As this paper is read extensively on this road, and as this practice is contrary to my instructions, I take this opportunity to protest against it and give the following reasons.

Three times in the past month I have found triple valves that would not work in service stop after train was fully charged until over 20 pounds had been exhausted, and in consequence the slide valve No. 3 (Plate D, 22, Westinghouse catalogue) was pulled past the graduating ports and the air went straight across over the top of the slide-valve and not through the graduating port No. 7. On taking them down, they were found to be dirty, and when cleaned there was no more trouble with them.

My instructions to all concerned in testing brakes, where time permits, is to make a five-pound reduction and see if all pistons travel past the leakage grooves; then, upon a twenty-pound reduction, they must not travel over eight inches, unless the brake is stiff and wheels are in danger of sliding. I think there is less time lost by charging the train fully before starting.

Another point that seems to be greatly neglected in regard to this matter is the danger of brakes leaking off through check valve No. 15, when more than twenty pounds of air is used, or when train breaks in two. On this road all quick action triple valves have a drain-cock in place of plug No. 26, and by cutting out the valve and opening the cock the brake will fly on, then, if cock is left open a short time, the brake will leak off, unless the check-valve is tight, and to those who have not tried it, it is astonishing to see how many leak. I believe the brass is too light and will spring. We use an old, broken bit drawn to a square point, with edges sharp; put this in a brace, and they can be readily ground in.

I have often noticed, in going down the mountain, that the brakes will hold well until the engineer used about twenty-five pounds of air, when the brakes would seem to ease off and train would increase speed, but it was a long time before I found that it was the air leaking back through the check-valve into the train-pipe, and I think this accounts for trains that break in two, and for their not standing at times or leaking off in dangerous places.

GEO. HOLMES,

Air Brake Inspector, N. & W. Ry.

*Roanoke, Va.*

### Why Quick Action Takes Place with Service Application.

*Editors*,

Speaking of "Black Hills" three-car train on a mountain road, I should locate the trouble with the brake on the sleeper. The slide-valve of the quick acting triple-valve, contains a small conical-valve, called "graduating-valve," which is seated in a cavity in the valve. This conical-valve is connected to the slide-valve stem by a pin; this pin broke off and the air held the conical-valve to its seat, so that in making a service application, this valve did not unseat and let the air go into the cylinder gradually, as it would have done had not the pin been broken. The reduction of 8 pounds from train-pipe left about 60 pounds more pressure on top of piston-valve, than under it—8 pounds to the square inch, so the excess pressure overcame the graduating spring and allowed the valve to travel its full stroke, uncovering the port to quick action-valve, which was brought into action. WM. LANSING.

*Clinton, Iowa.*

### Air in the Foundry.

*Editors*

As the use of compressed air is becoming more general in railroad shops every day, would it not be a good idea to extend an air pipe out to the foundry and connect rubber hose to the same for each floor, thereby doing away with that relic of bygone ages, "the molder's bellows"? Now, do not for a moment think I entertain a particle of animosity, so far as the bellows is concerned. On the contrary, I consider it has earned a well-deserved rest, as well as

one of the molder's hands, in which he can hold his piece of looking-glass, and cast a bright, refulgent ray of light into the innermost depths of his mold, and observe the exact effect of his air, even when the valve is in the emergency position. The idea, so far, is so good that probably the writer should have patented it before sending it broadcast through the country through the columns of your paper. Some practical molder may say that a rubber hose and nozzle would be a fine thing to have laying around under his feet on the floor. Well, let us see what can be done about that. Do you play pool or billiards? No? Well, just get some young man who does to explain that rig for holding the chalk on a string so you can pull it down and walk around the table while chalking your cue, and it may be the means of suggesting a ready method of keeping the hose out of the way when not in use.

F. H. TREACY.

*Poughkeepsie, N. Y.*

### Continued History of the "Fury."

*Editors:*

I am more than interested in the historical old engines. Your last number contained a sketch of the "Fury," built in Boston. Now, I think I can tell you something about her.

The Lake Shore, or rather the State Line Railroad (for the road was only built to the State line of Pennsylvania at first) then, in '62, I think, the name was changed to Buffalo & Erie. Well, we had on that road a "Fury" exactly like the one you have illustrated. She was inside-connected and independent cut-off, drop hook. She was No. 1 and had "Fury" in brass letters on the side of the cab. She ran there a number of years and was finally put in a stall in the roundhouse, next the sand-dryer.

When the Buffalo & Washington (as it was called then) was built to Emporium she went there and ran passenger for some time. She was No. 2 on that road, and I think Al. Vail ran her. Then, when the Buffalo & Jamestown was built, she ran there, and George Moore ran her on a gravel train. The last time I saw her she was in the B. & J. shop with her fire-box cut out, and Jim Hubbard, who was master mechanic, said she was good for some years yet—anyway, as long as they could get wood for her. That was in the winter of '81.

We had one a good deal like her on the Old Erie, and I believe from the same shop (old 99); maybe some of the old heads down there will remember her. Many a time she has run to Hornellsville in two hours and forty minutes with Jack Sawyer on the right-hand side and Jake Thompson feeding her with Blossburg, and how she used to kick herself away from a station! It used to be music in our ears. She was a broad-guage, so she is in the scrap now, I expect.

OLD WOOD-TOSSER.

*Chicago, Ill.*

### Possible Cause of "Black Hills" Brake Failure.

*Editors:*

The air-brake difficulty presented by "Black Hills" in the December issue would undoubtedly occur under certain circumstances already noted and referred to by correspondents of this paper, but if the case is original there must have been something frozen about the triple-valve under the sleeper. Not that a frozen triple valve is an ordinary occurrence on most roads, but if the pipe from triple body to auxiliary reservoir was nearly choked with ice and the graduating valve or port frozen shut, the brake would act in the way described by the correspondent from Deadwood. It would thus be impossible for the sleeper brake to apply until the triple piston had compressed the graduating spring which would be delayed by the slow accumulation of pressure above the piston owing to the interrupted flow of air from the auxiliary reservoir, the brake holding off until the valve had moved to the emergency point when she would go full on, quick action.

WILL W. WOOD.

*Terre Haute, Ind.*

### More Air-Brake Details.

*Editors:*

Thanking Mr. Paxton for his answer in the last number of your paper, I should like to ask further whether the strainer under discussion stands across the main train-pipe, and if so, at what point? or whether the one to which he has referred is the one where the triple-valve branch pipe is connected with the main pipe, for if the latter be the case I do not see how the conditions he describes are possible, as this perforated metal is of cylindrical shape and forming a continuation of the train-pipe should not offer any more resistance to the passage of waste in one direction than in the other.

The inside lining of the hose being loose and rolling up so as to plug the opening, sounds more like the correct explanation, and I was very glad to see it as I confess it revealed a new possibility to me in a case that I have given considerable thought.

Regarding the problem propounded by Mr Black Hills, I should say that in a number of similar cases which have come under my notice, I have found the small pin that unseats the feed-valve in the triple broken off, the result being that the reservoir pressure held it shut and prevented the escape of air to the cylinder until the slide-valve moved down far enough to bring the quick action into play; this, of course, by a reduction in the train-pipe, affecting the whole train.

PAUL SYNNESTVEDT,

Gen. Air-Brake Ins. C. & N. W. Ry.

*Chicago, Ill.*

### A Plea for Testing Brakes from the Rear of Train.

*Editors.*

I have been hunting for that strainer ever since Mr Paxton related his story or experience; I can't find it. Where is it located? Can somebody tell? The only strainer attached to the car that I can find is the one at the union where the pipe is connected with triple-valve, and a "plug" of waste in behind this strainer can't affect but this one car.

I see there is some kicking about the habit of opening rear cock by the train men to test brakes. Now suppose F. F. D.'s car, as stated on page 232, had been end about, and some careless trainman had neglected to cut the air in a car or two from engine after doing some switching, and some careless engineer had pulled out without testing brakes, and this train had been flagged to stop suddenly. The engineer finding he had no brakes to stop with would certainly call for them. The first thing the conductor or rear brakeman would most likely do, would be to open rear stop-cock of train-pipe. Now, if that car with that hose that stopped the air from passing through the train-pipe for F. F. D. had been the rear car, what would have been the result if the brakes had been tested from rear before starting? It would most likely have been found.

*Clinton, Iowa.* WM. LANSING.

### Two More Puzzles.

*Editors:*

As puzzles seem to attract attention from the readers of the LOCOMOTIVE ENGINEERING, here are two easy ones.

One of our engines broke a right forward eccentric strap-bolt letting the two parts of the strap spring apart and bending the other bolt bad. She was working hard and running fast at the time when the strap opened up, the forward cylinder-head on that side blew out breaking it in small pieces. The piston did not strike it, nor was anything else about the engine except the parts already mentioned, broken. What did it?

One of our engines when standing still with one gauge of water, showed water in bottom gauge, dry steam only at the middle gauge, and steam and some water at the top gauge. These gauges are the usual distance from the crown-sheet, and the top one would show a little water all the time if it was left open for a minute or for two minutes. This condition has puzzled all the different men who had run her for some months. What did it?

I bored the cock out clean and it then had a $\frac{1}{16}$ hole in it. It was almost stopped up with lime scale before, not over a $\frac{1}{32}$ hole at end in boiler.

C. B. CONGER.

Road Foreman of Engines, C. & W. M. Ry.

*Grand Rapids.*

### Three Good Things.

*Editors:*

In your last issue I noticed three things which I particularly desire to speak of; I refer to Mr. Headley's piston-rod fastening, the short article headed "Improvement in Cutting Tools," and the several notices of Leach's improved air sand feeding apparatus. The Gould & Eberhardt cutting tool has been in use here for the last six months, and has proved satisfactory in every respect: it is a very good tool. The piston-rod fastening is one that I have had in mind for a long time, and it appears to be a very desirable arrangement. The Leach sand-feeding apparatus has been in use on several of our engines for some time; it gives good satisfaction. I consider it to be the best and the only good sand-feeding device that we have ever had.

WM. A. FOSTER,

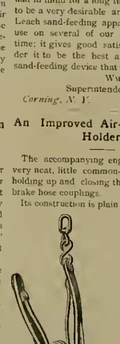
Superintendent, M. P. & M.

*Corning, N. Y.*

### An Improved Air-Brake Hose Holder.

The accompanying engraving shows a very neat, little common-sense device for holding up and closing the opening in air-brake hose couplings.

Its construction is plain from the engraving, the holding is done by the ring on one jaw of the holder that goes over the head of the threaded plug on the back of the coupling. The disk on the other jaw not only closes the opening in the head, but an annular recess covers and protects the rubber gasket. The swivel prevents cramping and putting a permanent kink in the hose.



The best thing about the device is that there is no possible way to hang the hose up wrong, no hook to hang the hinge-pin on. This valve is being introduced by the Beery Valve Co., 605 Phœnix Building, Chicago, Ill.

We have an armful of pencils of all kinds, sizes and colors, with the compliments of the Joseph Dixon Crucible Co., of Jersey City, the makers. We certainly ought to please all kinds of people with all kinds of sticks.

In front of the post-office in Chicago there stands a bronze bust of George Buchanan Armstrong, the founder of the railway mail service. This statue was raised by employés of the railway mail service. Mr Armstrong was born at Armah, Ireland, in 1822, and died at Chicago in 1871. Such men deserve monuments.

### A Locomotive Pioneer Gone.

Another of the pioneer inventors who put a permanent work upon the locomotive has passed away. By a letter from his son, we learn that Thomas R. Yarrow died at Arbroath, Scotland, on November 24, in the 74th year of his age. Mr. Yarrow is known to the engineering world as one of the first to work on the problem of burning bituminous coal without causing sufficient smoke to be a public nuisance.

He was a Scotchman by birth and learned the coppersmith trade. When he was an apprentice, the locomotive engine began to attract attention, and being an ambitious youth he concluded that railroad life would give him better opportunities than any other. He was one of the many workmen whom the democratic railway gave the means of rising above his natural condition. Before the railway era, the chains of custom bound the workman very firmly to the condition of his father. Yarrow worked in different shops after his apprenticeship was finished, and about 1840 went into a well-known locomotive building shop. From there he went to France with some engines. He liked that country and remained at work in Paris, and rose to be a foreman of a railway shop. The scenes of the revolution of 1848 convinced him that life was too cheap in Paris, so he returned to Scotland. He obtained a position as foreman of the Caledonian shops in Glasgow, and rose to be assistant locomotive superintendent. Then he was appointed locomotive superintendent of the Scottish North Eastern Railway, and on the engines of this line all his smoke-consuming inventions were applied.

Coke was the only fuel then burned in British locomotives, on account of the strict laws against smoke nuisance. Mr. Yarrow tried a variety of experiments with fire-boxes to burn coal without causing smoke. In 1857 he settled upon a brick arch with means of admitting air above the fire. This combination proved a success and no more coke was used on Scottish railways. Mr. Yarrow has long been out of railway service, but he kept remarkably well posted on all matters connected with railway machinery. Two years ago the writer, who learned his business under Mr Yarrow, visited the old gentleman and listened to many tales of other years, and of the men and methods that built locomotive engineering into success.

### Quite Home-Like.

We entertain decided views against monopolies of all kinds and it has pained us beyond measure to think that our great country has a monopoly of the practice of train robbing. While we were fretting over this injustice a few lines in the press dispatches brought great comfort. The dispatch went on to say that there has been an unprecedented number of train robberies in Russia in the past few months. The latest instance occurred on the railway line between Warsaw and Cracow, in Russian Poland. A gang of men stopped a goods train near Wlosy station, overpowered the train hands, loaded themselves with booty and made off. A detachment of soldiers were sent in pursuit of the robbers. The fleeing robbers, to escape capture, abandoned a part of their plunder which was carried back to Wlosy by the soldiers. The robbers then made good their escape.

This reads as familiar as if the dispatch had come from Wisconsin, even to the escape of the robbers. The only unfamiliar thing was the robbing of a freight train. Probably the robbery was for the purpose of securing something to eat.

The Brakeman's Brotherhood paid out in death claims $36,000 for the month of October.

The Baldwin Locomotives are putting in a new slotting machine made especially for them, which will slot eight frames at once.

D. O. SETTLEMIRE, President. GEO. W. EVANS, Vice President. W. C. ARTHURS, Sec'y and Treas. FRANK SNYDER, Supt.

## Mt. Vernon Car Manufacturing Co.

MANUFACTURERS OF FREIGHT CARS OF EVERY DESCRIPTION, CABOOSE AND REFRIGERATOR CARS, CAR WHEELS, CAR CASTINGS, AND GENERAL FOUNDRY WORK.

Capacity, 15 Cars and 200 Car Wheels.

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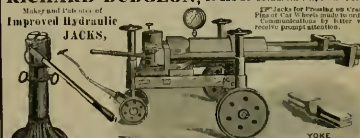


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ESTABLISHED 1876.] [SAMUEL OTLEY, Patentee and Gen. Mgr.

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A set for one fire box will convince you of their merits, safety and economy.

## Civil Service in Railroad Management.

BY WM. S. MELLEN.

To the employer but little need be said to illustrate the fact that the best service he receives is that which comes from willing hearts and hands, and these will not exist except where there is a higher aim than the results of unchanging routine labor There must be something ahead of the present routine work and its compensation—something to be won—to make the employé willing and efficient, and to produce the best results from his efforts.

On the part of the employé in any rank, there is no more discouraging situation than one which does not have for its beacon light the magic words, "Promotion and betterment of condition." The time is rapidly approaching, if the day has not already dawned, when the successfully operated railway will be the one which carries into its system of every day work, the most thorough system of civil service promotion for merit Men who have no incentive to work beyond the stipulated compensation for their grade very soon become inattentive and careless of the property entrusted to their charge, and the result is increased cost of operation and the general inefficiency of the service. On the other hand, the employe, however humble his position, who knows that meritorious work is sure to be rewarded by promotion to a more responsible position, with increased compensation, will give a better and more efficient service in every way.

These principles apply with peculiar force to railway operation, where the work is so diversified that it calls into play a greater variety of qualities than almost any other line of employment. Employés should be promoted, whenever vacancies occur, on the basis of character, meritorious service, knowledge of the work in which they are engaged, and fitness for a higher grade of work; and when possessed of these requisities, they should always be recognized and promotion given according to age in the service in preference to the employment of new material. The lower positions should be filled with new material, which in its turn would have the same opportunities for advancement. This policy, carefully systematized and carried out by the great railways of this country, would have a tendency to make employés more permanent, and to largely if not wholly eradicate that undesirable element known as the tramp railroader. There is no large railway in the United States which has not in its various ranks employés who are capable of advancing to the topmost positions, and let it be understood that every position, however high, is available by the man who wins it by meritorious and efficient work, and the railway will receive better results from all ranks of employés. No official should be permitted to fill a vacancy through favoritism; the position when vacant belongs to the next man below in the line, who has capacity and character to fill it, and it should be given him without question. A prolific cause of complaint among railway employés in the past has been the fact that good men were ignored and good places filled without regard to promotion by merit. These conditions are rapidly changing, and I believe that the application of civil service rules, such as are now in effect on a number of railways, will in the future bring out many a light which has been heretofore hidden under a bushel, and result in great improvement. Every subordinate officer having direct charge of men, should consider it one of his first duties to thoroughly acquaint himself with them, and carefully select for promotion, from time to time, such men as are qualified for it by previous good work and length of service, and men who are not in sympathy with this principle are not fitted for official positions on any railway. The growth of our large systems makes it impracticable to a great extent for the higher officials of a railway to become personally acquainted with their employés, but it is their duty to see that in the lines of promotion no man is elevated to an important position, in charge of others, who has not the proper qualifications which will enable him properly to select for promotion the employés of his department. There is no barrier to prevent subordinate officials from becoming thoroughly acquainted with those directly under their supervision. The railway official who neglects the application of civil service promotion to the men in his charge, omits one of the most important duties connected with his position and due to the corporation employing him.

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Pedrick & Ayer, of Philadelphia, are sending out a fine eraser as an advertisement. This firm recently sent out a lot of pencils, and their latest move looks as if they wanted some of the marks made by them rubbed out. They have furnished blank books, pencils, erasers and paper knives, the next thing should be roll-top desks or typewriters.

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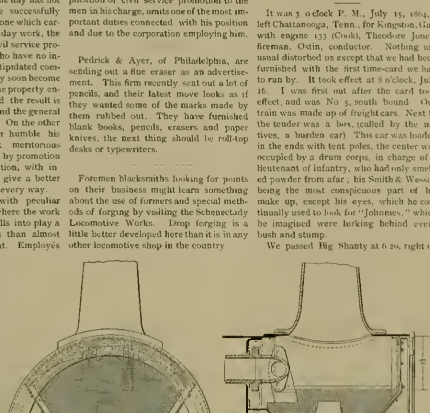
Foremen blacksmiths looking for points on their business might learn something about the use of formers and special methods of forging by visiting the Schenectady Locomotive Works. Drop forging is a little better developed here than it is in any other locomotive shop in the country




## Front-End Arrangements of N. Y. Elevated Locomotives.

The accompanying illustration shows the plan of arranging the netting in the smokebox of the Manhattan Elevated engines. As will be seen, the fronts are short, with a high, large nozzle. The arrangement of netting puts it into three flat pieces, the back sheet is a deflector.

The two side pieces cut without waste, and the front piece very nearly so. In the front sheet there is a light door to enable a man to reach the nozzle. It is evident that with this form of netting it will be a very easy matter to replace a worn-out sheet. The whole thing is accessible and presents a large area for the passage of the products of combustion.

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Thirty thousand copies of this edition were printed and circulated. This is the largest edition ever issued by a railroad paper


### A War Time Wreck.

It was 3 o'clock P. M., July 15, 1864, I left Chattanooga, Tenn., for Kingston, Ga., with engine 133 (Cook), Theodore Jones, fireman, Ostin, conductor. Nothing unusual disturbed us except that we had been furnished with the first time-card we had to run by. It took effect at 8 o'clock, July 16. I was first out after the card took effect, and was No 5, south bound Our train was made up of freight cars. Next to the tender was a box, (called by the natives, a burden car) This car was loaded in the ends with tent poles, the center was occupied by a drum corps, in charge of a lieutenant of infantry, who had only smelled powder from afar; his Smith & Wesson being the most conspicuous part of his make up, except his eyes, which he continually used to look for "Johnnies," which he imagined were lurking behind every bush and stump.

We passed Big Shanty at 6 20, right on time. Captain "Wash," Ashmead quartermaster of the Army of the Tennessee—an old Bee Line conductor—was standing on the crossing, and I gave him the time as I passed

Just south of Big Shanty, near the foot of Kenesaw mountain, was a water tank and wood-shed, called by us "Buttermilk tank." Here we took water and wood and then started for Marietta I was a little uneasy for fear some mistake would occur, and we might have some trouble breaking in the new time-card, so I told the fireman to keep a good lookout for engines coming down the hill. After we had gone about a mile, Theodore jumped off his box and told me to lookout, there was an engine backing down the hill. My engine was just leaving a deep cut, around a sharp curve I reversed and called for brakes before I looked out. My reversing and calling for brakes frightened the crew, who hit the "grit" and took the track back to the tank, but the train guard of soldiers set the brakes and stopped the train. At this time I saw a commissary train, engine 37, (Mason) Spence Smith, engineer, backing toward us at about twenty miles per hour, I knew a wreck was inevitable, and remembered the car next to the tender, with the tent poles and drum corps The 133 was pawing away, trying to back up and I was trying to get the soldiers to get out My lieutenant was sitting in the door with his legs hanging out, and paid no attention to my shouting to him, so I run to him and caught him by the leg and told him to jump He did, he got on his feet right quick, and got his "pop" and commenced blazing away at me I ran a few steps up the side of the cut and threw up my hands, to show him I was not armed After two or three shots, the shock of the collision came, and my brave boy was trying to stand on his head between my feet, and I got his gun as quick as possible. By this time every thing was over, the 37, which was backing up, had set her tank on top of the 133, the car of tent poles was on top of 133's tank The boys of the drum corps assisted me to get the poles away from the fire-door and put the fire out I found my fireman down the bank with a sprained knee, and Spence Smith, of engine 37, sprained his ankle.

Now comes the laughable part. The car next the box was an L. & N. stock car, loaded with naptha, in small kegs, to be used for the purpose of quickly igniting bridges or buildings which the policy of war saw fit to destroy. In this car was an army surgeon returning from a leave of absence, and a news boy I must tell you that by order of General Sherman, no soldier was allowed to ride on the engines or in the cabooses. The boy, who had about a half car load of papers, got out and followed the crew, but the surgeon got stuck in the door, and when the crash came, the car bowed up in the middle and completely wedged him in.

Now understand that nearly every persons' first thoughts in these times was of guerrillas. Our surgeon was one of them, and he put up some very pitiful petitions for help, told us all about his sick wife in the North, and what he would give us if we would come and release him before the rebs came and got him. This was all going on while we were saving the engine. It took an ax and several minutes work to release the door's captive without injuring him When Ostin and the crew came up on the wreck train, and were laughed at for deserting us, they said they only went back to flag U S engine 133 is in passenger service on the W & A. at the present time, and is named "U S Grant," and numbered 18

JAS. H. HEVEY

*Rome, Ga.*

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Locomotive cabs so ingeniously arranged that the reverse lever takes the driver's hand against a steam pipe when it goes into the corner, that have the gauges so far back that he can't see them without trying, the brake-valve behind him; the cylinder cock rig so flimsy that only three cocks open, and a shower bath attachment to the injector overflow, go a good way toward making a class of engines popular (?) with the men.


## Changing Rules About Cars.

The Master Car Builders' Association every year in convention assembled, take up the rules relating to the interchange of cars and amend them. Disputing about these rules gives an excellent opportunity for the display of oratory, and amendments must be made if they confuse all the car inspectors in the country and require railroad companies to hire extra help to do the letter writing called for in settling disputes. It used to be the case that when a car was away from its own road, the company pulling it, put in new brake-shoes or journal bearings if either were needed, and treated the case about the same as they did their own cars. This was too simple and easy a way of doing business for some of the members of the M. C. B. Association. The practice worked very well, for if one road put on brake-shoes and brasses to cars belonging to other roads, the other roads were doing the same thing to its cars. Justice was fairly balanced all around.

At last convention this practice was "amended" by the requiring of every road to be responsible for the brake-shoes and bearings of its own cars when they were away from home. The way the new rule works is that the conductors of all freight trains should make a report of all brasses put into foreign cars, and the car inspectors must do the same thing about brake-shoes and brasses. The change of rule has introduced picturesque variety into practice about brake-shoes and bearings. Some conductors report the number of brasses applied to foreign cars, others forget all about it. Still others charge all the brasses put in during a trip to foreign cars. Car inspectors report the new brasses and brake-shoes as nearly correct as their numerous duties will permit, and by the end of each month a big volume of claims goes into the offices of every railroad company for shoes and brasses. Some of the companies charge only the cost of the articles put in and others put in bills for labor based on a scale that would make the pay of brakemen and of car inspectors equal that of the president. Then the fun begins. But it gives employment to clerks and typewriters and the attention of the railroad world is directed to the important changes made in the rules of interchange of cars by the master car builders at last convention.

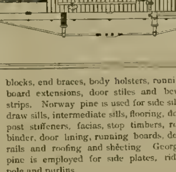
The London & Northwestern Railroad will exhibit a section of track and some of the crack equipment of England, at the World's Fair, at Chicago.

## New York Central Standard Box Car.

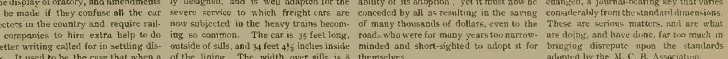
The annexed engraving illustrates the latest form of box car used by the New York Central Railroad, having a capacity of 60,000 pounds. The car is very carefully designed, and is well adapted for the severe service to which freight cars are now subjected in the heavy trains becoming so common. The car is 35 feet long, outside of sills, and 34 feet 4½ inches inside of the lining. The width over sills is 8 feet 6 inches and inside the lining 8 feet. The height from bottom of sill to top of plate is 8 feet 1 inch, and the inside height is 7 feet 3¼ inches. The best of material is used in the construction of these cars, secured in the manner best calculated to secure strength and durability.

The following parts are of white oak the carlins, side braces, side posts, end sills, corner posts, draw sticks, stop blocks, needle beams, end plates, door posts, end posts, ladder posts, side cripple studdings, belt rails, roof saddles, door stops, dead blocks, end braces, body holsters, running board extensions, door stiles and bevel strips. Norway pine is used for side sills, draw sills, intermediate sills, flooring, door post stiffeners, facias, stop timbers, roof binder, door lining, running boards, door rails and roofing and sheeting. Georgia pine is employed for side plates, ridge pole and purlins.

The cars are equipped with the Westinghouse air-brake, steel brake-beams and vertical plane couplers.



The most novel feature of the car illustrated, however, is the trucks, which are of the Fox solid pressed steel pattern, fifty of these cars being thus equipped. We give a separate engraving of this truck, that its design may be properly understood by our readers. As the name implies, this truck is made of pressed steel formed under powerful dies. The form of the truck can be readily understood from an inspection of the engraving. It is made to take the Master Car Builders' large journal




## Master Car Builders' Standards.

BY A. M. WAITT.

Of all the beneficial results of the work of the Master Car Builders' Association, probably none has done so much for the operation of railroads as the adoption of the M. C. B standard axle for 40,000-pound cars. Up to the time of the adoption of this standard nearly every road in the country had two or more standards of its own, each one differing in some of its important dimensions from those of neighboring roads. As a result of this great diversity it was oftentimes necessary for large roads to maintain a stock of wheels and axles, whose varieties were legion.

Although at the time of the adoption of this early standard there were many, doubtless, who were incredulous as to the practicability of its adoption, yet it must now be conceded by all as resulting in the saving of many thousands of dollars, even to the roads who were for many years too narrow-minded and short-sighted to adopt it for themselves.

The conditions of railroad service are to-day quite different from what they were twenty years ago. Then the movements of cars were largely local, where now cars may frequently traverse the whole continent. With such a condition of things it becomes a question of vital importance to consider how the cars of various companies shall be maintained when far from the home road. With ordinary service, breakages will constantly occur, and with the tremendous rush of American life (especially railroad life) it becomes an important matter to have necessary repairs made with the greatest dispatch. Dispatch in repairs cannot be obtained if, in making repairs, it becomes always necessary to keep a loaded car waiting until a certain part needed to fit the particular car is manufactured in the foundry, forge shop, machine shop or mill.

Such absence of dispatch must always follow a lack of uniformity in parts liable to frequent renewals or repairs, and so the highest interests of all railroads must be best subserved by having absolute uniformity in details of the principal cars of all roads. This result can only be arrived at by the careful adoption of standards, *and putting them into use after they are adopted*. When will railroads have the general good enough at heart to do away with the "penny-wise-and-pound-foolish" policy of persisting in the use, in new equipment and repairs, of old styles of detail in car construction, when uniform standards have been agreed upon? It is surprising and lamentable that one or two very large and prominent roads continually persist in ignoring the general standards in their own equipment, though these standards have the hearty approval of the best railroad mechanical experts in the country. Alas for the perversity of some few minds who can never see anything good or worthy of copying outside of their own horizon! It is astonishing to find the lack of attention paid to important standards by some of the members of the M. C. B. Association, who come yearly to the conventions. It is surprising to find the amount of ignorance displayed by many members of the M. C. B. Association as to what the standards are which have been adopted.

Within two years the writer knows of one very prominent railroad with over 15,000 cars, and which has been looked to as a leader in car department matters, which had not at that time adopted the U. S. standard screw-threads in its car department, which standard was adopted by the M. C. B. Association in 1872. On this road the nuts tapped at one shop could not be turned upon the bolts cut at another shop. On the same road were two distinct and separate patterns of M. C. B. journal-bearings, which were not interchangeable. I could name at least five companies whose car department heads are among the most prominent in the M. C. B. Association and at the various railroad clubs, who are not using the present standard M. C. B. oil-box or pedestal, and who have, unless recently changed, a journal-bearing key that varies considerably from the standard dimensions. These are serious matters, and are what are doing, and have done, far too much in bringing disrepute upon the standards adopted by the M. C. B. Association.

If I should touch on the subject of draft-rigging, *i. e.*, sizes of spindles or spring-pockets, followers and springs, I am sorry to say that even more diversity exists among roads who can have no good reason in refusing to substitute the recognized standard dimensions for the "good old ways" in which their predecessors traveled.

The M. C. B. Association has adopted, wisely, many standards whose general use in new work would greatly facilitate repairs and gradually bring about that uniformity and reduction of stock to be carried, which is greatly needed, with the crowded condition of so many of our shop-yards.

Three important questions arise in connection with the subject:

1st. How shall we bring about the more universal adoption of the standards that have been adopted?

2d. How shall we get absolute uniformity in the adopted standards, as manufactured by different companies?

3d. What additional standard parts is it essential and advisable to agree upon and adopt.

First. To bring about the further adoption of the standards that have been adopted, I believe the proper committee of the M. C. B. Association, should issue a circular of inquiry to all the roads represented in the association, taking up the standards one by one, and asking if the roads have adopted and are using such standards: First, On all new equipment, if not, to what extent? Second, On all repair work, if not, to what extent? Also, if the standards are not in use, an inquiry should be made to ascertain the reason for their non-adoption. Such a circular would bring about two good results; it would bring freshly before each head of the car departments, the fact that certain standards exist, and just what they are; it would also develop, if they exist, any difficulties which stand in the way of more extended use of any standards.

I believe that much of the seeming apathy in the matter of using some of the present standards arises from the fact that

many of those in authority are not aware that certain of the standards have been adopted. A circular as above outlined would correct this source of inaction.

As to the second question, the method of securing absolute uniformity in the practical use of the present standards, I believe it necessary that patterns for castings should all come from one approved source. It has been demonstrated that, in order to obtain absolute correctness and uniformity in gauges, they must be manufactured by some one reliable firm. I believe that the same holds good as to patterns for castings adopted as standards. Many companies have obtained their M. C. B. standard oil boxes, journal bearings, etc., by obtaining a casting from some other company, and then allowing a patternmaker to copy it as near as possible, without knowing whether the original casting is larger than standard, through too much wrapping or otherwise.

All shops should be furnished with official drawings of the standards, and work only from the dimensions on the drawings, and never from samples. If the above were generally practiced we should have much better results. I hope every reader will immediately examine the M. C. B. standards in use on their roads, and be sure that they are conforming strictly to the official dimensions.

Third. Do we need more standards? I say yes. The adoption of some standards in years past may have been rather hasty, and we can learn a lesson thereby and go slowly *but surely*. We need more standards. I do not at present believe a standard car, of any class, or a standard truck, is feasible, or perhaps necessary, but there are many parts of both which are frequently broken and require renewing and should be made uniform.

1st. Standard dimensions, in section, of sills and floor timbers should be adopted for the leading types of cars. This is of great need.

2d. Standard dimensions, in section, for end-sills and draft timbers should be adopted.

3d. Standard sizes of draft timber bolts should be adopted.

4th. Standard center-plates and size of bolts should be adopted.

5th. Standard uncoupling device for M. C. B. standard drawbar is needed.

6th. Standard brake-beam and hangers would be a great blessing, although a very difficult point to decide upon.

7th. Standard dimensions, in section, for truck bolsters and spring-planks, for both spring-motion and rigid trucks, are much needed.

8th. Standard dimensions, in section, for end posts and corner posts in box cars should be decided on.

I have hastily outlined above a few possible standards which would, I believe, if they could be agreed upon and adopted, add greatly to the value of the invaluable work of the M. C. B. Association.

In conclusion, let me urge the universal use of all standards that have been adopted, the careful examination of the so-called M. C. B. standard patterns and templets in use on our roads, and a united effort to bring about an agreement on some of the more important details of cars, still untouched.

## New Driving-Axle and Crank Pin Lathe.

The engraving represents a new design of heavy axle and crank pin lathe recently turned out by the Bridgeport Machine Tool Works.

The swing is 26 inches and bed 14 feet 6 inches long, taking 8 feet 10 inches between centers.

The head has a three-section cone, largest section being 16 inches diameter and has patent friction clutch-head for instantly changing from belt to gear speed without stopping. Change from back to triple gears made by means of a positive clutch, handle for same being shown on top of front box. Results on speed, as follows. First, spindle driven by belt, three speeds, second, three speeds through first, or double train of gears, at a ratio of 8 to 1, third, three speeds through triple trains of gears at a ratio of 16 to 1. By means of a two-pulley countershaft, six speeds may be obtained without stopping the machine or shifting the belt, making a total of eighteen speeds by shifting the belt from step to step.

The carriages have independent feeds which can be reversed to feed right or left. When used for turning axles the right hand carriage should be run to rear of tail stock.

The tool-posts are arranged so that the centers will come within 22 inches of each other, and the points of the tools 12 inches apart.

The illustration is so complete that a description is unnecessary, all details being clearly shown. The lathe weighs 8,000 pounds.

Every year makes the heating of cars by steam, more successful. The experience of every cold spell overcomes new difficulties relating to details of the apparatus. It is very seldom now that we hear of any one questioning the fact that the deadly stove must go. There is no class of men so enthusiastic in favor of steam heat as the varnish makers and their agents. The steam that leaks from drip-cocks, traps and couplings, help materially in creating the necessity for a new coat of varnish.

A recent description of paper car-wheels says that the disks are so hard that they cannot be scratched with a diamond, and then proceeds to tell how they are glued together under pressure and turned true in a lathe. The mechanic naturally wants to know what the lathe tools are made of.

## RUNNING A RAILROAD.

### The Evolution of the Management of a Jim-Crow Line.

BY JOHN ALEXANDER.

After I got back from my exile in Kansas, following the strike of '77, I struck a job on a road up near my native place, that owned four tea-kettles and some miles of wire fence—by courtesy called a track.

This little road had been built by a hard-headed old merchant and lumberman, to get the products of a certain valley to the river, and he was considered a great man in that section of the country—as he really was. He had a hand in every enterprise in the country, represented the district in the Legislature, and was president of the railroad—we'll call him Higgins.

Well, when the first engine came—a second-hand Hinkley, with lots of new paint—she was named the "Colonel Gideon Higgins," and Dick Pomeroy was imported from New Jersey to run her, and as long as she remainded the only engine on the "cow-path," as the neighbors called it, Dick was king-pin of the concern—and a masher from away back.

There was a rooster by the name of Lester that did odd jobs around the depot at the county-seat, he could telegraph a little, but there wa'n't any to do, he helped with the freight, was express agent, peddled water on the wood train, helped keep books, carried mail, took care of the Colonel's horses, and generally 'lent a hand.'

Business got pretty good, and they had to have another engine, and Dick fell. The new engineer was a prettier man, and had forgot more about steam than Dick ever knew.

When they got four trains each way a day, they had to put up a telegraph line, and Lester done what telegraphing there was to do at headquarters. This was in the day of the old paper-ribbon telegraph machines, when the "operator" could take his time, and long years before I went there.

Lester done *at* a little of everything, and was soon depot agent, nobody liked the critter very well, and yet, nobody had much against him, except some of the boys said he was stingy, because he saved his money.

Colonel Gid had been married twice, in which particular he wa'n't much ahead of his wife, seeing as he was her third choice. The wife had a girl by a former union, that had been left over and to carry, when Colonel Gid was added to the widow.

Now, Lester saw, or thought he saw, where he could do the Colonel a favor, and make himself solid, by subtracting that girl from the Colonel's loss account. That critter was always looking out for a chance to do some one a favor of this kind.

He got the girl, and a little block of the railroad stock, as a sort of premium—stock wa'n't worth anything in the market.

Well, Lester got to be second mate of these eleven miles of road inside of a year or so, not because he knew the road from the turnpike—except when he saw the cars on it—but on account of a whole lot of little causes—mostly because he had married some of it.

Along in the late seventies, there was great excitement in the county seat, it was rumored that the Halifax & St. Louis Road was going right plump through the town, using the "cow-path" and consolidating with it, and at a meeting of freeholders to vote bonds, at which Colonel Gid presided and where Lester got in the crowd, and yelled for Colonel Higgins to speak—an old hayseed got up, and pointing to a map of North America, said:

"Are all you 'uns so plaguery blind that you can't see that we are the pivotal pint, atween Halifax and St. Louis? Don't yer see that we are right kerplunk in the line? Don't yer see that we have the key to the whole siterwation? In course we has. We will be a city bigger nor Bellus Falls inside of two years, and who do yer have to thank for it? Why, our feller citizen, the Honorable Colonel Gideon Higgins, Esquire, sir, and I, for one, vote for three million bonds. What's three million to a city like we'll be? Nothing! just nothing!"

And then every one of them damphools voted a debt upon their children, and their children's children, just for the privilege of seeing the cars go by on the air line from Mud to Ice.

Well, the road *did* finally consolidate with another half-starved road that was struggling through from the East—farmers all along the line doing the grading for fun, and at last but a few miles of rail was wanted to connect the county-seat—the name of which had been changed to Higgindom—with somewhere.

Mrs. A. was homesick to see me, and so wrote that there was great excitement up around Higgindom about a new air line, and that they had a hundred new engines, and maybe, if I would come home, I could get one of them to run. I came home.

I found that Jim Tompkins, the second engineer, was going to be master mechanic, that the road would be connected through in about two weeks, and have ten new engines on hand, and I should have the first one, sure. I got her.

The offices, such as they were, had always been over the depot, and as the road grew, this partition and that partition was taken down to give more room. A 40-foot addition had been added, and the office made that much bigger.

Colonel Gid had his desk there. Lester had one. The train dispatcher had his table of instruments in one corner, with 40 cells

of battery under it, the treasurer was there, the auditor, the road master, the master mechanic, the freight agent, the local passenger department, the bridge builder, the civil engineer, book-keepers, type-writers, a big stove, a colored janitor, an umbrella rack, and a cloud of dust—all in one room. The bigger the business got, the more things were collected in the museum.

Lester was Assistant General Manager to Colonel Gid., and as the Colonel was not there much, he was kind of head of the road.

In earlier years Lester had been familiarly dubbed 'Less, by the boys; when he got married, they changed it to "Helpless," and the first practical railroad man that went into the office and saw him on duty, named him "Useless," and Useless was his name forever after.

I reckon I had been running there two or three years, 'pears to me it was along in '81 or '82, that Jim Tompkins, the master mechanic, commenced to show the worry and work, and looked pretty bad. One day, along in the fall rush, Colonel Gid. came down to my train and told me that Jim had petered clean out, and been home for several days and asked me to come up and take his place till we could see how he came out; but, said the Colonel, as he went away, "I guess it's galloping consumption."

The next morning I was sitting in Jim's chair, up in the general bedlam, and Useless was telling me what to do, and how to handle my department, and I was wondering why he didn't do it himself, by taking a half hour nooning.

Well, for the next week I didn't do much but watch that critter of a Useless and study his methods.

Mr Editor, did you ever, in your boyhood days, watch a company of tumble-bugs build a nest? Don't you remember the big one—I don't know what position he holds, but suppose he is Assistant General Manager—that used to rush from one working bug to another, push him out of the way, take a look at what he was doing, and then rush to the next—but never doing a tap himself? That was Useless all over—I imagined I could see the extra legs on him.

We had a new dispatcher, a good man off the Central, but he didn't know the road nor the engines, and, as I sat next to him he often asked me to help him out. A couple of days after I went there, we were trying to get delayed 6 out of a hole, and not hold all the trains on the road or get any together. He was pounding an order to 21 and 6 and 17, and a special East—confounded compound thing—and I was telling him about what trains could do or ought to do, when Useless dropped down on him like a hawk on a spring chick.

"Excuse me," said he, laying the *Evening Blanket* on top of the poor dispatcher's hands and instruments, "but I want you to help me to formulate a reply to this criticism about the delays to trains on our road."

A pained expression crossed the dispatcher's brow; he held out his left hand imploringly to me, held his key down a minute, and a message commenced to come. The lines around his mouth drew down and his face was white, he opened his key a minute, then called to all operators to put out red flags and hold all trains. He was rigid as the O.Ks. came in from station to station, till at last Lindom O. K.'d and added, "Six is here for orders." Then the dispatcher fainted, and Useless went right on talking to him as he lay across his instruments.

That was a close call for 6 and 17, and the dispatcher resigned—said he wasn't going to help murder people by being an accessory before the act.

Useless was into everything. If a roundhouse foreman asked me for a tool or an extra man, Useless brought the letter to me to ask what reply *he* should make, and like as not remark

"I don't see what we want of a flue expander; the regular boiler makers used to do all that work themselves before you came; might it not be a bad precedent? Wouldn't the boilermakers have a right to infer from this precedent that they wouldn't have to do flue expanding?"

I used to resign every week, but couldn't find anybody with authority to receive it except Colonel Gid., and he refused, cursed Useless, and all would be smooth for an hour or two.

Phelan Haggerty orders a spike maul and three bars. Useless takes the opened letter over to Dan Toole, the roadmaster. Toole is counting up—partly in his mind and partly on his fingers—a very staggery row of figures, supposed to represent the number of rails and ties he has on hand. "Here is another *farmer* railroading," says Useless, "your department is full of 'em. Why don't you get rid of men that don't know what they want. How am *I* to keep track of this. Who is to know whether he wants bars of 60 pounds or 40 pounds railroad iron, or does he want bars of soap?" Toole loses the figures and his temper.

"Ave coorse the mon wants thrack bars! Who the divel but ye would call a *rail* a *bar*, anyhow? Phy in the name of the Howly Smoke don't ye give *me* the letters coming to *me* department, and lave *me* to answer them? No, ye must put *your* fut in the dish. Go 'long ave ye, and send the mon a couple ave bars off some cow yeard."

It subsides and goes back to its desk, but—the door opens and he pops up again.

He climbs into the treasurer's cash account, fingers the books, cusses the colored janitor, kicks the stove, rings his bell for a boy every fifteen minutes—then goes after him before the boy could get half-way there—and generally makes Hades seem like an ice pond in comparison with the office till he goes home

But when it came to arguing a mechanical matter was where he showed up. It was a custom in them days for every road to *design* engines for its particular work. Jim got into that, and had an old Dutchman making drawings of some new engines, and they had been left for me to finish. I knew we had a very ordinary road, and only needed ordinary engines. I looked over the sizes, and sent to Baldwin's for prints of their engines of the same size, had Gottlieb put the names on the cab; and "Great Air Line" on the tank, told him to keep still, and—submitted them.

Col. Gid. was pleased, and gave me credit for lots of things I never saw before, and especially complimented my speed, but Useless was on nettles at the first sight.

"That will never do, my dear sir; you can't have a very good mechanical eye. Just look at the difference in the sizes of them two *dumes*; little one ahead, big one behind—any law for that? Might not the people be deceived? Does it look right to make a radical departure from our practice for years merely for a whim? It don't balance; that will *never* do."

"No," said I, "there is no good excuse for making the sand-box smaller than the *dume*, but you have been looking at that old switch engine with two sand-boxes and no *dume*, and got off your base. If it was not for making a radical departure from our former practice, I should have put the smoke-stack in the center of the boiler and grouped the *dumes*, etc., around it." Then Colonel Gid. stopped us.

Jim had expressed a desire to see the drawings of those engines when complete, and one evening I took them up to him. He was pleased.

"How does the Colonel like them, John?" he asked.

"First-class," says I; "but that man Useless don't like 'em," and then I told him about the *dumes*. Jim laughed. I told him I met Useless on the street when I was coming up, and he made another objection.

"What was it?"

"Well," said I, standing up, "he come up like this"—and I imitated his voice and style—"No, no, Mr. Alexander, we will have to decline those designs; we owe it to our patrons to keep up the *high* standing of our engines. For years we have had large wheels; now you have made half of the wheels under this new engine less than half the usual size (the yard engine had no truck). Our patrons have a right to assume that the next engines will be *all* small wheels. People have a right to assume from this precedent that—"

"Don't!"

I looked at Jim; there was a look of pain on his face, his hand was extended toward me, palm out, as if warding off a blow—I had been too real.

I took his hand; it was rigid. Jim was dead. And do you know, Mr. Editor, that I couldn't get his hand down, and the undertaker couldn't get it down, and none of us could; and we finally had to make a coffin with a sort of mansard roof on it for poor Jim. I reckon he kept that position till he got inside the pearly gates—knowing they'd have no use for Lester there, he *might* take it down.

Lester took on about two pounds of fat every day that he got hold of a requisition for material and supplies.

He would listen to a long discussion on the absolute necessity of building a new bridge where one had burned or been washed out, and then deliberately run his pencil through the requisition for the material, draw a line out to the margin of the paper and write "Half"—this was his idea of economy.

One time he cut out Dan Toole's order for 5,000 pounds of fish-plates but let the bolts for them come on.

I ordered a set of flues for an engine once and he cut it in half—holding the engine in a month till the rest came.

Never a month passed but what we borrowed oil from some one to get through the month.

I got out some rules when we adopted the air-brake and ordered the men to carry twenty pounds "excess" pressure, but Lester made a fuss as quick as he got his eye on it.

"We can't afford to carry around excess air, Mr. Alexander," said he. "Enough is enough, we must do business in a business way and use what we have and no more."

He made an awful kick when the train-master insisted on two red lights on the cabooses and had a fit when he discovered, accidentally, that I allowed for shrinkage in castings. "Castings," he shouted, "castings cost us money, and the foundry must turn out a pound for the price, no shrinkage shall be allowed."

I guess that if the moon had been a department of the road, the officer in charge would have been blamed for allowing her to reduce size after once showing a full disk

But when the consolidation was finally finished, and the stockholders had called in all the stock and bonds, and issued consolidation mortgage bonds, they held an election, returned all the old officials, but voted to have a general superintendent, and inside of a month old Cap. Carr, from the Lake Shore, was added to the general stock in the big pen.

The Cap'en went over the road a couple of times, looked into everything, at everything and everybody, but, like Brer Rabbit, "he lay lo' and say nuffin'."

One afternoon, when he had been there about ten days, he came along to my desk, and says:

"Mr. Alexander, let's walk down to the shops."

I got up to comply—and so did Useless.

"Just wait till I finish this letter, and I will go with you," said he.

"Finish your letter and we will call in for you," said the Cap'en, as he closed the door, and added (on the outside) "when we want you"

"Let's go in here a minute," said Cap., stepping into a restaurant, and, establishing himself in a little room in the rear, he motioned me to a seat

"Waiter (giving him a quarter), two boiled dinners, two bottles of Milwaukee, and no disturbance"

Then he told me he wanted to pump me—and he did.

He wanted to know all about Useless, what? why? when? how? and all—and I told him.

"Think the Colonel would kick if I straightened him out a little?"

"No, often told me to tell him to go to thunder."

"Be in the office at nine to-morrow morning," said he as we parted at the door

"I was there."

Useless was defining the unwritten law of his method of filing letters to a deaf and dumb office boy, when the Cap'en got up from his desk, looking at a letter he held in front of his nose glasses; he stepped to the center of the room and said

"Where did this letter about a scarcity of freight cars at Holdbrook come from, and why hasn't the car accountant had it?"

"I laid it there, thinking you might wish to see it, or, perhaps, could help me out in replying to it," said Useless.

"Ah, yes, yes, by the way, Mr. Lester, is it part of the duty of the Assistant General Manager to open everybody's letters?"

"*We* must keep the run of our business, most certainly."

"Yes, jesso, but who is *our* and *we*? Now, Mr Lester, what are the duties of your office?"

"Well—well—I—'er—"

"You don't know. Well, I do. It is my *specialty* to know what every man's business is on a railroad. One man can't carry so much of a load as—"

"But, sir," interposed Useless, "*some one* must exercise a general guardianship over the whole, *some one* must run the railroad."

"Do you *run* the railroad? No, sir, you don't know the first principles of it. Does Colonel Higgins run it? or Mr. Alexander? or Mr. Murphy? No. *The men who run the engines and fire 'em, and run trains, and sell tickets, and load freight, and tamp ties—they run the railroad.* Not you nor me.

"Mr. Lester, we have passed the one-man stage—the back-yard railroad—this is now the Great Air Line. There must be a grand collection of the many details into one result, we must so work, each in his own line, as to accomplish a certain end, and in order to do this, we must have order, system and time. I can't find any of these things on the place.

"Now, Mr. Lester, just compare the whole road to that clock. There are a hundred pieces in it, each doing its own work, but the whole clock depending on every piece to do its whole duty. If one fails they all fail. A clock has to be wound up, regulated once in a while, watched all the time, cleaned regularly and certain pieces renewed or repaired occasionally—just like a railroad.

"Let us call the main parts of that clock the heads of our departments, the main spring is the motive power department, the pendulum is the treasurer's department, I guess, because it keeps us from going too fast. Now, the wheels and shafts and frames are the petty foremen, superintendents, etc., and the cogs and screws and wires or pins, are the rank and file, the little important parts—the men who run the railroad.

"Each of these little ones does his work and reports to the wheel above him in importance, these to the heads of their departments, and the final result is shown by the hands—the result—the auditing department. These report to me, I am the time-keeper, the head of the operating department, if there is a hitch I hunt for it, repair before the break-down, keep the thing going with the least friction—to earn the most money with the least expense. I don't know how to make, adjust or repair all of these parts, nor any of them, but I know men who do, and I use them to gain an end. Now, sir, some one has been monkeying with the regulator of this clock, got the pendulum out of beat, the spring

loose on the shaft and the alarm wound up—we've got to be cleaned and regulated."

"What part am *I*, sir?" asked Useless, with a half smile.

"Well, you've got the best of me, but you do not belong in my department at all," said the Captain. "Till now you have been a good deal like a toy balloon with a red string to it, bobbing around among the works, not doing much good, but often interfering with the wheels; but you are a part of the case, I guess—the ornament to the works, and its protection. If you don't know, sir, I can tell you that the case is the General Manager's department, and its business is to appear nice to the public, to float the stocks and bonds, look after the surplus, and pay the interest.

"In floating bonds, manager and assistants sometimes retail, but more generally wholesale, but I believe your forte is in the retail line. You have a bent for writing letters, why not write to some of these old farmers, and sell 'em stock? It is worth $100 on its face, and about $8.16 in the market, but bless you, they don't know that? Sell it to 'em at par, $75, $50 or $8.25, and hustle 'em up all along the line. Now, Mr. Lester, over in the new offices—I forgot to tell you that we were going to move in the new brick across the street, not this rubbish, but the men—your office is with Col. Higgins, on the ground floor; we are upstairs; any time you want to come up, step into my office, and my clerk will give you a pass into any department you may wish to visit. But, as to what you shall do, you are not in the operating department at all, but in the manager's department. You should report to Col. Higgins"

"Yes, report to *me*!"

We all looked around, and Col. Gid. sat in his chair, with his feet on his desk—he had heard the lecture.

Then the sun came from behind a cloud and shone in a motherly way on twenty-seven pale-faced men, a smile passed around, a large gob of plaster fell off the ceiling of the great den—and it was light.

## Some Valuable Suggestions.

They have an engineer on the New York end of the Pennsylvania, noted for his good horse sense and dry humor.

He ran one of their new "Class P" engines with the Belpaire boiler and the double-barreled traps to carry steam from the wagon top to the dome, this mill had not been exactly a perfect steamer and the engineer would have been glad to trade her for his old pet.

The engine went into the shop recently, and the foreman asked the engineer if there was anything special that he wanted done. The runner said, that he thought perhaps the engine would do better if they would tack up a blue-print in the boiler, so that the steam would know just where to go.

At another time his superintendent told him that they were arranging to put in another trough to scoop water from, and added, that with this they ought to make the ninety miles in the ninety minutes easy enough.

"The scoops are all right enough," said the engineer, "but you would be sure of success if you had one more, arranged as I could suggest."

"What's your idea?" asked the interested superintendent.

"Put in some device whereby we could scoop a new fire along about Trenton!"

## The Rhode Island Compound Locomotive.

We illustrate on this page a Forney locomotive as compounded by the Rhode Island Locomotive Works for the Brooklyn Elevated Railroad. Very little change has been found necessary in compounding this engine, the intercepting-valve placed in the steam pipe between the high and low-pressure cylinders being the only additional mechanism. This intercepting-valve is the special feature peculiar to the compound locomotives made by the Rhode Island people. It is so designed that the engine can be used simple or compound at any time. In practice this is found to be

an excellent arrangement, since it gives the engine all the power desired for starting a heavy train promptly, or for dragging a train over the crest of a grade where the ordinary power is liable to be slightly deficient.

Figures 1 and 2 give sectional views of the intercepting-valve. In ordinary compound working steam from the high-pressure cylinder is exhausted through the pipe E, Fig. 1, into the receiver and thence to the steam chest on the low-pressure side. In starting, steam is admitted direct from the boiler through the pipe D and reducing-valve B. This pushes back the pistons *a b c* forming the intercepting-valve, closing the pipe E and opening a direct communication with the receiver. When the high-

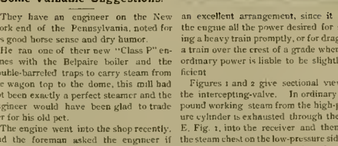




Fig. 1.

pressure cylinder exhausts sufficient steam to raise the necessary pressure in the pipe E, the intercepting-valve is opened, cutting off the supply of direct steam. In case the compound action is not sufficient to supply the power required, a valve connected with the pipe E is opened, which permits the steam to escape into the exhaust pipe and the intercepting-valve is moved to close the connection between pipe E and the receiver. The operation of opening this exhaust-valve admits exhaust steam in front of the intercepting-valve *h* which aids in moving the valve. When this is done, both cylinders take live steam and both exhaust it into the atmosphere.

Fig. 2 shows a front section of the intercepting-valve through ports *d* and *e*.

Two compound engines of the kind illustrated have been running on the Brooklyn & Union Elevated Railroad for over a year with a fuel saving of about 30 per cent. and water saving to correspond. In cities where the water used has to be paid for, the saving is worthy of consideration. Compound locomotives are getting beyond the experimental stage, for they have been in use long enough to show that the cost of repairs is no greater than that of simple engines and the mechanism is quite as reliable.

Let us see what engines of this type would save to the Elevated Railroad Company of New York were all the locomotives compound. During the year ending June 30, 1891, that company used over 190,000 tons of hard coal for their motive power at an average cost of $4 on the tender. The water used cost $65,790. If only 20 per cent. of the fuel and water was saved—and that is putting it very low—the aggregate reduction of operating expenses would be over $165,000 annually.

Compound locomotives are peculiarly well adapted to city and suburban service, owing to the decrease of noise and throwing out of sparks and dirt. Where soft coal is used, the reduced drain on the boiler, will make the prevention of smoke much easier accomplished.

The Pennsylvania recently ran an experimental train from Jersey City to Washington. It was pulled by one of the regular "Class K" engines, having a 78 wheel. The run to Trenton—56 miles—was made in 53 minutes, and the 91 miles to Philadelphia in 88 minutes. At Bristol the automatic water scoop was dropped into the trough, but it was brushed off in an instant. At North Penn Junction the brake was applied to get under control, and it stuck on the rear car and could not be released, and the engineer pulled it on to Gray's Ferry. Query 1. Where was the excess pressure? Query 2. If the excess was there, when was the triple on that car oiled and cleaned?

One of the most expeditious methods of cleaning castings we have ever seen is in use in the works of the Springfield Glue and Emery Wheel Co., at Bridgeport, Conn. They use the swing-frame grinding machine, which most railroad men are familiar with, and run the emery wheel lightly over the surface of the casting. Small wheels are used to reach corners and parts of the casting difficult to reach.

## To Detect Broken Stay-Bolts.

Mr. G. W. Stevens, Superintendent of the Lake Shore & Michigan Southern Railway, writes: It has been our practice for several years to use Fall's hollow stay-bolts, for the staying of locomotive fire-boxes, restricting their use to such portions of the fire-box where the risk of broken stay-bolts is greatest, such as the first row, row from top, around furnace door and the upper corners of the throat-sheet. The iron has given the best of satisfaction, and I have no hesitancy of recommending our practice, believing, that the advantages of the hollow stay-bolts, for the purpose of detecting breakage, is much preferable to the solid bolt, drilled for a short distance, as it is the experience of those making use of the latter practice, that the drilled portion will become coated over with grease and other accumulations and fail to give the desired notice when breakage takes place.

This hollow bolt permits an opening, both inside and outside of fire-box, thereby presenting a double opportunity for detecting breakages, as the annular opening passes through the bolt entirely, and failure of the stay at any point will immediately make itself known.

Railroad men interested in robbing the lime-impregnated feed-water, used in so many districts, of its evil effect on boilers will be sure to read with profit and pleasure the article contributed to this paper by Mr. George Gibbs, Mechanical Engineer of the Chicago, Milwaukee and St. Paul. Mr. Gibbs is eminently fitted to throw light upon this subject, for he has both the scientific knowledge and the practical experience that makes him a safe teacher. Mr. Gibbs graduated from the Stevens Institute, where he had devoted special attention to chemistry, a department of knowledge which is absolutely necessary to the understanding of water purification. In his practical career, he has devoted great attention to the water question, and no man in the country is better qualified to say what can be done to purify feed-water and how to do it.

## To Prevent Overwork in Train Service.

The following is a copy of a bulletin order posted in dispatcher's office in Rome, Ga.:

Sup't's Office, Atlanta, Ga., November, 9, 1891.

*All trainmen*

In order to comply with the State law of Georgia, after a run of (13) thirteen hours trainmen must have (10) ten hours' rest.

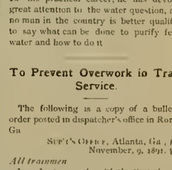




Fig. 2

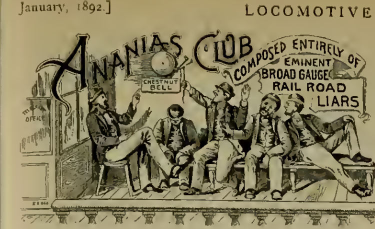
Trainmen must not work over (13) thirteen out of (24) twenty-four hours.

All employés reporting for duty are supposed to comply with this law.

The intention of this law is that the men must not be overworked, and we wish to comply with the law.

Beaupre, Sup't.

The original bill called for but twelve hours' work, but was lobbied up to thirteen, which is far better than no law at all. This law makes the company liable as well as the men.




## A Tribute to Greatness.

"Speakin' of snowplows," said the old timer, as he dropped into the Ananias Corner, "Speakin' of snowplows, reminds me of a cool spell we had whilst I was on the Mexican Central."

"What! cold in Mexico?" asked the gang.

"Yes, cold, c-o-l-d. Why you fellers don't know what cold is. When one of them Chinnooks comes up from Yucatan, it starts the bark on the trees of Mexico, I tell you.

"The time I'm tellin' you about I were deadheadin' south on Tim Fagan's train, when the Chinnook come up. The cars were hett by stoves and the greaser brakesie kept a roarin' fire, but the stove-pipe were a half-inch deep in white frost in spite of him. I had a buffalo overcoat and a pint flask of native brandy, made from red peppers, but I never come so near freezing up in my natural life.

"There was a young married couple sittin' right in front of me and I noticed the groom a shiverin'; finally he ast her to kiss him and she started to do it, when someone opened the door and froze the kiss right on her lips. Yes, gentlemen that poor critter sat there froze as stiff as an order to cut pay, with her dusky face puckered up just like a boy smokin' his first cigarette. That were the saddest sight I ever see," said the old villain, wiping a tear from his eye.

"The engine seemed to go awful slow and jerky like, and I thought perhaps Tim was getting out of wood, so I went ahead. The fireman was leanin' agin the boiler-head froze stiff, and Tim had pulled the engine over to stop and then chilled through.

"I got a drink of pepper whisky into him, and then noticed that the engine was white with ice.

"I couldn't imagin' what kept her a-goin' until I thought a minuit. She was runnin' by vacuum. The condensation was so quick that a vacuum was formed and it was suckin the pistons back and forth

"When we got in we couldn't blow the headlight out—the flame was froze—Tim cut it out with a hatchet and give it to the master mechanic for a paper w——"

"Gentlemen!" said the past president. "Gentlemen, this is our annual election. I do not know the name of the distinguished artist who has addressed us, but I move that all rules be suspended and that he be unanimously elected by acclamation as president of this club. Is it a vote? Carried. Stranger will you please take the chair—and—and treat?"

## The Decline of the Conductor.

"The leveling tendencies of our day," remarked the General Manager with a sigh, "are breaking down all our old idols. In my day the conductor was the great man on the railroad. When I was first raised to be superintendent, every passenger conductor on the road looked down upon me because I had only been a master mechanic before. The way that some of these conductors would walk out of the office, glance at the train and signal the engineer was a sight to behold. All the small boys looked upon the conductor as one having reached the height of human greatness, and the ladies brought him bouquets of the finest flowers, while the engineer had to be satisfied with a bottle of whisky put in his wood-ticket box on the quiet.

"We had a conductor named William Ford who was the most pompous and imposing man I ever saw. He was no good, and the boys called him Windy Bill on the sly, but the hardiest of them dared not say anything less than Mr Ford to his face. He was a big man and dressed in the best broadcloth, and walked about as if the earth belonged to him. One day he walked into the office at a station where my wife and little boy were sitting in the waiting room. As he passed through every one made room for him or tried to show him attention. My little boy watched him quietly till he disappeared, and then he whispered to his mother, 'Ma, was that God?'"

## Where Ignorance was Bliss.

"Large Shipper," "Regular Patron" and "Commuter" are characters specially privileged to criticise and condemn the actions of all railroad officers—just as "Old Subscriber" and "Mr. Constant Reader" are allowed to harass the soul of the editor, not to say the readers.

Some men delight in "making things hot" for the railroad officials who won't run the road for the special benefit of the individual kicker. One of their pet plans is to stir up public feeling against the road or the offending officer by "putting a piece in the paper."

If the official is indiscreet enough to reply in print, he exposes his abdomen to the vicious but irresponsible stabs from the untrained pen of Mr Large Shipper, *et al.*

One of these men became very much offended at General Superintendent H H Vreeland, of the New York City & Northern. Vreeland had the hardihood to run the road the way he thought best, and not the way the kicker thought best. The kicker called upon Vreeland for an explanation, got it, and then unbosomed himself. But Vreeland still ran the trains as he wanted to

After numerous protests, letters, calls and petitions, Mr Kicker sat himself down and wrote a very severe arraignment of the road and its management and published it in the *Tribune*

It remained unanswered and unnoticed while the trains on the "little Northern" ran regularly

Finally the kicker called on Vreeland again

"Say," said he, looking pleased, "the people are taking up this fight, it's going to hurt the road, going to ruin it, in fact, when you get everybody to thinking the same something must *come*. See?"

"Yes, that's so," admitted Vreeland

"Someone's been writing to the *Tribune* about this road and he hits the nail on the head, according to my notion; of course you've seen it?"

"No. Where did you say it was?"

"In the *Tribune*."

"*Tribune, Tribune*," muttered Vreeland, scratching his chin, "that must be a paper; where is it printed?"

"Why the New York *Tribune*, you know——."

"No," broke in Vreeland, "No, I don't remember such a paper. *Tribune*, let's see Charley!" calling one of his clerks, "Say, Charles, do you know of a paper called the *Tribune*?"

"No, sir, there's the *Times* and the *Sun* and the *World*; I think there is some mistake about the *Tribune*."

"James!" another clerk appeared, pen in hand, "James, do you know of a paper called the *Tribune*?"

"No, sir, there aint no paper published by that name around here as I know of."

"Never heard of the *Tribune*?" broke in the discomfited schemer.

"No, never heard of it," said Vreeland calmly. "You see we don't care so much for the howling of these little country weeklies, but we'd hate to have anything come out on us right here in town"

The kicker turned and made for the stairs, and it was so quiet that you could have heard a pin drop.

"That worked pretty good, boys," says Vreeland, "now he can't do anything else except grease the track or wreck a train I guess I'll smoke a cigar—sorry I hav'n't got three"

## A Good Galvanizer, but Not Up in Spelling.

"From memory's store-house, almost buried by years of exciting events of railroad life, I call to mind one incident which may be of interest," said Frank Coolbaugh, an old D L. & W train dispatcher, as he threw his leg over the railing of the Ananias Corner.

"The scene was laid in a country frontier railway town, twenty-five years ago, on a warm June day. No. 1 and No. 2, the only passenger trains the schedule contained, had gone, and the excitement of the day had passed. The townspeople who had gathered, as was their wont, in hordes to witness this 'passing sight,' had departed to their homes, leaving 'Gus' Jones, the station agent and myself alone until next day at the same time, when the same scene would be re-enacted. 'Gus' had just finished billing one coop of chickens and a dead calf, and the writer had just settled back to rest after an exhaustive effort in reporting the arrival and departure of these two trains, when 'Jim' Young, the company's galvanizer, who, to fill the idle moments, bought and shipped to New York butter, eggs, poultry and cheese, and whose tool shanty was a mile down the track, burst in upon us. With pen projecting threateningly from behind his ear, still moist with ink, coat off and sleeves rolled up, and with a face bearing the most troubled expression, we intuitively knew what was coming—we had been subject to these interruptions before. With an expressive movement of the hand, but no change in facial expression, he belched out—and his words were charged with intense disgust for himself

"'Gus, how in the devil do you spell Isaac,' and before answer could be made he said 'Oh, what a stupid damned fool I am—I-s-s-u-c-k,' and turned on his heel and trudged back through the hot sun to his shanty a mile away, and to his arduous duties, leaving us to our own ruminations. The next day at train time we waited anxiously for the arrival of the box, which we knew would explain the perturbed condition of 'Jim's' mind on the previous day, and sure enough, the box came, borne gallantly upon his shoulder, and on it we read in glaring letters

"'ISSUCK JOHSHUN,
"'NEU YORK.'"

## Swearing Back.

"In what is now called the 'good old times' of railroading," said Colonel Haines, of the Charleston & Savannah, in the course of a recent after-dinner talk, "there was a superintendent of a railroad in the South, who was noted for the richness of his swearing vocabulary, and he did not forget the expressions for want of using them. From morning till night he was swearing at some one, and his lash-like oaths were applied on the smallest provocation, or on no provocation. Some of the men got so accustomed to the daily dose of profanity, that they cared no more for it than they did for the bark of a dog, others constantly resented the degraded position they were compelled to hold.

"Among those who strongly objected to be sworn at in a promiscuous fashion was Jim Simpson, an engineer, who had been hired from away up in Missouri or Iowa. Jim had received the vials of the superintendent's wrath poured down his spine several times without cause, and he did not enjoy that kind of medicine. Feeling blue about it, Jim spoke to his conductor one day, and asked what could be done to prevent the superintendent from jumping onto him.

"'The best thing you can do,' said the conductor, 'is to swear back at the old man after he jumps onto you.'

"It was not long before Jim had the opportunity to try this method of repelling his tormentor. The superintendent went for him the next day, and Jim gave cuss word for cuss word, and threatened to pull the old man's nose. Jim instantly got fired.

"Meeting the conductor shortly after, he said, 'that plan of yours didn't work well, for the old man has discharged me for giving him a little of his own medicine. How is it that he does not fire you, when you swear back at him?'

"'Why, you blanked fool,' said the conductor, 'you don't say that you swore to the old man's face! I get even with him by doing my swearing when I get home to Atlanta'"

Some of the supply men are telling a joke at the expense of Jim Brady. The tale goes that on a hot, sweltering day of summer Jim stopped at a junction point to wait for a train, and that in the waiting-room he found some ladies of his acquaintance waiting also. With his usual courtesy and zeal to do a kind act Jim proposed taking them out for a drive, but there was no vehicle at the depot and no person to send for one. Jim remembered that while approaching the place he had noticed through other buildings the letters L I V E on a big, barn-like structure and he concluded that the full lettering read "livery stable." So he started for the place. The sun shone with its keenest rays, and Jim perspired freely as he hurried along, but he was walking in a good cause, and he strode manfully forward, although the distance was much further than he calculated on. At last a full view of the building was obtained, and to his utter disgust he read "Liver Regulator.

We stood in the yards of the Consolidated Road, at New Haven recently, and noticed a switch engineer trying to hang into his cab with his feet in order to see signals, while the firesey was busy at the steam factory door. Looking down the yard we observed that the whole place was on a curve, and that wherever the pony went the engineer was hanging out of the window. Stopping a man, who from his appearance might have been a yard man or a shop hand, we ask him why in the name of the New Haven Road, that engineer didn't turn his engine around so that he would be on the inside of the curve where he could see. The man looked at us suspiciously a moment, and said "I guess you don't live around here, that shifter has been shuntin' cars, headed east, for twenty years. You couldn't turn her around without getting an order from the president over the protest of every official from him down to the train butcher, there ain't no precedent for heading her the other way"

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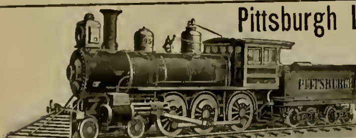


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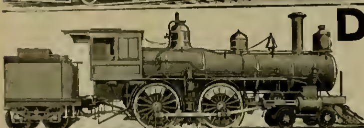

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Manufacturers of CAR WHEELS of all descriptions. Wheels and Axles Chilled Tires; Engine, Car and Bridge Castings, of any pattern, furnished to order at short notice. Wheels of all sizes constantly on hand.
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Plates up to 100 ins. in width.

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PITTSBURGH, PA.


(1) G H , Burlington, N C , writes

1 Why does the engineer's equalizing discharge valve blow at the exhaust of train-pipe, when the valve is placed on lap and then placed in running position? 2. When you make an emergency application of brakes with the equalizing valve, why is it that the red and black pointer will not vary over four or five pounds? *A.*—1 If there has just been an application of the brake, putting the valve "on lap" does not stop the blow from train-pipe exhaust port, because the piston has not seated the equalizing valve; the blow will continue until train-pipe pressure is reduced below that in the small reservoir. If it blows very long in "running position," it simply shows that the large drum does not contain the necessary pressure, or that the excess pressure valve is stuck. 2. When the lever of the engineer's brake and equalizing discharge valve is thrown to the emergency stop, both gauges are shut off from their supply of air, and a movement of either hand of the gauge represents leaks in the connections to it. This has fooled many engineers, who thought that the reduction, or entire absence, of train-pipe pressure ought to show on the gauge, same as with the old valve. Rest assured, that if there is a rush of air from the emergency port, that your brake is getting in its work

(2) J. T W., Willard, Tex., asks

1 In warming up cylinders do you open throttle a little and shift reverse lever backward and forward, or do you close throttle before you move lever? 2. Does the size of driver have anything to do with the load an engine pulls? A 17x24 engine will pull a heavier train with a four-foot wheel than it would with a six-foot wheel, would it not? *A.*—1. It does not matter, if the lever can be handled easily, it is as well to leave throttle open; anything to get steam through the cylinders. 2. The small-wheeled engine can pull the heaviest load. She uses the power of her cylinders more times in a given time or distance

(3) T J W , Weldon, N. C , writes

In conversation recently with an air-brake man I was informed that the lower a brake-shoe was hung the more power it had. If he is right, please explain why, as he could not to my satisfaction. *A.*—The length of hanger will not affect the power of the brake.

(4) W., Brockton, Mass , asks

Give definition of "Consolidation" engine and tell what constitutes a Wootten fire-box? *A* —A consolidation engine is one having eight coupled wheels and a pony truck (one pair of wheels) A Wootten fire-box is one built above the wheels, much wider than the track and having a bridge wall and a combustion chamber ahead of the grates The engine illustrated on the first page of the paper for December, has a Wootten fire-box, plainly shown.

(5) J N F , Titusville, Pa , writes

Will you please tell me through the "Asked and Answered," how I can get a description of the different snow plows for railroad work? *A.*—The manufacturers of the various rotary plows can furnish you with the details of machine plows The different forms of wedge plows vary but little, we know of no descriptive work on the subject.

(6) J. M , Peake, N. Y , asks

Will you be so kind as to explain the meaning of a degree gravity, in your valuable paper? In Forney's New Catechism, on page 531 it says Air cylinders should be sparingly lubricated with a small quantity of 32 gravity mineral oil. *A* —The gravity or weight of oil is reckoned according to what is called the Baumé scale In this water is put down as 1, and as all oils are lighter than this, their specific gravity is a decimal part of 1. Oil of 32 gravity, has a specific gravity of .8641 compared with water, and one gallon weighs 7.20 pounds. A gallon of water weighs 8.33 pounds.

(7) J. S., So. Brooklyn, asks

1 Why is the outside engine for locomotives preferable to the inside other than it is more convenient? *A.*—The outside engine is cheaper to make, easier to repair and avoids trouble of broken crank axles —a serious matter with insiders. 2. What size are the largest locomotive wheels and where are they? *A.*—The English engine "Cornwall" has drivers nine feet in diameter, the largest we know of.

(8) Sub., Dennison, O., writes

Supposing a train consists of twenty cars, ten cars on the front end are equipped with air-brakes The train breaks in two, eight cars from the engine, how should the engine-man act on finding that the train had parted? Also would like to know whether the answer to this question would also apply to a passenger train breaking in two? *A* —The brakes on forward end of train would prevent its being kept away from the rear, the whole train would stop, and with as much shock as the short distance between cars and the weight of unbraked portion of train would produce. The only thing the engineer can do in a case of this kind is to put his valve "on lap"—this prevents the air from being blown out of the main reservoir and leaves the engineer in condition to at once release his brake This applies to any train with air under same circumstances.

# OUR PREMIUM LIST.

## Useful * Things * that * You * Want!

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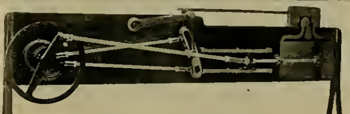
RECOGNIZING the fact that the railroad men of the land are not made of money, and that those who are most anxious to get tools, instruments and books, are often least able to do so, we have prepared this Premium List. Only the best makes of instruments and tools, and the truly reliable books are offered. These are no job lots that we have got cheap, but every identical thing in the list is new and the latest and best, *and will be shipped direct to you from the maker*—just as though you had sent *them* the cash. None of these goods are for sale by us—we give them for getting up clubs. Below each article named is the maker's price, and the number of subscribers for which we will give the article. Every subscription must be accompanied by $2. When a club is received and the premium mentioned that is wanted, we will order it sent direct to you from the maker—and we will always pay the mail or express, no premium shall cost you an extra cent on any pretext. We want you to work. In sending your club write each name, town, box and street plainly. State when paper should commence; but we can supply back numbers, and prefer that all should commence with January—it is best for those who want to preserve files. Send the money with the list, and give the name and number of the premium you want.

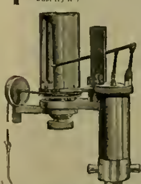
There is no excuse for a Lodge-room without a Valve Motion Model, or Westinghouse Valves; for an engineer to be without standard books, or a machinist without tools or instruments. Every man in the service needs the paper, and will thank you for calling their attention to it.

## DO YOU NEED ANYTHING HERE?



**Premium No. 1. 85 Subscribers.**

This is the new and improved Valve Motion Model. Patents of John A. Hill and F. J. Miller, built by Pedrick & Ayer. *Improved for 1892.* Half the actual size of a 17x24 locomotive. Just as adjustable as a locomotive, no more no less. Tram for setting valves furnished, and complete directions for setting valves, eccentrics, finding exact dead centers, etc., go with each machine. No wood but the main frame—a machine, not a toy! Everything visible from one side—just the thing for lodge-rooms. Crank on back as well as front. Patented audible exhaust, you can watch something else and hear the exhaust. More can be learned from this practical machine than from anything else. *No Lodge room complete without it.* It is worth $60. We will give it for 85 subscribers for 1 year. (A committee from any lodge can scoop 85 subscribers for this purpose in a day. Just try it.)



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TABOR INDICATOR.—This is one of the finest instruments made. One of the Ashcroft Manufacturing Co.'s best and improved type for high and low speeds, with detent motion, handsomely finished and plated, with one spring, one scale, two nickel-plated cocks, a treatise on indicating and the indicator, extra cord, 100 cards, oil, screw-driver, and extra drum spring; all put up in a handsome walnut case, with nickel-plated trimmings. Price, $85. Given for 100 subscriptions for one year.

PREMIUM No. 3

**Premium No. 3. For 60 Names.**

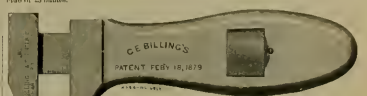
This is the famous full-jeweled Locomotive and Marine Chronometer made by the E. Howard Watch and Clock Co. The porcelain dial is 4½ inches in diameter, the case, nickel plated, 6¼. Nothing finer made. Price, $40. We give one for a club of 60.

**Premium No. 3 A. For 50 Names.**

This is the well known Seth Thomas Jeweled Chronometer. Probably more of these in satisfactory use on locomotives than all others combined. Will keep just as good time as the best watch and last for years. Nickel case, screw on front, 6 inch, are worth $27.50. We send one for a club of 50.

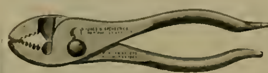
**Premium No. 3 B. For 25 Names.**

This is the Hecker & Lathrop Locomotive Clock, not jeweled. It has as fine a case and looks just as well as the chronometers. The makers guarantee them to keep good time, and we know that there are over 100 of them in use on one road, some of them having run steadily for 11 years. Six inch face, screw on front, dust and damp proof. Works made by Seth Thomas. Cost $10. We give one for a club of 25 names.




**Premium No. 4. For 5 Names.**

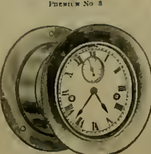
ENGINEER'S POCKET WRENCH. The finest wrench made, drop forged from bar steel and case hardened. Bar graduated in 32ds, opens one inch. Nicest thing out for oil-cups, etc. They are worth $1.00 black, $1.25 nickeled. We will give the black one for 5 yearly subscribers, the nickel one for 6.



**Premium No. 5. For 6 Names.**

COMBINATION PLYERS, WRENCH AND SCREW DRIVER. Drop forged from tool steel, fine finish, the handiest tool ever carried in an engineer's tool box and highly appreciated by a mechanic or in any household. By a quarter turn of the handle, and sliding from one hole to the other, done instantly, changes from 3-16 to 1 inch. Plyer, wrench, wire cutter and screw driver 6 inches long; cut represents plyers one half size. Black are worth $1.25, nickel, $1.50. We will give the black for 6 yearly subscribers and the nickel one for 7.

PREMIUM No. 3A



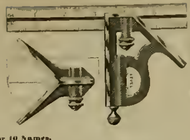
PREMIUM No. 3B

### STARRETT'S FINE TOOLS.

The following list of tools are from the well-known maker, L. S. Starrett, and will be sent direct from his shops. There are no better tools, and a little work will put you into possession of a neat set.

**Premium No. 6. For 25 Names.**

STARRETT SCREW MICROMETER. The finest measuring instrument made, the engraving gives a very good idea of it, being full size. All the latest improvements to compensate for wear, etc. Price, $6.50, in morocco case. We give it for a club of 25.

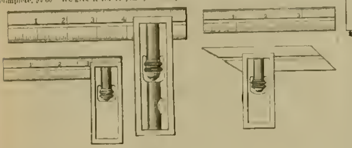


**Premium No. 7. For 8 and 12 Names.**

Combination Square, Level and Center Square.—One of the handiest tools made, a substitute for a whole set of try-squares, a good depth gauge and a splendid tool for transferring measurements. The 6 inch scale, with level and center head, is worth $2, we send it for 8 names. The 12 inch is worth $3, we send it for 12 names.

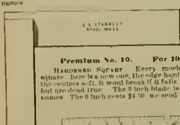
**Premium No. 8. For 10 Names.**

Small Square.—A fine tool for tool makers and others on nice work. Pa tent sliding rule, rule is narrow and can be adjusted to any length, will go where ordinary square is useless. Beveled and narrow blade furnished. Price, complete, $2 00. We give it for 10 yearly subscriptions.



**Premium No. 9. For 10 Names.**

Double Square, Stirred Head. A fine tool, blades cannot get out of square. An extra blade furnished with hexagon and octagon ends. Complete, 6-inch blade, costs $2 50. We will send it for 10 names.



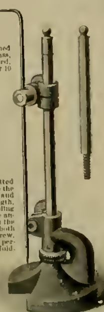


**Premium No. 10. For 10 and 15 Names.**

Hardened Square. Every mechanic wants a hardened square. here is a new one, the edge hardened enough to cut glass, the centers soft, it wont break if it falls. They are not graduated, but are dead true. The 3 inch blade is worth $2 50, given for 10 names. The 6 inch costs $4 50. we send it for 15 names.

**Premium No. 11. For 20 Names.**

Inclinometer. Consists of a cast steel stock and disk, both slotted to receive the blade, which folds in the stock. The blade attached to the graduated rotary disk may be secured at any angle from 0 to 90 degrees, and by loosening the clamp screw it may be shortened or extended full length, or removed for a straight edge. The working face of the stock, extending both sides of the blade, admits of its being reversed, so that the same angle may be laid off in opposite directions without changing the angle in the tool, thus requiring but ¼ of a graduated circle to obtain all angles both ways. At 90 degrees, the blade brings up against a case hardened screw, accurately adjusted, thus forming a try square; by holding the blade perpendicular (the level in the stock being at right angles), a plumb; by folding the tool, a level, length of blade. Open it to any degree and work may be leveled to that incline. The 12 inch blade is worth $5. We give it for 20 names.



Premium No. 12

**Premium No. 12. For 10 Names.**

Surface Gauge. The maker declares this tool perfect, has a new needle clasp, can be used for a depth gauge. The 8-inch size costs $2 00, we send it for 10 names. The 12 inch size has an extension piece, shown, it is worth $4 25, we send it for 15 names.

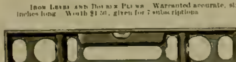
Premium No. 13

**Premium No. 13. For 15 Names.**

Large Bronze Dividers and Calipers. Every mechanic likes to have a large pair of compasses for use once in a while here is a nice tool, made of bronze, socket legs, caliper points, pencil holder and extension legs. Improved lock and adjusting device. The complete thing, as shown, costs $4 00. We send it for 15 names.

**Premium No. 14. For 7 Names.**

Iron Level and Plumb Plumb. Warranted accurate, six inches long. Worth $1 50, given for 7 subscriptions.



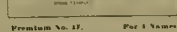
**Premium No. 15. For 8 Names.**

Same as the short level but 18 inches long. Worth $2, and sent for 8 names.

Premium No. 16.

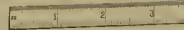
**Premium No. 16. For 5 Names.**

Screw Pitch Gauge. The best on earth, any guage in the set will go inside of a nut or stud hole. This gauge has 20 pitches viz. 9, 10, 11, 12, 13, 14, 15, 16, 18, 20, 22, 24, 26, 28, 30, 32, 34, 36, 38, 40. Worth $1. Sent for 5 names.



**Premium No. 17. For 4 Names.**

Scales.—These fine scales need no description they are divided as follows: 1st corner, 10, 20, 50, 100; 2d corner, 12, 24, 48; 3d corner, 16, 32, 64; 4th corner, 14, 28. We send the 3 inch for 4 names, the 6-inch for 5 names, the 12-inch for 7 names, and the 24-inch for 12 names.



**Premium No. 18. For 4 and 6 Names.**

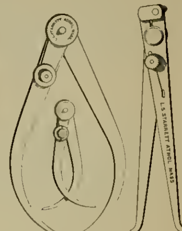
Flexible Rule.—Thin, watch spring steel, graduated on one side only. Worth 65 cents for the 6-inch, and $1.25 for the 12-inch. The small one for 4 names, the long one for 6.

Premium No. 19

**Premium No. 19. For 2 Names.**

Center Gauge, Standard Center and Screw Pitch.—Send you one for 2 subscribers.

Premium No. 20





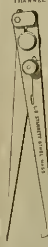
Premium No. 21.

**Premium No. 20. For 13 Names.**

Trammel Points.—Made of bronze metal, with forged steel points, hardened. Either point can be removed, and the pencil socket, accompanying each pair, put in its place. Adjustable like spring dividers. Light and durable. The 3-inch points adjustable instrument, costs $2 50. Given for 13 names.

**Premium No. 21. For 4 and 13 Names.**

Lock-Joint Calipers.—Simple, light, cheap and good, with a wide scope. The 4-inch size we give for 4 names, the 8 inch for 6, the 12 inch for 8, and the 18-inch for 13 names. You can have either inside or outside.





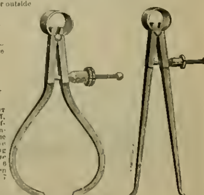
Premium No. 22

**Premium No. 22. For 5 Names.**

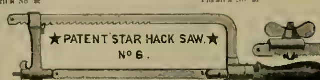
Hermaphrodite Calipers.—Six inch, patent lock nut. We send it for 5 names.

**Premium No. 23. For 6 Names.**

Fay's Patent Spring Nut Calipers.—The bow is stiff, making the caliper reliable. After calipering inside a chambered cavity, by pressing the legs together they may be withdrawn, and as they spring back will show the exact size calipered. Sizes, 4, 5, and 6 inch. The 4 and 5 inch given for 6 names, the 6 inch for 7 names.



Premium No. 23





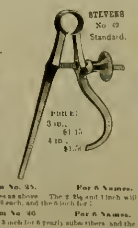
**Premium No. 24. For 8 Names.**

Hack Saw. The teeth are so hard that they cannot be filed, and the prices so low that it would never pay to file them even if they were soft. On account of high temper their cutting and wearing qualities cannot be excelled. The frames are made to hold saws facing in four different directions. They also have connecting pins so shaped that they cannot fall out. No. 6 is a patented Steel Frame, heavy and stiff, is highly polished and heavily nickel-plated. The handle is ebonized. This frame will hold all blades from 6 to 12 inches, and with the extra clamp, as seen in the cut, will hold all broken blades. With one dozen 12-inch blades for 8 names.

## STEVENS ARMS CO.'S CALIPERS.

There is no need to describe these tools, they have been on the market for years and are well known. Always order by No., and state size, and specify "Stevens."









**Premium No. 25. For 6 Names.**

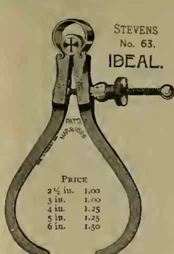
No. 47 is furnished in 6 sizes, prices as above. The 2, 2½ and 3 inch will be given for 5 yearly subscriptions each. The 4 and 5 inch for 6 each, and the 6 inch for 7.

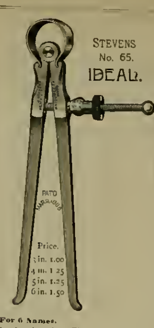
**Premium No. 26. For 6 Names.**

Keyhole Calipers. No. 40. The 3-inch for 6 yearly subscribers, and the 4-inch for 7.

**Premium No. 27. For 6 Names.**

Inside Calipers (No. 50).—Five-inch, given for 6 names for a year.



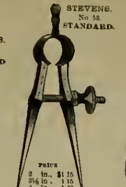




**Premium No. 28.** **For 6 Names.**

IDEAL OUTSIDE CALIPERS (No 63) – Heavy spring, patent nut and washer The 2½ and 3 inch will be sent for 5 names, the 4 and 5 inch sizes for 6 names, and the 6 inch for 7.

**Premium No. 29.** **For 5 Names.**

IDEAL INSIDE CALIPERS (No 65).–Same style as the 63. The 3 inch given for 5 names, the 4 and 5 for 6, and the 6 inch for 7



**Premium No. 30.** **For 6 Names.**

STANDARD SPRING DIVIDERS (No 52) The 2 and 3½ inch for 5 subscriptions, the 4 and 5 inch for 6, and the 6 inch for 7

**Premium No. 31.** **For 6 Names.**

SPRING DIVIDERS WITH THUMB ATTACHMENT AND PATENT WASHER (No 53) –The 2 or 3½ inch for 6 subscriptions, the 4 or 5 for 7, and the 6 for 8

**Premium No. 32.** **For 4 Names.**

HELICAL COIL CALIPERS (No 54) Something extra nice, the two smallest sizes are gold-plated, and are used as watch charms We will send either of them for 4 yearly subscriptions. We will give any size of the larger plain steel for 3 yearly subscriptions

---

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**Premium No. 101.** **For 20 Names.**

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**Premium No. 102.** **For 10 Names.**

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**We offer Four Sets of Instruments from the well-known makers, Keuffel & Esser, New York. Theee Instruments are Germen Silver, with steel points, highly finished, all put up in Morocco cases with purple velvet lining.**

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Contains 1 Compass, 5½ inch, with Pen, Pencil, Needle Point and Lengthening Bar, No 717; 1 Hairspring Divider, 5 inch, No 710. 1 Set Steelspring Divider and Bows, No 755, 750, 757; 1 Drawing Pen, with Joint, No. 782; 1 Drawing Pen, with Joint and Pin, No 785, 1 Box with Leads, No 830 Price, $12 75. We send it for a Club of 28


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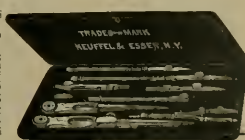


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## BOOKS.

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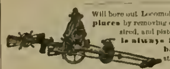

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This machine will mill out ports in valve faces of steam cylinders, duplicating work exactly and in the shortest possible time.
It is operated by a rope belt similar to that used for driving drills, etc.
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Any desired thickness of cut can be taken, jointing the faces perfectly true.
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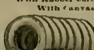

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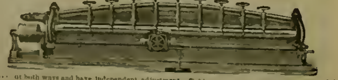
THIS CUT SHOWS OUR

## Boiler Plate Planer.

WILL PLANE ANY LENGTH OF PLATE.



Tools cut both ways and have independent adjustment. Table acts as a gauge for setting the Plate. Driven by a steel screw, which is supported its entire length so that it cannot be bent or sprung. 7 sizes.

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36 PAGES.

A Practical Journal of Railway Motive Power and Rolling Stock.

VOL. V, No. 2. NEW YORK, FEBRUARY, 1892. PRICE, 20 Cts. Monthly. $2 00 per Year.



## Automatic Brakes in Great Britain.

The last Board of Trade report shows that there are on the roads of Great Britain, 9,931 locomotives and 48,777 carriages, fitted with automatic power brakes. Of these, 7,521 engines and 31,519 carriages have the automatic vacuum brake and 2,410 engines and 17,158 carriages have automatic air-brakes.

Every failure of brakes over there must be reported to the Board of Trade, who investigate all serious ones. The board classify brake failures as follows.

(1) "Failure or partial failure to act when required in case of an accident to a train, or a collision between trains being imminent." (2) "Failure or partial failure to act under ordinary circumstances to stop a train when required." (3) "Delay in the working of trains in consequence of defects in, or improper action of, the brakes, distinguishing whether they arose from neglect or inexperience of servants, or failure of machinery or material."

The report of the board for the first half of 1891, shows that neither one of the brakes has a single charge against it for the first class. There were seven failures of the second class reported against the vacuum and twelve against the air, and of the third class, 404 failures against the vacuum and 232 against the air. These are remarkable results and even of the last order, where most failures are reported, there was only one failure of vacuum for each 118,000 miles run, and one failure of air for each 105,000 miles run.

## Speed of Wood-Working Machinery.

It is curious, said a well-known master car builder the other day, as we strolled around his finely arranged planing mill, it is curious how ignorant most of your iron-working friends are about the speed of wood-working tools. Most of them know that this class of machine requires great power to drive it, and that is due to the enormous capacity of these machines for doing work. Wood, of course, is more easily worked than metals, but the material is cut up so rapidly that it represents immense concentration of power. Here are some notes on the subject that may surprise some of the men who are deficient in respect for the wood workers of the country.

A properly driven circular saw has a periphery speed of 7,000 feet per minute—nearly a mile and a half. A band saw is run at about half that speed. Planing machine cutters have a speed at the edge of 6,000 feet per minute, and the cutters of molding machines slice out material at about 4,000 feet per minute. Wood-carving drills are run 5,000 revolutions per minute. Augers one and one-half inches diameter are run 900 revolutions per minute, and those half that size are run at 1,200 revolutions per minute. Mortising machine cutters make about 300 strokes per minute.

No free specimen copies of February will be sent out. The splendid colored plate in this issue cost over $300, and every one is worth a frame. Extra copies can be obtained at the retail price.

## Give the Devil his Due.

That many, many men are killed every year and every day on account of couplers there is not the least doubt.

We never hear of accidents causing death on account of defective draft rigging, yet it is not unlikely that a great many occur that are saddled upon the poor coupler.

A great many of the so-called coupler accidents will show two unbroken couplers, the draft gear has simply broken down or the stops have been forced apart and the draw-head shoved in.

Couplers that do not require the presence of men between cars at all will prevent deaths from defective draft rigging, but give the coupler only its own crimes to answer for—they are enough.


THE LARGEST ROAD LOCOMOTIVE.

## A Modern Samson.

There have just been turned out of the Baldwin Locomotive Works at Philadelphia four decapod locomotives for the Erie Railroad that are so far the largest and most powerful single locomotives ever built.

When you get a 76-inch boiler of ¾-inch steel on ten drivers and a truck, 193,000 pounds on a wheel-base of 27 feet 3 inches, you have considerable locomotive in one lump.

As will be seen, the engine is compounded on the Vauclain plan, having a high and a low-pressure cylinder on each side; the upper or low-pressure cylinders being 27 inches in diameter—the largest pair we ever heard of on a locomotive. There have been 32-inch low-pressure cylinders built for two-cylinder compounds.

The engraving on the next page shows how the cylinders, pistons and valves are arranged. These monsters will be used as freight pushers.

The following are the general dimensions:

Gauge, 4 ft. 8½ in.; actual weight in working order, exclusive of tender, 193,000 pounds; actual weight on driving-wheels, 170,000 pounds, estimated weight of tender, including coal and water, 90,000 pounds, estimated weight of engine and tender, in working order, 283,000 pounds; high-pressure cylinders, 16x28 in., low-pressure cylinders, 27x28 in; driving-wheels, five pairs coupled, diameter, 50 in., total wheel-base, 27 ft. 3 in.; driving-wheel base, 18 ft. 10 in.; total wheel-base of engine and tender, 53 ft 4¾ in., length over all, 63 ft 8½ in., boiler of steel ¾-inch thick, diameter, 76 in., height of center line of boiler above rails, 8 ft., extreme height above rails, 15 ft 6¼ in., fire-box (Wootten style), 10 ft. 11 1/16 in. long by 98¼ in. wide inside; tubes, 354 in number, 2 in. diameter, 12 ft. ¼ in. long, combustion chamber, 36 in. long, heating surface of fire-box, 182.5 square ft., heating surface of combustion chamber, 51.8 square ft., heating surface of tubes, 2,208.8 square ft., total heating surface, 2,443.1 square ft., tank capacity, 4,500 gallons; working pressure, 175 pounds per square in., boiler designed to carry 200 pounds per square in. Each of these engines takes the place of two 18x24 pushers on the Susquehanna grade, and does the work with less coal than formerly used.

## The Record-Breaker of the Empire State Express.

The engraving on this page was taken from a photograph of engine 870, N. Y Central R. R. one of the engines that made the world-famous run on September 14, 1891, and one of those used on the Empire State Express every day The record-breaking run from New York to Buffalo—439½ miles—was made in 425 minutes and 44 seconds, actual running time One day early in January this train (the Empire) made up 31 minutes on the schedule time, which is 52⅓ miles per hour

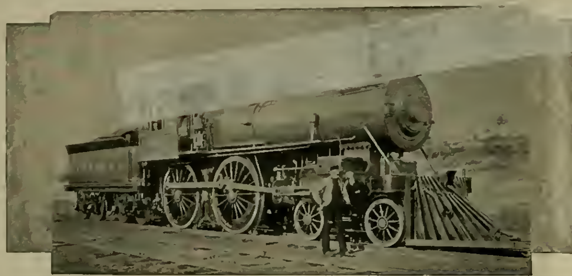
Engine 870 was built by the Schenectady Locomotive Works in 1891 The following are her general dimensions

Gauge, 4 ft 8½ in , cylinders, 19x24 in , diameter of drivers, 6 ft. 6 in , driving-wheel base, 6 ft 8 in., truck wheels, 36 in. diameter , weight on drivers, 80,000 pounds weight on truck, 40,000 pounds, wagon-top boiler, diameter, smallest ring, 58 in , firebox (shallow), 96 in long, 40¾ in wide , 268 2-inch flues 12 ft. long , grate surface, 27.3 square ft., total heating surface, 1,851.50 square ft The boiler has an extension front, 16-inch stack, double nozzles, and a brick arch supported on pipes , working pressure, 180 pounds.

The tender has a capacity of 3,500 gallons of water and 6¼ tons of coal and is fitted with scoop for taking water without stopping Weight of tender, loaded 80,000 lbs., making the complete machine, with tender, weigh 100 tons.

This engine develops a tractive force of 15,720 pounds.

The Empire State Express is now the fastest regular train for long distance run in America.

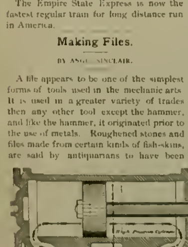


THE RECORD-BREAKER OF THE EMPIRE STATE EXPRESS.

## Making Files.

BY ANGUS SINCLAIR.

A file appears to be one of the simplest forms of tools used in the mechanic arts It is used in a greater variety of trades then any other tool except the hammer, and like the hammer, it originated prior to the use of metals. Roughened stones and files made from certain kinds of fish-skins, are said by antiquarians to have been used as files during the earlier stages of the bronze age These were succeeded by files made from hardened bronze, and later on came the steel, the master material from which files have been made for thousands of years.



ARRANGEMENT OF THE PISTONS AND VALVE OF THE BALDWIN COMPOUND LOCOMOTIVE

VARIED PROCESSES IN FILE-MAKING

A casual examination of a file would lead one to think that the making of this tool must be a very simple operation, but a visit to a file-making factory produces a different conclusion One of my school books had an article illustrating the advantages of subdivision of labor, and showing that it took ten men to make a pin. Those familiar with this phase of manufacture, will not be surprised to learn that a file goes through about twenty hands in passing from the steel bar to the article ready for use.

DIFFICULTIES OF USING MACHINERY.

File making seems a process, highly adapted for being done by machinery, but it is only within the last few years that machinery was successfully applied to the work. An edition of Chambers' Encyclopedia, published in 1885, says, that "many attempts have been made to cut files by machinery with only partial success." Readers of engineering literature will remember that only a few years ago there was a heated discussion about the relative value of hand-made and machine-made files, wherein the latter appeared to be badly worsted , yet nearly all the files now used in this country are made by machinery.

IN THE NICHOLSON FILE WORKS.

File-making, as now conducted, is one of the most interesting operations I have ever followed. Any railroad man visiting the Rhode Island Locomotive Works at Providence, R. I., will find himself well repaid, after satiating himself with the details of locomotive building, to step across the river and go through the Nicholson File Works. If he should stop off a day especially to visit these adjoining works, that are so different in character, yet so full of interest, he would spend the time very profitably

THE STEEL

In the round of the file works I was accompanied by Mr. Pierson, one of the partners, who understands how to lead a visitor so that the various operations of file-making will be seen in their proper order. First, we go to the place where the steel is stored, and here we find bars suited for all the kinds of files that are made. These bars, of course, are made of the best crucible steel.

FORMING THE BLANKS.

The bars are first taken to the shears and cut into the proper length for blanks. From there we follow them to a long room where the first impression received is that the place is as noisy as a boilermaker's shop There are two long rows of small forges with a trip-hammer beside each Here the blank file receives its first manipulation. In some cases it is merely the forging of the tang. That is with plain flat files. Other forms are put into shape. dies cut on the anvil assisting the blacksmith to do the work quickly

ANNEALING.

From the forging room the blank is conveyed to the annealing shop, where it is placed with many more of its kind in a heavy, oblong iron box. This box, when filled, is luted to make it air-tight, then it is put in a furnace and kept at a red heat for the time required for thorough annealing, and slowly cooled. This is one of the critical processes of file-making, it being of the greatest consequence that the blanks shall come out uniform in hardness.

STRAIGHTENING AND GRINDING.

Being handled by men of developed skill and long experience, the future file emerges from the softening process in the proper condition for receiving the impress of tools. It is straightened and then taken to the grinding room Here immense grindstones are revolving and on one of them the file receives the finish that makes its surface ready for cutting. It is highly important that every particle of scale be removed from the surface If the file is plane-faced the grinding is done automatically, a frame holding the blanks to the revolving stone If the face is circular or irregular, the grinding is regulated by hand All the grinding is done on ordinary wet grindstones, that are notable principally for their width and, when new, for their great diameter

FILE-CUTTING BY MACHINERY.

In following the blank to its next place of attention, we enter another large and particularly noisy shop where rows of machines rattle. making up a din like the inside of a power-loom factory The machines are the file cutters, and the noise is made by the constant impact of the numerous hammers A file-cutting machine is something like a small planer, with the cutter operated from the tool post The blank rests on a bed of soft metal, which is moved along on the table at the rate required for the number of teeth to be cut Young women attend most of the machines and appear to be very expert in the manipulation required. The principal skill called for in file-cutting by machinery is in the care of the cutters and in the adjusting of the machines This appears to be attended to by overseers There are numerous points about the operation of file cutting, that will be interesting to a mechanic to watch, which I have not space to describe Round files are cut in a special form of machine and are held vertical and constantly rotated while under the cutter.

FILE-CUTTING BY HAND.

A small proportion of the file-cutting in this establishment is done by hand. Hand-cut files vary, from the coarse rasp, with twelve teeth to the inch, to the file with three hundred teeth per inch. Files have been cut on machines with as many as five hundred teeth to the inch. It takes a good magnifying glass to see the rows of teeth in the finer files made. An exceptionally good workman can cut three hundred teeth to the inch, and under the glass the rows look as regular as if the distance between them was measured. This shows a wonderful development of touch. There is no instrument used to guide the workman. The blank is laid on a block and held secure on a piece of lead. The workman then strikes the first cut at the proper angle, and that is the guide for all the others. A hammer and cutter are all the tools used, the spacing and the horizontal and tooth angles being formed by manipulative skill.

LEARNING THE BUSINESS.

I was interested in how apprentice file-cutters learned their business without spoiling loads of good steel. I supposed that they had to practice on dummies, as young surgeons learning to use the lancet have to practice on the veins of cabbage leaves. But I learned that the apprentice file-cutter practices on the plain rectangular forms of coarse files that can be used for a smaller form if damaged under the hand of the novice.

HARDENING.

Between the cutting and the hardening rooms the file goes through some minor operations, which need not be described The hardening is done by heating the file in a lead bath to a bright red and then dipping it vertically into a clean-water vat This water is kept in motion and is maintained at an even temperature of about 70 deg. Fahr. There are several methods practiced of strengthening the files after they are hardened. The tang is softened by heating in the lead bath and then dipping in oil.

VARIETIES.

On the various interesting methods of cleaning, inspecting, oiling and packing the files I cannot dwell. An inspection of the curious variety of files that are made here, from wood and leather-cutting rasps up to the needle-like file employed by jewelers, is highly interesting. The finer classes of round files are cut by a process which is not open for the gaze of visitors. A mechanic naturally feels mystified about how the work is performed.

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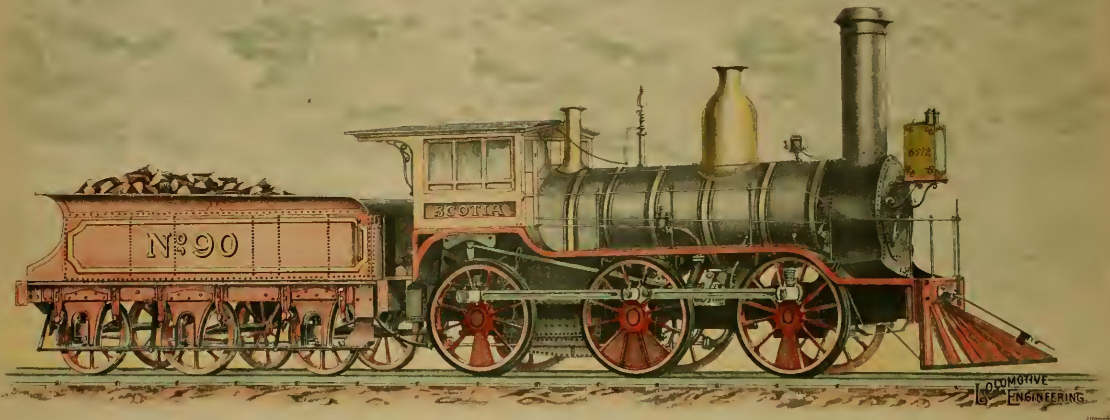
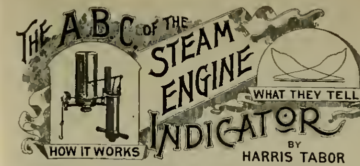
The economy of using labor-saving tools is well illustrated by the introduction some time ago into the shops of the Chicago & Northwestern at Chicago of a power traveling crane which cost about $6,000. The engines and material are handled so much better by this tool that the output of the shop has been increased two engines per month. At the same time the work of several laborers has been dispensed with and overtime on tools has been decreased about two hours per day




THE FIRST LOCOMOTIVE WITH A STEEL BOILER.

DESIGNED BY RICHARD EATON, LOCOMOTIVE SUP'T.

BUILT BY THE GREAT WESTERN RAILWAY OF CANADA
AT HAMILTON, ONT IN 1861




The diagrams shown in first paper were intended to make the reader familiar with the names of the various lines on the indicator-card, and the relation they bear to the movement of the valve and piston in the engine. It is of the utmost importance that this relation between the piston in the engine and the indicator-pencil be thoroughly understood. To make the text as plain as possible, this paper will be devoted to sketches showing the position of the piston and valve in a locomotive cylinder at the points of admission, cut-off, release and exhaust closure through one revolution, with each position of the piston the line that the indicator-pencil would make will be given, until the card is completed.

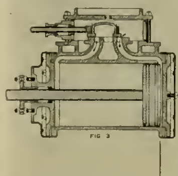


FIG 3

By referring to Fig. 3, which has been reduced from a drawing of a standard locomotive cylinder, it will be seen that the piston is at the beginning of its stroke, and the valve has commenced to open the steam port, allowing the steam to flow into the cylinder through the "lead," and exert a pressure on the piston before it has commenced its movement. The line made by the indicator while piston and valve are at the beginning of the stroke is the admission or lead line. When the valve opens just as the piston is at the end of the stroke, this line is vertical, but when the valve opens before the piston is at the end of its travel, the admission line inclines outwardly, and when the piston has commenced its forward motion before the lead occurs, the admission will incline inwardly; the latter case is often called negative lead. The admission of the steam always occurs when the piston has comparatively no motion.

As the piston advances in its stroke it gives a coincident motion to the paper drum of the indicator, making the horizontal line to the point where the valve closes and the cut-off takes place, as shown in Fig. 4, this is the steam line, and is the second line on the card. Theoretically this line should be parallel to the air line, practically it varies with every engine and condition. Where the steam pipes and ports are large and the piston velocity not too great, this line will run nearly straight to the cut-off, and will approach, within two or three pounds, the boiler pressure. Such conditions are rare, and are to be found only in the best stationary engine practice. In locomotive practice this line is straight only at very slow speed, as will be seen from cards shown later, taken from locomotives running on the road.

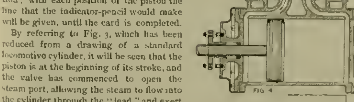


FIG 7.

Fig. 5 gives the next position of the piston and shows that it has moved from cut-off, or where the valve closed, to release, or exhaust opening, it is through this movement that expansion takes place, hence the line made on the indicator-card through this period is called the expansion line. This is the most important line on the card; it represents work done after the supply of steam has been shut off from the cylinder; compared with an engine which takes steam to the end of the stroke, it indicates work done without cost; within certain limits, the earlier cut-off means economy. When the valves and piston are tight, the expansion curve approaches very closely the hyperbole.

Fig. No. 6 shows that the piston has completed the forward stroke, and has moved five-sixths of the return stroke, to exhaust closure, or where compression begins. During this entire movement the exhaust-valve has been open; the indicator has responded to the change in pressure, as shown by the exhaust line from release to compression. While the piston was moving from release to the end of the stroke, the steam pressure in the cylinder dropped nearly to the atmosphere, and before the return stroke had fairly commenced, the exhaust line and air line were practically one. What was said of the steam line is true of the exhaust line, its shape and location depend upon the area of its ports and pipes, and the velocity of the piston. At very slow speeds the exhaust and air lines run together; when at very high speeds there may be a difference of twenty pounds between them. In stationary practice, where the engine is not called upon to blow the boiler fire with exhaust steam, and where expansion runs low, it is not unusual to see the exhaust and air lines run together. In locomotive practice, however, the fire must be blown by the exhaust, and if this be allowed to run too low it reduces the capacity of the boiler to make steam in a much greater ratio than the gain accruing to the engine from reduced back pressure (If the cranks who assume to revolutionize locomotive practice, without knowledge of the conditions, understood these points, there might be fewer failures.) Back pressure cannot be dispensed with in railroad practice, but it should be kept to the minimum with free steaming capacity.

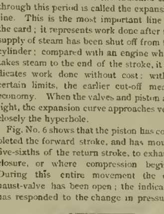


FIG 4

We must now turn to Fig. 3 for a completion of the return stroke. In Fig. 6 the piston has one-sixth of its return stroke to make; with the exhaust-valve closed, the confined steam follows the Mariotte law, rising in pressure as it is compressed into smaller space, and making the compression line, or curve, which is a hyperbole. We now have the completed card, as shown in Fig. 7, which represents the work done on one side of the piston during its forward stroke, and the resistance of the atmosphere and compression against it during the return stroke. If an indicator had been attached to the other end of the cylinder it would have produced a similar card, and the two would represent the work of one complete revolution of the engine. The vertical line at the right of the finished card is the clearance line, and indicates the waste room in the cylinder that the piston does not fill, this waste includes the space between the piston and the cylinder-head when the piston is at the end of its stroke, and all that space in the steam port up to the valve face. The clearance need not be considered in getting the power of an engine, but in analyzing the card it must be taken into consideration. It has the same effect upon the expansion and compression lines as so much additional length of cylinder would have. The steam contained in the clearance space expands after cut-off, and exerts some force on the piston, but up to the point of cut-off it has no effect on the piston. It will be seen at once that large clearance is a source of loss, and should be kept down when possible. In the cylinder under consideration the clearance has been assumed to be 8 per cent. of the piston's displacement.

The link gives peculiar features to its valve motion which can be best understood by comparing the extremes in cut-off commonly used. In the foregoing example the cut-off took place at three-quarters of the stroke. We will now consider a card with a cut-off at one-quarter of the stroke. It will not be necessary, in this case, to use the piston and cylinder for illustration, the movement will be the same except in distance and time. If we keep in mind the fact that the paper drum on the indicator takes its motion from the cross-head of the engine, we can always locate the position of the piston in the cylinder by the points on the card. If the cut-off be at one-fourth stroke on the card, we know that the piston had moved one-fourth its distance when the steam valve closes the port against further admission, and we know if the release show at three-fourths the piston has gone through the same portion of its stroke when the exhaust-valve opened to the atmosphere, and so with all the valve functions. Fig. No. 8 shows the steam distribution we would get with the link "hooked up" to cut-off at one-fourth stroke. A comparison with No. 7 does not show much resemblance, the steam pressure is alike, but in all other cases the cards differ. At three-fourths cut-off the steam is exhausted at 105 lbs. pressure (more than is carried in the average stationary boiler), and all that is not needed to give draft to the fire is wasted. At one-fourth cut-off the expansion line runs down to 40 lbs. when the exhaust opens, showing a fair amount of work done by expansion. The irregularities of the link motion become apparent when we consider the remaining points on the cards. On diagram, Fig. 7, the release occurred at $\frac{11}{12}$ths of the stroke, and on Fig. 8 at $\frac{3}{4}$ths. Following along the exhaust line we find that on Fig. 7 exhaust closure

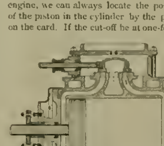


FIG 5

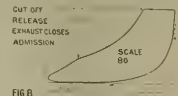


FIG 8

takes place at $\frac{5}{6}$ths of the stroke, and compression runs through the remaining $\frac{1}{6}$th, No 8 has the exhaust closed at $\frac{8}{12}$ths of the stroke, and the piston meets pretty serious resistance in compressing the confined exhaust through the remaining $\frac{4}{12}$ths. In one case the compression rises to 28 lbs. above the atmosphere, and in the other to 80 lbs. above. Coming to admission, or lead, we find that with the $\frac{3}{4}$ths cut-off the valve does not open until the piston has finished its stroke, when, in the case of $\frac{1}{4}$th cut-off, the admission is so much earlier that the lead line has a decided inclination outward. At first thought it might seem that these defects in the locomotive valve gear were a serious fault. This is not so. In a future paper the effect of the variable features of the link upon the economy and running of the locomotive will be considered.

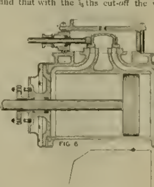


FIG 6

Harris Tabor

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The annual meeting of the Central Railroad Club was held at Buffalo, January 27. There was a large meeting of practical railroad men who attended ready to take part in the proceedings. Consequently there was a lively, interesting and profitable meeting. They discussed several matters relating to car wheels, brake shoes and car bearings. Mr E. Chamberlin, Master Car Builder of the New York Central, was elected President of the club for the fifth time. This honor is well deserved, for Mr. Chamberlin is one of the best presiding officers we have ever seen. The expeditious way he pushes through business, his faculty for undoing the kinks of conflicting motions and his alluring way of drawing members up to speak have much to do with the success of the club. There was a banquet in the afternoon attended by the lady friends of members and visitors. It was a highly successful affair

The Pittsburgh Locomotive Works have put in a hydraulic flanging plant, and are now able to press out boiler heads, tube sheets, etc., very quickly and accurately, doing any number exactly uniform. They are also pressing out stack bases, cylinder head covers, etc., of light steel in place of using castings or hand-flanged pieces.

The shops of the N. Y. S. & W. at Wortendyke, N. J., were burned down recently, and the site will be abandoned and new shops built at Paterson.


[James H. Hevey was born at Columbus, O., October 11, 1833. He commenced his career as a railroad man on the Columbus & Xenia road as a wood-passer when he was sixteen years old. A short time after this the road was consolidated with the Little Miami, and he was made a fireman. Of this part of his life Mr. Hevey says:

"I fired a six-wheel connected engine named the 'Ohio,' Phillip Wagoner, engineer. About this time Anthony Harkness built some ten-wheelers, and Phil got the 'Hercules,' and I went with him. These engines burned, on an average, seventeen cords of wood per trip of 120 miles. Moses B. Anthony, who came here from Paterson, N. J., to make a success with a Swinbourne engine, built to compete with a Hinckley, received the appointment of Master Mechanic of the Louisville & Frankfort road, and several of the engineers and firemen went with him. He was killed soon after, and I came North again and got a job on the Three Cs between Columbus and Cleveland. I made a little money, bought a saw-mill, busted, and went to firing on the C. P. & I. between Columbus and Piqua for W. H. Romans, M. M. I did not fire long until I was promoted. In 1850 I was put in charge of a regular passenger engine. I remained on this road until 1861, when I went to the Bee Line and ran local freight for about a year, when a Government agent passed through the country hiring engineers for the Government service out of Nashville, Tenn., where I arrived in February, 1863, and remained until late winter of 1864. On my return North I again took service with Mr. Romans and ran a passenger engine between Columbus and Bradford until 1866, when I went into the employ of the city as an engineer in the Fire Department, where I remained three and a half years, leaving the service on account of rheumatism, which disabled me for a year. When able for duty, I went to the U. P. and ran a passenger engine between Grand Island and North Platte and Sidney, having been in this service continuously until the past year."

The picture of Mr. Hevey shown herewith was taken in July, 1864, on Lookout Mountain at Chattanooga, then the seat of activity. The war reminiscences have already called out a great deal of comment and excited interest among engine-men, old and young. Mr. Hevey's mother has just passed away at the advanced age of 92.]

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"Hello! Have you seen the old man yet? No? Well, he wants to see you—they opened a new box this morning."

A new box meant another consignment of engineers from Nashville to the front (Chattanooga).

At the office I met Engine Dispatcher H——, who asked me if I knew Joe Q—— and Sam C——. I owned to Joe, but did not know Sam. After being questioned as to Joe's skill as an engineer, and my answers being satisfactory, I was informed that I would find him on the wood pile (a favorite resort of the boys when off duty). I repaired to the aforesaid wood pile, and was greeted with numerous questions as to my trip, such as:

"Glad to see you, old man. Heard Wheeler's cavalry had stopped you, and that you were in a fair way to spend some time in Andersonville."

"How did you get away? Heard they made you turn the 126," etc.

I, seeing the new men in the gang, "tumbled" and said:

"Not so bad as that; but I was stopped and the guard driven off, but after the 'Johnnies' had helped themselves to what they wanted, they left us, the guard returned, and we finished our trip."

This kind of chat was put up for the express benefit of the "tenderfeet."

According to instructions, I introduced my friend Joe to Bob K——, Clerk and Time-keeper, who entered him on the payroll as one of Uncle Sam's engineers at $150 per month, less $8 for rations and 50 cents hospital tax.

Joe and myself repaired to the Mess House, near the Crutchfield Hotel, and had our dinner. The bill of fare generally consisted of pork, beans, bread and coffee, with plum duff about twice a week. This was where we got our meals in Chattanooga. On the road we got them in the caboose. After dinner I took Joe to our sleeping quarters, a room occupied by Dusenbury, Freeman, Brown and myself. Our beds were made exclusively of army blankets for both mattress and covering, our coats being used for pillows. Our quarters were a sort of general headquarters for many of the trainmen, to whom I introduced my friend Joe as they dropped in during the afternoon and evening. By the time we went to bed friend Joe had heard of more wrecks and engineers captured and sent to Southern prisons than occurred during the whole war. After listening for a long time, he called me out and asked me if the boys were telling the truth, and being assured he had not heard the half, he drew a long breath and informed me that if the rest of us could stand it, he could—that he had as much sand as any of us. I assured him he would get used to it, as we all had.

The next morning we went to the office, and the engine dispatcher told me to take my friend out with me and learn him the road. This was a new one on me, as heretofore new men were sent out alone; lucky to have a fireman who knew the road. I think the "old man" done it because Joe came from his part of the country.

Well, at 3.30 P. M., with engine 126, we left Chattanooga for Marietta. My friend mounted on the fireman's box, all eyes and ears. I assured him we never had any trouble north of Dalton.

"How far is that?" asked he. When told, he remarked that it would be dark when we passed there. Out about Graysville he mounted the tank box and began helping the fireman by piling wood for him. Below Ringgold the road is very crooked as it winds its way through the mountains; it crosses Chickamauga Creek a great number of times. Along here dark struck us.

My fireman, Jack Carfield, informed me that his Nibs was getting nervous. Now, Joe had been considered game in the North, and I was a bit surprised at it, and thought I would try his nerve a little below Dalton, but how should I do it? All the way to near Tilden I tried to think of some scheme to test Joe's pluck and not hurt him. In my box I had a 38 Smith & Wesson, but how was I to get it out of the box without being seen?

I called Jack over, and said to him, "Tell Joe something to make him look out of the side-window, and keep your wits about you." Jack got in the gangway and laid his hand on Joe's shoulder, which I noticed made him start. I slipped off the box and got the pistol, and up again on the box unnoticed. Holding the pistol on the outside of the cab, I waited for a good level place which happened to be in a dense wood with a thick growth of fine chapparal. Here I fired three shots in rapid succession, dropped off the seat to the deck; Jack squatted in the tank, but friend Joe took a flying leap out of the window. Full of laughter, I shut off, called for brakes, stopped, and the search began. I called, but getting no answer I became frightened, fearing that Joe had seriously injured himself. We searched the ditches, sent men back, but Joe had vanished. The whole crew, train-guard and all, finally joined in the hunt. After about fifteen or twenty minutes, we found the brave lad snugly stowed away between the roots of a large stump, as nearly as possible being covered with pine straw and leaves. After being assured that there was no danger, he came out and we proceeded on our trip. At Resaca, we met a train north bound, which Joe boarded with his grip, and I have never seen him since to explain matters to him.

As soon as possible, he got back north of the Ohio river, where he told marvelous stories of his narrow escape and of the grit possessed by the brave men who ran engines on the Government roads during the war. Old Jerry M., of Galion, had a son in the service, who was ordered home on the strength of Joe's hair-raising narrative.

James H. Hevey

## HISTORICAL LOCOMOTIVES.

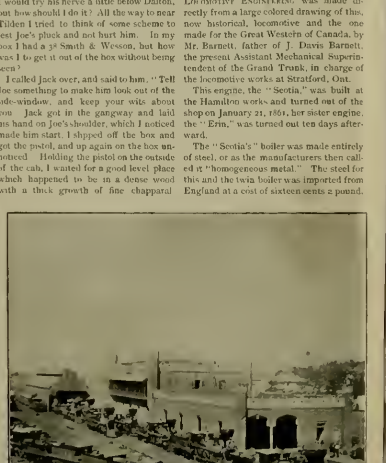
### The First Engine with a Steel Boiler Built in America.

[Colored Inset.]

The colored plate found in this issue of LOCOMOTIVE ENGINEERING was made directly from a large colored drawing of this, now historical, locomotive and the one made for the Great Western of Canada, by Mr. Barnett, father of J. Davis Barnett, the present Assistant Mechanical Superintendent of the Grand Trunk, in charge of the locomotive works at Stratford, Ont.

This engine, the "Scotia," was built at the Hamilton works and turned out of the shop on January 21, 1861, her sister engine, the "Erin," was turned out ten days afterward.

The "Scotia's" boiler was made entirely of steel, or as the manufacturers then called it "homogeneous metal." The steel for this and the twin boiler was imported from England at a cost of sixteen cents a pound.



U. S. MILITARY ENGINES AT NASHVILLE DEPOT, PHOTOGRAPHED IN 1864.

These locomotives are the ones referred to by Alex. L. Holly in his "Railway Practice in the Economical Generation of Steam," 1861, in which he says:

"In this country the practical test of the Albany semi-steel has been quite largely commenced. But both here and in England the use of steel is confined almost exclusively to fire-plates. The author is not aware that any one but Mr. Eaton, locomotive superintendent of the Great Western Railway of Canada, has made an entire locomotive boiler of steel. However the new material may stand the great test of fire, it is quite unnecessary to postpone its known advantages for the outside plates of boilers."

One remarkable thing about these steel boilers was that the thickness of sheets selected was almost exactly what afterward became the standard practice of the country, being as follows: Inside box, tube sheet, $\frac{1}{2}$-in.; door sheet, $\frac{1}{2}$-in., side sheets, $\frac{7}{16}$-in.; crown plate, $\frac{1}{2}$-in., and for boiler the face plate, throat-sheet and dome were $\frac{7}{16}$-in., the barrel sheets $\frac{3}{8}$-in., and front tube plate $\frac{3}{4}$-in., rivets of $\frac{3}{4}$-in. diameter of Low Moor iron were used throughout the construction.

The weight of the boiler, without tubes, was 10,356 pounds, there were 240 brass

tubes used that weighed 4,643 pounds, making the total weight, empty, 14,999.

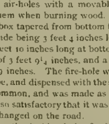
The boiler pressure carried was 130 pounds per square inch. The engine had cylinders 16x24 inches and three pairs of coupled wheels five feet in diameter, no truck.

Mr Robert Archibald, now of Hamilton, and Mr J. G. McIntyre, now of Stratford, were shop foremen at the time of building these boilers, and Mr McIntyre still has a test piece cut from one of the plates and tested by drilling a hole through it and drifting it out of all shape, but without the sign of a crack

Mr Eaton at this time was often heard to say that the price alone was all that stood in the way of the successful use of this metal, both for shell and fire-box plates

The "Scotia" class were designed to burn either coal or wood, and above the foot-plate the fire-box was provided with a line of air-holes with a movable slide to close them when burning wood. The back of fire-box tapered from bottom to top, the size inside being 3 feet 4 inches long at top and 4 feet 10 inches long at bottom, with a width of 3 feet $9\frac{1}{4}$ inches, and a height of 3 feet 9 inches. The fire-hole was elliptic in shape, and dispensed with the solid ring then common, and was made as in sketch, a form so satisfactory that it was not afterward changed on the road.

Across the inside of the fire-box was a water-table, sometimes called a baffle, this water-box was 5 inches thick and $10\frac{1}{2}$



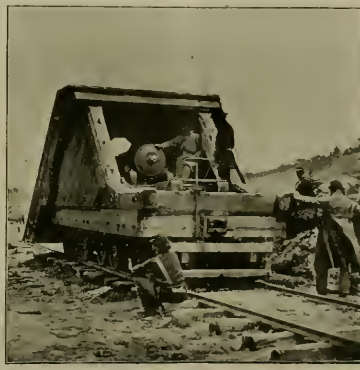
inches wide, it was not set level in the box, but was on an incline, the right hand end being 8 inches the highest, this was done to insure circulation, water flowed in at the lower left side and out at the upper

The crownbars and gusset stays were continuous, and made out of steel plate strengthened on both sides with beot angle irons This was the designer's favorite form of crownbar, and was often used by him, but has proved to be defective because it lacks elasticity. The top corner of of fire-box (side sheets to crown) had a 6-inch radius, and the water spaces tapered from 2 inches at the foundation ring to 3 inches at the top.

The fire-grate was fitted with revolving bars, worked from the foot plate by a screw, so as to either fracture the clinker or dump the fire.

The tubes were $1\frac{1}{2}$ inches external diameter The smoke-box was of thin wrought iron plate, double, with distance washers between

The main engine frames were solid throughout, 8x2 inches in section, and were



forged at the railway shops at Hamilton The hornblocks of cast-iron with V recessed faces, so that the axle-boxes were of a double V section. This design had in view increasing the jaw wearing surface of the box, and getting rid of flanges on the sides of the axle-box. The trailing side of all jaws were fitted with adjusting wedges, the front side was solid.

The "Scotia," or one of her sister engines, had the first set of wrought iron driving wheels forged in Canada. It is possible that Ross Winans & Co may have made some earlier in the States for the B. & O. Ry., but this is open to question

Another point to be noticed in the cylinder design is that the ports in length were equal to the diameter of the cylinder, 16x $1\frac{1}{2}$ in steam, and $16x2\frac{1}{2}$ in. exhaust, with a valve having $\frac{3}{4}$ in. lap and $\frac{1}{16}$ in. lead. This is an early instance of liberal ports

The side-bars were of 2-inch round steel, 3 in diameter, the crosshead was of the "spectacle" pattern, of cast-iron, with brass bushes $13\frac{1}{2}$ in long, and sponge glands or stuffing-boxes at each end of bushes for assisting the lubrication.

Having cylinders inside the frames, the valve motion was direct, but the motion itself was a combination, as it had a curved or Stephenson link in conjunction with a Gooch or movable reach-rod on the valve spindle, both link and reach-rod being connected to short arms on the weigh-bar shaft or tumbling shaft, as now called, as in the Allen straight-link motion, so that, as the curved link was dropped down, the free end of the valve stem reach rod was lifted up. The short arm on the weigh-bar shaft lifting the link was $2\frac{1}{4}$ in. long, the other moving the reach-rod $3\frac{1}{4}$ in. long. The link was suspended from its lower end

The "Scotia" had in each piston three cast-iron rings, $\frac{5}{8}$ in. square, sprung into place This is an early record of this type of piston packing, and the size is correct for a 16-in. cylinder judged by modern practice.

Part of the exhaust steam was used in heating the feed-water.

Weight (presumably loaded) is said to have been 31 gross tons = 69,440 pounds Engine was broad gauge (5 ft. 6 in ), and went out of existence as an engine with the G W Ry "change of gauge"

Mr. Eaton was a locomotive engineer of good and advanced ideas, and he had the courage of his convictions, as these engines show.

The effect of "exercising a proper control of the railroads" by a farmer Legislature, has been illustrated very well by the progress of railroads in the best (?) regulated States the past year In Kansas two miles of new track were laid; Nebraska got forty-four and Iowa twenty-eight

Coolbaugh & Pomeroy, of 29 Broadway, New York, have been appointed general agents for selling the product of the Lukens Iron and Steel Works, Coatesville, Pa The material is steel sheets suitable for locomotive boilers and fireboxes.

## Against the Brake Club.

The common practice followed by brakemen of supplementing their strength by the use of a stick in setting brakes has lately been vigorously opposed by General Superintendent Brown, of the Fall Brook Coal Co. In a bulletin-board notice he says last month "This company put on eighty new brake-beams at Lyons before the Central would receive the cars Most of these beams were broken in the center, caused by the brake being drawn up too tight, and when a brake-beam breaks parts of it are liable to get under the wheels and thereby wreck the train. This led to an investigation, and we found that brakemen were using sticks to set brakes."

The investigation revealed the fact that the caboose not provided with clubs for braking purposes was an exception This led to vigorous action. After giving permanent leave of absence to some men found sliding wheels by means of club leverage, Mr Brown intimated that the rule prohibiting the use of sticks means what it says, and its violation will result in official decapitation of brakemen and conductors

## Cars Designed to Cause Wrecks.

The views on this page are taken direct from photographs made by the Government photographers during the war, the negatives now being owned by the War Exhibition and Photo Co., of Hartford, Conn

The two upper pictures show front and rear views of a battery fixed up by General Grant's men for use on the military railroad before Petersburg This was a very heavy car, made of timbers as shown, in the shape of a snow-plow, the planking was afterward plated with railroad iron

On the car was mounted a heavy rifled cannon as shown, the gunners could push this car back and forth or haul it by horses or locomotives.

It was made very harassing to the enemy, as it would suddenly turn up in a new quarter, do considerable damage and get away before their batteries would be able to get the range to silence it

The lower picture shows another car a flat, mounting a large mortar, which the soldiers named the "Dictator" This mortar did effective work before Petersburg, as it was always to the front The photograph shows the gun crew as they appeared ready for "business"

The *Age of Labor*, a 12-page semi-monthly, has appeared in Chicago, with L. W Rogers, late of the *Trainmen's Journal*, as editor Never mind making fun or kicking at any other paper, Bro Rogers—make your paper bright and interesting—that will help you Let the others win or lose on their merits—if they have any

The Chicago & Alton people are about to order some new ten-wheel locomotives.


## Guides.

Upon this subject probably but little will be said which will materially aid experienced locomotive mechanics. However this may be, I hope to say something which will prove a benefit to apprentices, and those unaccustomed to this class of work. I have seen machinists who claimed to have had vast experience in these matters who could not, or at least who never did, line up a set of guides which would run cool, and not cause excessive wear to the crosshead.

Before starting to line up a set of guides it is, of course, very necessary to have the bearing surfaces of each crosshead lug planed perfectly straight and parallel, also to have each guide planed or ground true its entire length. To true up the crosshead I should proceed as follows.

Place securely in the tapered hole from which the piston-rod was removed a short mandrel; this mandrel should fit the hole perfectly. Place the head on the planer bed with the top side down to enable the bottom bearing surfaces to be planed first. In some shops they use two V-shaped iron blocks bolted to the planer bed, and clamp the mandrel with the crosshead attached in the V part of the blocks. This is a very good plan, and it insures the surfaces being planed in line with the mandrel, which is the thing desired. In case no V blocks are to be had lay the top part of the head flat on the planer bed, and shim under it with narrow strips of roofing tin, or paper, until with the aid of a pair of inside calipers you find that the mandrel is in line with the bed.

Now, it is necessary that the bottom bearing surfaces should be, when finished, equally distant from the center of the piston-rod hole A, Fig. 1.

Now turn the head over, and clamp it to the bed, allowing the surfaces just finished to rest on two parallel strips of iron, B B. This will insure the upper and lower surface of each lug being parallel when finished. It is not necessary that the upper surface of each lug should be equally distant from center A, it is better to leave them an unequal thickness than to plane away the stock to make them equal; plane only enough from each upper surface to true it up.

Now the guides should be planed or ground the entire length of each, that is, when finished the ends A A, Fig. 2, which bear on the guide-blocks should be in line with the wearing surface B. I have known some alleged mechanics who, when they wished to close guides, instead of removing and reducing the guide-blocks reduced the end of the guides as per A B, Fig. 3, to bring the wearing surface C to the crosshead. This is not the way a mechanic would do the job. Better have a liner say ⅛-inch thick on top of each block.

These liners can then be removed, reduced and replaced without disturbing the guides, which thereby remain standard.

After the crosshead is trued up and the guides are ground their entire length all is ready to begin the operation of lining them up. I have taken for example that style of crosshead and guides with which ordinary eight-wheeled engines are usually equipped, for the reason that the task of properly lining up this style of guide is about as intricate as that of any other style.

Before running the line through the cylinder care should be taken to have each guide-block in both the cylinder-head and guide-yoke perfectly level with the engine when each is screwed solidly to place, and to obtain good results each block should be leveled *separately*. I have seen machinists endeavor to level them by placing the level on a straight-edge reaching from block to block across the head. This is poor policy, as it is impossible to level them thus unless the distance from center to lower face of each block is equal; that is, of course, assuming that all other parts are properly constructed. The reason it is impossible to level them in the manner de-

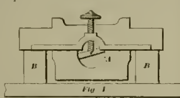


Fig. 1

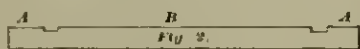


Fig. 2.

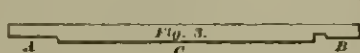


Fig. 3.

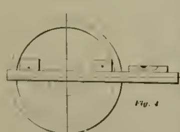


Fig. 4

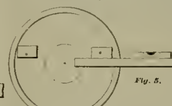


Fig. 5.

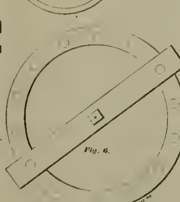


Fig. 6.

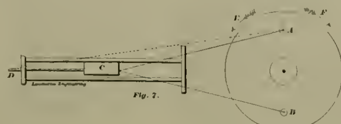


Fig. 7.

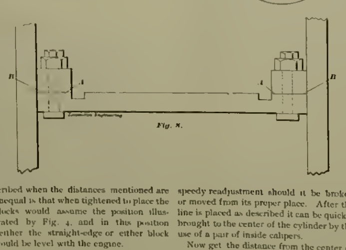


Fig. 8.

scribed when the distances mentioned are unequal is that when tightened to place the blocks would assume the position illustrated by Fig. 4, and in this position neither the straight-edge or either block would be level with the engine.

Therefore, I say the better plan is to level each block separately in the following manner

Adjust the level to a long straight-edge reaching from frame to frame just back of the cylinders, or adjust it to that part of the cylinder upon which the steam-chest rests. Then fasten the level near the end of a shorter straight-edge, then holding the top of the other end firmly to the under surface of each block (see Fig. 5) twist them until the level shows correct, tighten each thus and you are sure that all are level with the engine.

After leveling the blocks, take a narrow piece of board and bore an inch hole through the center; also one through each end, the proper size and distance apart to take two of the front cylinder head studs. Over the center hole tack a small piece of thin sheet-iron, and bolt the board to the cylinder, as shown in Fig. 6. Then mark the center of the counter-bore of the cylinder on the sheet-iron, and with a breast drill bore a hole in the iron through which the line or fine wire will easily pass. After passing the end of this line through this small hole, tie a knot in it, and pass the other end through the stuffing-box in the back cylinder head, and fasten it to a stick driven tightly into the slot in the guide-yoke through which the main rod plays. This method of securing the line in the front end of the cylinder will insure its speedy readjustment should it be broken or moved from its proper place. After the line is placed as described it can be quickly brought to the center of the cylinder by the use of a pair of inside calipers.

Now get the distance from the center of the piston-rod hole in the cross-head to the lower bearing surfaces of the lugs, and compare this with the distance from the under surface of each guide-block (when in place) to the center of the line through the cylinder. Should the latter distance be the greater, then about $\frac{1}{16}$-inch more than would make the distances equal should be taken from the under surface of each block. This allows for a liner $\frac{1}{16}$-inch thick to be placed between each block and bottom guide when placed in their proper positions relative to the center of the cylinder. After scribing on the side of each block the amount necessary to come off, measure from the mark to the top of each, and mark on the same side the amount necessary to make it when finished ⅛-inch less in thickness than is the crosshead lug.

I say ⅛-inch less because, as previously mentioned, I consider it a good plan to have a ⅛-inch solid liner between each block and top guide, so when it becomes necessary to close the guides these liners can be slipped out and reduced the amount required, leaving each block in place. This lowers the top guides and takes up the lost motion between them and the crosshead.

When closing guides the bottom ones should never be disturbed after they are properly lined, for by so doing they are liable to be thrown out of line with the cylinder, and this would surely cause trouble. Then the top of the crosshead and top guides are worn more than are the bottom ones when an engine is working forward, and as locomotives usually run forward more than backward, this difference in wear is marked.

I will try and illustrate why the top guides receive the greater amount of wear when an engine is moving forward. Let A, Fig. 7, represent the crank-pin on the upper quarter; B, the same on the lower quarter; C, the crosshead; D, the piston rod; A to C and B to C, the main rod. Now, when power is applied at D, to move the wheel in the direction indicated by the dart E (forward), the tendency is to bring the main rod, crosshead and piston rod to a straight line indicated by the dots; this pulls the crosshead against the upper guides; then when the pin reaches the point B and power is applied at D, it tends to make the angle D C B greater; this again pushes the crosshead to the top guides. Now, when the thing is reversed, and the wheel made to revolve in the direction indicated by dart F (backward), and power is applied to pin at A, it tends to increase the angle D C A, and this pushes the crosshead to the bottom guides. When the pin arrives at point B, applied power tends to straighten the angle D C B, and this pulls the crosshead to the bottom guides. I hope that this illustration will make it plain why there is usually more wear to the top than from the bottom guides, and also why it is better when closing guides to lower the top than raise the bottom ones.

After having replaced and leveled the blocks, bolt each bottom guide to place with a $\frac{1}{16}$-inch liner between it and each block, leaving the liners large enough to trim off flush with the blocks after they are in place. Put in all of the bolts which are to be left in when the job is finished. Do not use temporary bolts. See that each bolt is a snug driving fit with the soft hammer. Large nuts, or a sufficient number of washers, can be used on top of the blocks in place of the top guides. After all nuts are tightened place a straight-edge lengthwise of each guide to see that tightening the nuts did not spring them. A straight-edge which reaches from oil-slot to oil-slot would be about the right length. Should a guide be high near the center, place a narrow paper liner across under the block at point A, Fig. 8, at the end nearest which the high point is. Should the center of a guide show low, put the liner across at point B. The thickness of these liners, and whether placed at one or both ends, can only be determined by trial. After getting the guides perfectly straight, with all nuts tightened, take the short straight-edge, with level attached, and place it across the face of each guide, and see that it is level, and that the level shows correct with the engine when the straight-edge is placed across both guides. After this is done set the guide gauge so that when the beam is flush with the bottom bearing surfaces of the crosshead lugs the point will be at the center of the piston-rod hole (see Fig. 1). Now place the gauge across the faces of the guides. The point should come exactly in the center of the line or wire its entire length. In case it does not it must be made to do so, by either inserting or removing liners, as the case may require, being very careful not to displace the cross liners of paper put in to straighten the guides. To avoid springing them, it is best to try the straight-edges on them after every change made in the liners.

When the guides are straight, level, and in line with the cylinder, remove the line and lay the crosshead on them. Now we must see that the crosshead lies perfectly level on them at all points, or, to use a common expression, we must "take the rock out of it," and this is about the nicest part of the whole operation of lining up guides, as there is no line to guide one, and unless great care is exercised they will be thrown out of line. Very thin liners and cross liners may be removed or inserted without danger, as the crosshead will show the low points more accurately than did the straight-edges. A good way to ascertain if the guides are level is to draw heavy chalk lines across their faces at different points, for after the crosshead is passed over them they will be erased at the highest points.

When no rock of the crosshead occurs at any point, place a screw-jack under each end of the inside guide so that the bolts will just pass out; remove the bolts and put on the ⅛-inch liners, which, by the way, should be made exactly the size of the blocks, and the holes through them should be made large enough to admit of their sides being flush with those of the blocks when all are in their final positions. Now bolt on the top guide, which should be straightened and leveled by passing the crosshead forward and backward after the jacks are removed, and by the use of the heavy chalk lines previously mentioned.

When finished, the crosshead should pass freely from end to end of the guides, and only admit of the passage of a piece of heavy writing paper between it and the top guide.

Now with a small, very sharp chisel trim the liners flush with the blocks, and finish all with a fine file and emery cloth. After this course of procedure is gone through with on the outer top guide no fears need be entertained in regard to the crosshead running cool, and wearing but little, provided it is made of the proper material.

In regard to the proper amount of lateral motion to allow, I will state that I have always found good results follow leaving $\frac{1}{16}$-inch full. That is $\frac{1}{32}$-inch full on each side.

S. C. Hitchcock

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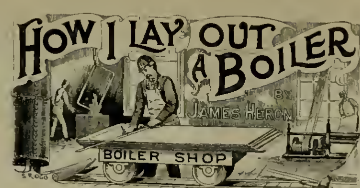
It is no unusual thing to set up a temporary forge under a bent front frame and straighten it, but to actually weld on a frame broken entirely off is not often done. A six-wheeled Baldwin switcher on the St. Paul & Duluth road, at Gladstone, Minn., recently broke off both the front frames under the buffer timber and they were welded on without removing the frames. A portable forge was mounted on a truck, so as to be moved quickly, air being supplied through a hose, the new ends were "V'd" in the blacksmith shop, the ends of the frames scarfed and good welds made, the job being hammered to a finish.

There is a select club of railroad men in New York, known as the Flat Wheel Club. No man is eligible for membership who does not personally believe himself capable of assuming the duties of any official position on a road, and members can only cast a white ball for an applicant when they believe him a poorer railroad man than themselves. If this was all, the club would overflow with the brains of self-made men, but there are other restrictions—have to bathe in the winter months, etc.




Knowing that I was an occasional correspondent of your paper, many of its readers who have visited shops of which I had charge, have asked me to write something about laying out locomotive boilers, tank sheets and other iron work.

I am well aware that there is no trade that is less understood by the men working at it—the rank and file—than my own. The few who do learn how to lay out and plan work usually keep it to themselves, and the average apprentice rarely gets farther than the riveting hammer and the calking tool. This is especially true of large shops, such as locomotive works, where the best results are obtained by having a specialist for each part.

I know better what my fellow boiler-makers need to learn than how to write it; but I trust an honest effort to help will be appreciated and that my critics will be lenient.

Fig. 1.

Fig. 1 shows the mud ring, or foundation of a locomotive boiler with section of inner and outer sheets at boiler.

To make a boiler of standard dimensions, this ring must be square and of the proper size. To prove this and get the holes in proper place, I use the following method

Take straight-edge and line off from inside of ring as at A A 1, do the same back and front. Now set your trams to center where side lines cross end lines. If one side is longer than the other this will show it. Then tram diagonally, always working from front end, scratch with trams as at A 1. If you strike both back centers, your ring must be square. If you should find ring out of square, say one-eighth of an inch, it will be of no consequence as that can be worked in to flange by putting the holes that much nearer the roof, or nearer the edge, as the case may be, but your starting point, or first hole in front end of mud ring must be square with opposite side, or your stay-bolt holes will not be in line in inner and outer sheets, and your sheet and fire-box would be twisted. This done, with A A as ends find center of ring at ends as at B. This will be your center hole at ends of ring. Now, take your regulator or templote, and lay off holes, working from center at ends, and from starting point at front ends at sides.

The reason I work from front end is this If you have not got side sheets square with each other at that end when you come to build up your boiler, your connection and cylinder will not be straight or in line with sides where engine frames are secured.

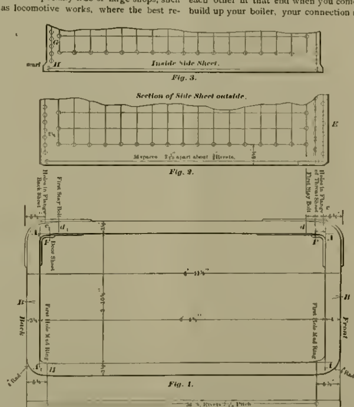


Fig. 3.

Fig. 2.

Fig. 1.

Now we have all rivet holes laid off, we must lay off stud holes for ash-pan and grate-bar rigging, also holes in corners, of which I shall write later, and our mud ring is laid out.

To find position of holes in outside side-sheets, where they connect to back and to hearth sheet, as at c and c 1, and stay-bolt holes as at d d, I have templates for all this work, which I shall illustrate in its proper place, and, as I am not writing for experts, I want you to understand how I made these templates. As you can see by Fig. 1, the corners of the mud ring is 4 in. radius, material ½ in., making radius 4½ inches over all. Corner forms quarter of a circle The sides are flat and must not lap over circle, so we must allow 1¼ in. for lap of side-sheet, added to the 4½ in. radius, making 5¾ inches, which bring us to first hole in side sheet as at E, Fig. 2. The same applies to back and front corners, now you have the length of outside side-sheet from center to center of holes. Note double row in front end.

Now locate first row of stay-bolts, the sketch will explain the rest. Now we have length of side-sheets, and stay-bolt holes laid off one way, we will go to Fig. 3 or inside side-sheets, and you will note at H, that first holes for mud-ring rivets are not on line with holes for flanges My reason for this is that I prefer a short flange at corners, with rivet as close up in corner as I can get it. Then the man with the big hammer and little knowledge of his business cannot wedge off the sheet from mud ring, when a leaking corner is reported. F F gives you the length of this sheet from center to center of hole for flanges, less ½ inch at top, back where door sheet slopes in. This will also be the length of crown sheet, c to c of holes, less ½ inch back end.

Note, 3½ in. water space at bottom and 4 in. at top of door sheet, d d gives position of stay bolts

I think I have made the foundation part clear enough. In my next I will show method of finding rivet and stay-bolt holes vertically.

J. Heron

## An Employes' Paper.

"It appears to me," said the agent of an envious contemporary lately, to a well-known railroad man, "that these fellows running LOCOMOTIVE ENGINEERING are well endowed with cheek when they expect to make a paper that will interest presidents, managers, superintendents, master mechanics, master car builders, foremen, shop-men, engineers and firemen."

"What is the difficulty?" questioned the railroad man. "Don't you think that all these classes of men are likely to be interested in reading news articles and discussions of railroad machinery matters?"

"That is not the objectionable part," said the agent, "it is the attempt to put all railroad men on one plane. Why, that is an employés' paper, and the editors put in things intended for presidents and general managers to read and profit by. The thing is absurd."

"It may seem very absurd to you," replied the railroad man, "but I look at it differently. In my eyes the presidents and general managers are employés just as much as firemen. To put them all on a common plane, and make up a paper that will interest them all alike is a high and useful purpose The difficulty with most railroad papers has been that there was too much class literature in them. The writers wrongly assumed that there could be no common interest between officers and workmen, and the tendency was to open up artificial breaches between classes that naturally come closer together when left alone This thing has been bad for railroad men and bad for railroad papers. It is why most railroad papers are so little read. The effort to carry out a different method has my sympathy."

The agent concluded that he had struck a wrong key, and said "Good day, you will have our paper free, as usual. I hope you will keep on taking it"

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Nearly all Western railroads have been working long mileage with their freight engines during the last few months, but the locomotives belonging to the Chicago, Burlington & Northern appear to be a little ahead of all others. During the month of December all the engines belonging to the company made over 5,000 miles. For some time there were only two engines out of service.

The Elevated Railroad Company, of Chicago, have contracted for Pintsch gas being used on all the rolling stock

For some heinous crimes the Chinese condemn criminals to be kept awake until they die—usually nine or ten days. Some of our American railroad men are so used to this punishment that they could probably stand eighteen or twenty

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## To Make Repairs Easy.

At some seasons of the year every railroad company in the country is short of power, and at these times a locomotive is from twice to ten times its ordinary value to the company. These are the times when the engine-houses are certain to get filled up with locomotives requiring repairs that will make them miss some trips. One has a cylinder-head broken, another is laid up with a broken eccentric-strap which twisted the rods and called for new adjustment. A broken valve-stem is holding one engine in, and another is bound to be idle for a day or two because the draw-bar of a caboose went through the front casting of the smoke-box. It is needless to enumerate the small disorders or breakages that are keeping other engines in shops when the transportation department is harassed with cars waiting to be moved. The delay of locomotives waiting for small repairs at times when the road is overcrowded with business is a fruitful source of disturbance and of animosity between the operative and the mechanical departments.

Every master mechanic who takes an intelligent interest in his business can readily see the saving of time that would result in the repairing of locomotives if parts were kept in stock ready to put on when an engine came in broken down. Those who do not recognize the importance of this are not a credit to the business. It is over a quarter of a century since the more advanced class of railroad mechanics began advocating the use of interchangeable parts for rolling stock repairs. For twenty years the expatiating on the advantages of an interchangeable system has monopolized the time of railroad men's meetings and the pages of the engineering press. Few men in charge of railroad rolling stock are to be found who do not indorse the interchangeable system, and yet there is not a railroad in the country, except the Manhattan Elevated, that has the system properly in practice. There are roads where duplicate parts are kept ready in stock for certain engines, and great saving of time is effected; but there is no railroad that has in practice the perfected interchangeable system followed in many other lines of machine work. The question naturally arises: Why do profession and practice disagree so thoroughly in this important matter?

The different superintendents of motive power, if asked to answer this question, would reply enumerating difficulties that beset his particular case, and we should receive a mass of conflicting testimony. A careful study of the question leads us to believe that the failure of railroad companies to put into practice a successful system of preparing interchangeable parts for repair work is due principally to the practice of depending upon drawings for dimensions, and on the two-foot rule for measurement. There are other obstacles that hinder the establishing of practical standards, such as the diverse character of the engines and cars purchased, but the real difficulty that has led to nothing all efforts toward interchangeability is the blue print and the boxwood rule. Both of these things are highly useful in their way, but as means for maintaining machine parts of the same size they are a failure.

The thing works in this way: a superintendent of motive power gets out drawings and specifications for a standard locomotive, and a class is established. Engines are built at different times and in different shops, according to the drawings. In laying out the work for the different parts a scribe line is $\frac{1}{64}$-inch to one side, dividers have led to 16-inch error in another place, and the trifling mistakes of those who lay out and of those who execute add up till very few of the parts can be taken from one engine and put upon another without fitting.

A correspondent writing in this issue, who is a well-known master mechanic, and has done important work in advancing the practice of making the parts really standard, proposes a certain remedy. He has struck the right note in calling for more general use of templates. If railroad companies would establish, in connection with their mechanical headquarters, a place where templates would be made by expert workmen for the use of all the shops in the system, it would be the best paying enterprise we can conceive. The templates would be made by men accustomed to accurate working, with good instruments of precision to keep the measurements correct. The development of such a practice would secure uniformity for all parts that were made to the templates.

There is no more certain way to attain diversity than to send out blue prints and order different men to make patterns or templates by the ordinary methods of measurement. There is already said to be half a dozen different standards of the last M. C. B. axle. There is not a standard made for railroad companies by outside concerns that does not have diverse forms that will not interchange with each other. The true remedy for this would be for the mechanical associations to arrange for the making of uniform templates of their standards. Drawings have had their turn and are found badly wanting. The mechanical head of a large railroad system can do for his company all that the associations ought to do for railroads at large. A template-making department could be established at small cost and its usefulness would soon be demonstrated.

## A Voice from the Car Stove.

The cold weather of the month of January has given the first real test of the systems of heating cars by steam from the locomotive, and they have gone through the ordeal very successfully. The systems that use hot water as a heating medium are most popular. Direct steam is much more satisfactory than any of the stoves as a means of heating cars, but with it the temperature fluctuates far more than with hot water. The leading objection to steam is that it keeps the cars too hot. This is bad, but it is not so objectionable as the service of the ancient stove which half roasts those in its vicinity and leaves those in the middle of the car to freeze.

The experience of this winter leaves no excuse for railroad managers to longer delay the providing of their passenger equipment with apparatus for safe heating. It has been the common thing for those who clung to the dangerous stove to say that they were waiting for the perfecting of car-heating appliances. Car-heating appliances that worked satisfactorily last month may be accepted without more perfecting. Those who persist in delay do so merely because they prefer the cheap and dangerous device to that which is safe and efficient, but calls for the expenditure of some money.

After all the fearful losses of life and suffering that have been caused by the heating of cars by stoves, it is amazing the number of cars yet to be found with that means of heating still in use. Several of the roads, doing the heaviest suburban passenger business around New York City, still use stoves. Some of these roads, such as the Delaware, Lackawanna & Western, have crowded suburban trains with red hot cast-iron stoves in the cars, running at very short intervals, and having absolutely no signal system for the protection of trains. It is appalling to think what will be the result when the inevitable collision happens to one of these trains on a winter night.

The last three mild winters have done much to disguise the danger that lurks behind the red hot stove given so prominent a place in so many passenger cars. But every recurrence of severely cold weather gives warning of danger. As we write the daily paper on the desk blazons in bold head lines: "Wreck on the Rock Island, the cars burned up." It was a story as old as our age of railroading. A train heated by stoves, a wreck, and the fractured stoves set fire to the splintered cars. Fortunately in this instance it is not related that a load of passengers was pinned in by the fractured timbers, and held in the wreck till the people were burned to cinders. The managers, who are responsible for the passenger cars of that company still being heated by stoves, deserve no credit for the wreck failing to be a holocaust. Circumstances over which penurious boards and reckless managers have no control, shout with no uncertain sound that the safe methods of heating must be applied to all railroad cars.

## "America's Greatest Railroad"—for Rear Collisions.

One hardly gets over the horror produced by one fatal accident on the New York Central road than another takes place to keep up the interest.

With the exception of the New England the Central wears the medal for accidents, while for killing and maiming human beings it stands at the head.

The Hudson River Division is a double tracked road running hundreds of trains a day, freight and passenger, and using the same methods for their protection that are employed on the meanest single track roads in the lumber regions.

Rear collisions are of almost daily occurrence; trains follow each other "in sight," sixty-car freights, without air-brakes, hurry from station to station to clear locals and dodge sixty-mile-an-hour expresses, without the protection of block signals, while the ornamental president and financiering board of managers "wait for the best signal to be invented."

Absolute block signals have been practically perfect these twenty years, 98 per cent. of the roads in England are using them successfully and yet "America's Greatest Railroad"—God save the mark!—waits for perfection, and dividends.

Absolute blocks will save most, if not all, the rear collisions, but it will not cure the general debility of this magnificent but mis-managed property.

There is dry rot at the core; the men in the train service are demoralized and disheartened; discharges take place without trial; suspensions are free as water; men of spirit are cowed or leave the service, and incompetents multiply. On Christmas Eve a fearful rear end collision took place at Hastings-on-the-Hudson. A passenger train was stopped while a freight got out of the way; the brakeman went back to flag and went into a depot; the express flew by and into the standing train—14 dead, many hurt. Last year this road had a strike of trainmen and put on a lot of inexperienced, cheap men and boys. Was this brakeman one of them?

Block signals would have kept these trains apart—a board from a quarter to half-a-mile from a station, worked by a wire and a man, is not a block signal.

The rule sends the flagman back half a mile; it will take him eight or ten minutes to go so far, yet they run trains sixty miles per hour on five-minute headway, that run this distance in thirty seconds. Penurious management has kept signals off the line; mismanagement has taken the heart out of the men; they are doing a four-track business on two tracks, and gambling in human life to keep it up.

The strength of a chain is its weakest link. Of what use is their stone-ballasted track, their magnificent "870's" that haul the Empire State express, their speech-making president, their Grand Central Station, and their Hudson River scenery, when their hundreds of trains are crowded out upon the line with nothing to keep them apart—absolutely by guess, so far as its directors know.

The engineers save much trouble by good judgment, but if a man has to stop his train on the road, then look out.

Is it not time that some practical railroad men had a place among the directors of this line?

Can the absence of the only known means of protecting trains on a road like this be called stinginess, lack of foresight or carelessness? Is it not crime?

Can the public prosecutor view the remains of these many mangled men and women and write "accidental"? Should he not use stronger language.

## Breakage of Car Couplers.

A great many new freight cars have been ordered within the last month, and it is greatly to the credit of the railroad companies concerned, that air-brakes and the M. C. B. automatic car coupler have been specified for most of them. Automatic couplers are rapidly forcing their way into favor in the face of great difficulties and over tremendous opposition which often has made itself felt in the wanton destruction of railroad property. It is surprising how much damage has been done in yards by those who were anxious to see just how much certain couplers would stand. This species of experiment has nearly stopped and explains to some extent the decreased percentage of breakage. The decrease of breakage, however, is to some extent due to the strengthening of weak parts and to the increasing number of the couplers in service.

The offer becoming common by makers to maintain the automatic couplers for one dollar or less, annually, settles the question of expense of maintenance as compared with link and pin couplers. A car equipped with the old form of drawhead which costs less than one dollar annually for links and pins makes very small mileage in heavy trains.

The weakest part of the M. C. B. coupler, and the part most liable to breakage is the knuckle. The success of the coupler requires the knuckle to be made of very strong metal, the stronger the better. Many railroad men interested in the coupler question, were startled a year ago by a statement made at the New England Railroad Club to the effect that replacing broken knuckles with others made of cast-iron was practiced. Some were indignant, others were incredulous. But cases of replacing broken knuckles with cast-iron substitutes were reported from other parts of the country, and few men now doubt that the practice prevails to a limited extent. We lately heard the statement made by a railroad man that there is a concern in New England which is regularly making knuckles of cast-iron, and that this accommodating foundry goes to the extent of imitating the maker's stamp put on the original knuckle. We examined in the office of the Gould Car Coupler, wretchedly made steel knuckles that had an imitation of the maker's stamp.

There is a good deal heard about the framing by Congress of laws relating to couplers. It would not be a bad plan to make the putting in of cast-iron knuckles a crime. At all events it seems to be time that the makers of couplers obtained legal trade-mark protection for the stamp they put on knuckles. Putting in of worthless material in a car-coupler knuckle besides causing delay, is a source of danger to the train men where the car is running.

## The Oldest Boiler-Plate Rolling Mill.

About forty miles west of Philadelphia, on the main line of the Pennsylvania Railroad, is Coatesville, a neat rural village nestling amidst the groves of a region of low hills and pleasant valleys that attract the city dweller to the haunts of nature undefiled. This Coatesville will excite little more than a passing glance from the traveler, yet it is a place that would be famous among the engineering fraternity if it was the practice here, as in other countries, to acknowledge or magnify the importance of places where valuable industries have originated.

About the finish of the War of Independence, when the infant States were famishing for the want of iron industries, there sprang into being in the valleys and hillsides around Coatesville numerous Catalan forges, where wrought iron was made directly from the ore. The advantage of this district for nursing such an industry was the existence of great forests that provided charcoal, and the fine water-power that operated the crude mechanism employed.

The presence of these Catalan forges and the great wood and water privileges led to the building here, in 1810, of the Lukens Iron Works, which afterwards became the Lukens Iron & Steel Co. The first work done by this concern was the making of iron plate from the charcoal blooms produced in the Catalan forges. Here the first plates for boiler-making purposes were rolled on the American continent, and the product was so good that a demand arose in England for the charcoal plates that could not be procured anywhere else. Standard No. 1 charcoal was the only grade used. The business was carried on in a very crude way at first, for they had no means of shearing the plates, and these had to be sent to the boiler-makers as they came from the rolls. The practice of trimming the sheets was introduced by other mills after a time, and this company had to do so likewise.

Fifty years ago the standard size of plate was 40 inches by 26 inches and ¼-inch thick. When a boiler-maker ordered a sheet this was the size he expected to receive. The Lukens mill has grown in proportion to the business of the country, and the largest plate rolls in America are now to be seen in use here. They roll sheets to the width of 120 inches, and ranging from $\frac{3}{16}$-inch to 1¼-inch thick.

The company have adhered to their specialty of making plate; they have devoted the greatest care and attention to the production of the best article that could be made, and their customers admit that no better plate is to be found on the market. They appear to take particular pride in the uniform quality of their steel.

Until this year this firm has made no effort to obtain customers among railroad companies, but it is now in this field. Lukens steel will soon be as familiar to railroad men as the most popular steels now in general use. The steel plate is made from selected blooms of known quality and rolled by the best machinery, rolling, shearing and inspection receiving particularly close attention.

The quality of the product may be judged from five tests I noted at random in the testing room. The tensile strength was respectively 59,000, 59,300, 57,200, 58,100 and 57,600 pounds. The percentage of elongation was 41, 41.5, 41, 39.5 and 41. The reduction of area was 62.2, 63.3, 61.8, 61.7 and 63.8 per cent. Those familiar with the physical characteristics of steel will note that this article has extraordinary ductility combined with strength.

They are building a fine new rolling mill with open hearth furnaces and gas-making plant attached which will greatly increase the capacity of the works. This is already about 200 tons per day. Coolbaugh & Pomeroy, of New York, have become general agents for the sale of Lukens steel.

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Some time this coming fall both the engineers and firemen will hold their bi-annual conventions. The entertainment committees of both orders have heretofore thought it expedient to raise a large amount of money and have got some of it by issuing a "souvenir"—usually a rather bulky book with a few pictures of grand officers and a lot of advertisements at high rates.

As a general thing, these "souvenirs" are "farmed out" to professionals who agree to turn over to the committee a lump sum of money for the privilege of doing all the work—and blackmailing the manufacturers of the country.

These disreputable bilks are making the fair names of the orders they use a by-word with decent people, and it will stand the brotherhoods in good stead to shut down on the practice of lending the name of the orders to bunco steerers to use as a club.

There is not one advertiser who pays money for space in one of these books that believes that it does him a cent's worth of good. He does not want to appear mean to men who handle his devices, or else has a vague idea that he is "helping the boys."

The two great brotherhoods are not objects of charity and do not need any Louisiana Lottery annex.

Manufacturers and dealers can rest assured that not above ten per cent. of their money ever gets to "the boys," regardless of what the letter "under seal of the lodge" says to the contrary.

Members of the orders should see that they are not used to further the ends of sharpers, who are experts at promising an edition of 10,000 by affidavit, and 250 by actual count. When this souvenir fake shows up this time, vote DON'T—write it large, and with red ink.

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LOCOMOTIVE ENGINEERING has an exceptionally large circulation in foreign countries, and a gratifying feature about it is that the foreign readers take a very active interest in the questions discussed in the paper, and display a disposition to express their own views. In this issue we publish letters from correspondents in Belgium, Australia, Mexico, Canada, and several from New Jersey, Missouri and Arkansas. Our office cat reports that these places embrace the ends of the earth.

## NEW BOOKS.

MACHINERY PATTERN MAKING. By P. S. Dingey. John Wiley & Sons, New York. 12mo, cloth. Price $2.00.

This is a book of over 100 pages, containing a large number of engravings. This book is not an elementary one, and does not attempt to teach pattern making; it discusses pattern making methods, offers suggestions, etc. The author is a practical pattern maker, and his book is therefore useful to practical men.

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The New York Safety Heating & Lighting Co. are equipping the Wagner palace cars with the Gibbs steam hose-coupler.

## Tools and Machinery for Railroad Work.

At the last meeting of the New England Railroad Club, Mr. E. E. Davis, Master Mechanic, Boston & Maine, read a paper on the above subject. He said that a very large percentage of railroad shops are equipped with machinery bought years ago, when the roads first started. This gives the tools such an age, that even if they were not worn in the least, their capacity for work would be such as to make them very far behind the more modern tools, both in amount and quality of the production. But when to these defects is added the wear and tear of years of service, so that the lost motion in every wearing part is such that it is next to impossible to turn out even a fair piece of work, there is assuredly a tremendous waste of money. Not only does the manufactured piece cost extra on account of the longer time required to make it, but when done it isn't as good as the modern tool would have produced, and of course it will not last as long in actual service, and here is another waste of money. Then again it takes two or three times as much power to keep the old traps running as is required for a good set of machines.

CLINGING TO OLD TOOLS.

Officials very often seem to hold rather queer notions regarding those things. They say, "Well, that machine cost a great amount of money and it ought not to be thrown away." They don't seem to realize that this old machinery has done them valuable service all through the years that are passed and that it has long since paid for itself.

Now when these old tools have done all that could reasonably be expected of them, why not let them go and take advantage of the development that has been made in all machine work, by putting in the shops the most modern tools that can be procured? Shops that omit to do this will be left tremendously far behind those that do use the most modern equipment.

TOOL SPEEDS PAST AND PRESENT.

What can we do with a lathe or a planer made twenty years ago when comparing the quantity of work done by it with that done by machines made to-day? A planer running ten or twelve feet per minute, with the feed so fine you can't measure it, won't answer at the present time. We want a planer to run from 16 feet to 30 feet per minute, with table traveling from 1 to 3. There are planers made to run 5 to 1, but I think they are under repairs about one-half the time.

We want a lathe to run from 25 to 45 feet per minute, with feed from 1-32 inch to ⅛ inch, according to the class of work it is on. There are tools made to-day for nearly every kind of work, and these improved tools are what every shop that has the work for them needs. In making the selection of tools for a shop it requires a thoroughly practical man, and after they are selected, it requires an able man to manage them.

There is not much difference between the combination of a modern tool and a poor manager and the combination of an old-fashioned tool with a good manager.

ADVANTAGE OF SPECIAL TOOLS.

Regarding the merits of different tools, the advantage of the screw machine as an addition to the shop equipment may be mentioned. It is without doubt, for what it can do, capable of saving from 25 to 500 per cent. in the cost of work done. When a machine can be had by which you can put a piece of work through a half dozen different operations and finish it complete before it comes out, you have a great advantage over being obliged to produce the same in a lathe, where the lathe must be stopped and the tools changed for each operation, and in the case of the lathe, the uniformity of product is nowhere near equal to that of the screw machine.

In much of the work done by this tool, one machine will produce in a day a quantity equal to what four or five lathes could do with a first-class operator at each lathe.

Take the studs for a boiler for one thing, they can be finished on a screw machine in the same time that they can be drilled and countersunk for a lathe, say nothing of turning.

FAVORS MILLING MACHINES.

Very few shop managers understand to what extent the milling machine for general shop practice could be judiciously used. The idea is, that it is solely for a tool room, to a certain extent it is, and was first used for that purpose, but it is fast taking the place of the lathe and planer on certain kinds of work, and the time has come when no railway machine shop is well equipped for economical work without some milling machines.

Some kinds of work can be done 25 per cent. cheaper on the milling machine than on the planer, and 50 per cent. cheaper than on a lathe.

Take the brass work, say a gauge-cock, with the milling machine, and using an under-cut, with the cutter as wide as the guage-cock is long and with the same form, you can finish the whole casting with one cut, and do more work with this machine in one hour than you can on a lathe in five hours, and do it better, though there are few railway shops that as yet make any account of this machine.

THE VERTICAL BORING MILL.

One of the modern tools for heavy work is the vertical boring and turning mill, most shops do all of the heavy work on the driving-wheel lathe. With the boring mill, you can bore a tire quicker and with half the help. Take for instance a driving-wheel center, the extra labor in shifting the heavy casting around on the driving-wheel lathe will pay the whole expense of fitting the casting ready for the axle with the turning mill.

PNEUMATIC HOISTS.

Now we have another new-fangled idea, as some are pleased to express it, and that is the way of hoisting and conveying the heavy work from one machine to another or one part of the shop to another. That is the overhead railway with the pneumatic hoist, and this hoist is as far ahead of the chain hoist as the chain hoist is ahead of manual labor.

TOOLS IN THE BLACKSMITH SHOP.

Referring to blacksmith-shop tools, there has been the same improvement here as in every other department, and I think the majority of shops, so far as they have room, have quite modern tools, in fact, more so, according to the number of machines, than any other department. But there are some shops where they use the same old beam-trip-hammer, where you have to pull a string connected with the binder to see it go. Now, if there were such a premium on some of the old antiquarian machines, as there is on some old furniture, what a harvest we should reap! I don't know of but one thing they are good for, and that is to remind us of our grandfathers' boyhood days. If you are going to see how cheap a lot of machinery you can keep the smith-shop down to, why not take out the fan-blower and use the old reliable hand-bellows, then you could do away with the exhaust fan and keep the blacksmith-helper busy.

THE OLD AND THE MODERN BOILER SHOP.

Take some of our boiler shops. There are men in charge of railway plants who say they can't do the work so as to compete with outside people. Well, that is right, but where does the trouble lie? Is it the lack of competent workmen in charge of the boiler shop, or is it the men at the head of the concern who fail to realize what a boiler shop needs for tools? Take a well-equipped boiler room with punch and shears, power bending rolls and steam or hydraulic riveter, planing machine, drills, cranes and overhead railways for handling work, and this shop, with a good man at the head, will turn out as good work and do it as economically as any outside people can, and the production will last 25 per cent. longer

MUSHET'S STEEL FOR DIFFICULT CUTS.

So I might go on through each department, but time will not permit We don't find all the improvements in one shop, but we do find things that are quite amusing. One day, while talking with a man engaged in turning off driving tires, I (being quite green and a stranger) asked how long it took to turn a pair of wheels. He said, on an average, about two days; when they were very hard, sometimes four days. He had several kinds of steel for lathe tools, and when they failed he had a piece of Mushet's steel at the bottom of his drawer to fall back on.

Now, I don't intend to enter into a discussion as to the merits of different kinds steel, but there are some shops that are shops that are using for 60 per cent of their lathe and planer work Mushet's steel, and it is cheaper than any other steel, even if it costs $3 00 per pound.

SPEED OF TOOLS

I have seen a man turning off a driving-journal with the lathe running the same speed as when he turned the tire, and the lathe was a modern machine. Another shop claims to turn out twelve to fifteen Master Car Builders' axles per day, all finished ready for the wheel Just think for a moment how fast that lathe must run.

In another shop you can see a planer, 60 x 60, 12-foot bed, with only one head, and running about 14 feet a minute, planing side rod brasses. Now that planer is new, and was all right for engine work 50 years ago, when a locomotive weighed about 12 tons, and where time was of no account, but to-day, with 88-ton engines, it is hardly worth the room it takes up.

THE TOOL-ROOM

Another important factor in the successful operation of a railway machine shop, is the tool-room This is a place where much money can be saved by starting a thorough system of classification and arrangement

It is also highly important that this room should be equipped with all modern tools that will in any way be required, and to have enough of them, so there will be no man waiting on one job while some other man is using the tool he needs, and another point is, not to expect a tool to perform a dozen different services when there should be a separate tool made for each piece of work.

Mr J T Chamberlain held that the remarks made about iron working tools, applied equally well to the condition of wood-working machinery. The location of such tools is of great importance. Knew a shop where the best tools were used but the arrangement was bad A large planer was so placed that the lumber that was brought in had to be carried past this tool to several other machines and then back to the planer There were 24 machines in the shop, and 23 of them required to be moved to make a good arrangement Before the change was made it took 45 minutes to run a stick through the planer, cross-cut saw and tenoning machine After locating the tools properly, the work could be done in 6 minutes

Mr. J N. Lander spoke of the difficulty of getting managers to realize the need for modern tools Thought there was no more wasteful practice than that of repairing rolling stock with worn out machines. Mentioned several cases of machines still in use that would, on account of their age, be valuable curiosities in a museum of antiquities Spoke of the great saving in cost of work, that resulted in his shop from the introduction of screw machines.

Believe that car-shops were as a rule, better supplied with proper appliances for building cars than iron-shops are for repairing locomotives. If you have a four-sided planer for your sills, everything comes out square and the work comes together well, and it costs very little to frame it in comparison with framing work that has never been planed, and the work saved by using such a planer instead of hand work, is enormous in the aggregate. The same principle applies to all the shops of a railroad In many of the blacksmithing shops for railroad work, the crudest kind of machinery is still used If you have a good foreman, and give him power to go ahead and exercise his ingenuity, he would generally produce appliances which will very much lessen the cost of the work.

In boiler shops, as a rule, the work for railroads is done in a very crude way. For repair work, he did not think it paid to use hydraulic riveters. Considered a plate planer a necessity with steel sheets. Its use avoided the danger that results from the grooves made when chipping sheets.

Mr. F D. Adams testified to the economy of using the best kind of tools and shop appliances It is often difficult to convince railroad officers of this. He remembered forty-five years ago, when wood-working machines were first introduced, that mechanics were afraid of them, and feared there would be little for men to do. There is nothing of this sentiment to be found now.

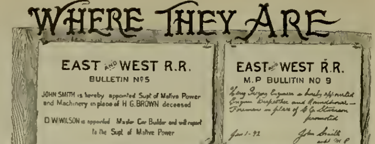
Mr J. W Marden was glad to say that he had never been refused tools which he considered necessary, was a thorough believer in first-class tools. In his shops they have a four-sided planer capable of planing sills at the rate of one a minute. Some people think it is capital tied up because they have not work for this tool half the time Suppose we plane fifty sills in an hour, and the machine remains idle for a week, it is a good investment, for it would take a man nearly a week to do the work on an old-fashioned planer. The same applies to improved mortising, tenoning and other machines.

Mr. Angus Sinclair considered that Mr. Davis was the best shop manager in the country, and his views on the tools necessary for the economical repairing of railroad rolling stock were well worthy of consideration. He knew from his own experience that many railroad companies do their work with tools which no manufacturer could afford to use. This is bad policy and unduly increases the expense for repairs. He thought that more attention was devoted in car-shops to the proper location of tools than in locomotive repair-shops. Was greatly in favor of the milling machine, but found that in many railroad shops its scope was not properly understood. Believed that it would amply repay railroad companies to send their shop foremen out for a couple of weeks every year to observe the labor-saving appliances used in different shops.

President Twombly was a thorough believer in good tools and in all labor-saving devices. He visited Mr. Davis some time ago and was so favorably impressed with the pneumatic hoists in use in the Boston & Maine shops that he went home and built twelve of them Now he cannot see how any shop can be conveniently run without these hoists in connection with overhead tracks. He uses the hoists inside and outside the shop to great advantage. They are carried on overhead traversing rails The practice greatly facilitated production and lessened the expense.

The Chicago, St Paul, Minneapolis & Omaha are getting out specifications for twenty new locomotives.

The demand for the Jerome metallic packing for piston and valve stem glands is reported to be increasing rapidly The railroads generally are coming to recognize that filling stuffing boxes with hemp to prevent the escape of steam is the most expensive plan ever tried, to say nothing of the labor involved. The Jerome packing makes the best kind of a substitute for hemp. It has lately been adopted by the following roads Lake Shore, Chesapeake & Ohio, International & Great Northern, Lehigh Valley, Beech Creek and a number of others Mr. Jerome has lately effected important improvement on his packing




Mr W E Cooper has been appointed Superintendent of the Chattanooga Southern.

Mr. J. H. Setchel was married on January 14 to Miss H J. Davis, Los Angeles, Cal.

Mr. H F. Hallstead, General Manager of the D., L. & W., fought the grip for some days, but finally gave in and lay in bed for ten days.

Among New York men prostrated by la grippe last month, was Mr. Hart, Secretary and Treasurer of the Lappin Brake Shoe Co.

Mr. Moses Hobbs, for many years Round House Foreman of the Chicago, Rock Island & Pacific, at Davenport, Ia., died a month ago, aged 67 years.

Mr. Herbert Wallis, Mechanical Superintendent of the Grand Trunk Railway was elected Treasurer of the Canadian Society of Civil Engineers at the last meeting.

Mr. J. P Hovey has been appointed Master Mechanic of the Oregon Short Line, at Shoshoné, Idaho. He was formerly general foreman of the Baltimore & Ohio shops at South Chicago.

Mr. Albert Langmoid, one of the pioneer New England Master Mechanics, died at Pembroke, N. H., last month. He was long Master Mechanic of the Northern Railroad of New Hampshire.

Mr. George W. Cushing has accepted the position of General Superintendent of the American Steel Wheel Company. He will have charge of the erection of the company's new works at Jersey City.

Mr. Coleman Shanks, Master Mechanic of the Los Angeles Terminal Railroad, is said to be making an enviable record on the Pacific Coast. He went from the Wabash and has enjoyed a highly varied railroad experience. In his efforts to reduce the fuel bills, which run high with coal at $8.50 a ton, he has ordered some Baldwin compound locomotives.

Mr. W. G. Richards has resigned the superintendency of the American Steel Wheel Company's Works. Some of the wheels made by him have been in use over two years, and have proved to possess the strength, soundness and wearing qualities necessary. These solid steel wheels have been produced by processes invented and patented by Mr. Richards

Relative to a rumor that President J. C. Clarke, of the Mobile & Ohio, would resign, that gentleman telegraphed to New York as follows "I see an absurd report from Chicago, printed in the New York papers, in regard to me. The answer is 'Few die, and none resign who can help it.' I belong to the latter class. I shall stay on deck until Gabriel blows his horn."

The facts used in the interesting article on the first steel boiler used on a locomotive were given us by Mr J Davis Barnett, Assistant Mechanical Superintendent of the Grand Trunk Ry at the Stratford Locomotive Works. Mr Barnett is one of the ex-presidents of the American Ry Master Mechanics' Association and one of the best posted mechanics in American railway service.

A circular from the Northern Pacific indicates that General Manager Mellen is practicing the doctrine of civil service rules which he preached in an article in LOCOMOTIVE ENGINEERING last month. Mr. John Dorsey was promoted to be Superintendent of the Yellowstone Division, and Mr J. G. Boyd was promoted to be Assistant Superintendent of the Rocky Mountain Division.

Mr. Jacob Johann expresses great interest in the biography of Mr. Isaac Dripps, published in the January number of LOCOMOTIVE ENGINEERING. Mr. Johann helped to build the locomotive with eight-foot driving-wheels turned out of the Norris Works for Mr. Dripps in 1847. Another incident worth remembering was that Mr. Dripps gave to Mr. Johann the first pass he ever received.

"Yes," remarked Mr. R. Carroll, general manager of the Cincinnati Southern, as he turned over the pages of LOCOMOTIVE ENGINEERING, "I read your paper with much interest. The part I like best is the Letters from Practical Men. I turn to that first because I like to read about the various difficulties encountered by men with engines and air brakes and other parts of train mechanism."

Engineer Palmer, who was for some time traveling engineer on the Chicago & Alton, has gone to the Chicago, St. Paul, Minneapolis & Omaha, as road foreman of engines and air-brake instructor. General Superintendent Scott requires Mr. Palmer to perform various other duties which make him something of a traveling superintendent. Great benefit is said to have already resulted from the duties performed by Mr. Palmer.

The pen lingers lovingly over the sketch of the engineer. For other operatives and railway officials we have at times severe criticisms, even scorn; but for him never. He is the object of our profound admiration. To us he is the embodiment of tireless fidelity, scorching heat of summer, smiting blasts of winter never deter him, flood, tempest and tornado he braves and conquers in ministering to the necessities of his fellows.—*Chicago Times*.

Mr B Malloy, Master Mechanic of the Wisconsin Division of the Chicago & Northwestern, died at Chicago, January 10 His death was caused by a blow from a broken link, received when he was superintending the putting a derailed engine on the track. Mr Malloy was all his working life on the Chicago & Northwestern, having begun work in the Fond du Lac shops when a boy He rose to be roundhouse foreman at Fond du Lac A year ago he was made Master Mechanic of the Wisconsin Division.

Mr W E Hall, who has been for some years Assistant Master Mechanic of the Pennsylvania Railroad at Altoona, has gone to be assistant to the superintendent of the Niles Tool Works. We think that the Niles Tool Works people have made a good selection, but we are sorry to see a bright young man like Mr. Hall leaving the railroad field It takes a long time to convince railroad companies that they can afford to pay salaries that will retain the services of good men.

Mr. William Smith, Superintendent of Motive Power of the Boston & Maine Railroad, died at his home in Lawrence, Mass., last month. Mr Smith began work on the Boston & Maine as a machinist forty-three years ago. After working in the shop for a year he went firing, and in three months was given an engine to run. He was an engineer for twenty-three years and then was made roundhouse foreman. From this he rose by different stages to the position he held at the time of his death.

Mr. J. D. McIlwain, who has been for the last eight, ten or twelve years Superintendent of the Car Department of the Grand Trunk Railway at London, Ont., has accepted the position of Superintendent of the Harvey Street Car Works at Chicago. Mr. McIlwain was on several American railroads before going to Canada, and was noted for his advanced ideas in car construction. The company he is now with will build wood as well as iron cars, so that the new superintendent will have wide scope for his ability as a car builder and designer.

Mr. J. R. Petrie has been appointed joint inspector of cars for the New York Central and the Lake Shore & Michigan Southern Railways at Buffalo. An interesting feature of the appointment is that Mr. Petrie receives the highest salary of any joint car inspector in the country. The recipient is well worthy of the large salary for he is one of the ablest men in his line in the country. He has been employed at Black Rock, N. Y., with the New York Central for several years. Mr. Petrie has been regarded by the Central Railroad Club as the best authority on interchange of car matters.

We find that the radial devices for tapping stay-bolt holes for locomotive boilers invented and handled by Mr. J. T. Connelly, Milton, Pa., are growing greatly in favor among railroad men. A few hours saved in repairing a locomotive fire-box is frequently of great value to railroad companies. Mr. Connelly's method of tapping holes without calling for the removal of frames is one of the most important time-saving inventions ever introduced into a railroad shop. Those who have not tried this invention are not doing themselves and their companies justice.

George W Syfan, an engineer on the Columbia & Greenville branch of the Richmond & Danville, has recently been placed on the pension list at $30 per month. He has run a locomotive fifty years—forty of them on the Abbeville branch. Mr. Syfan has been an extra faithful man, never having injured a passenger or seriously damaged rolling stock He ran from 4 A. M. to 10 P. M. most of last winter, doing the hardest kind of service, but broke down in August and has been confined to the house ever since. Mr Syfan hauled one of the first Confederate soldier trains and brought home the body of the first Confederate soldier killed in the war. He is 71 years of age.

There is a curious inkstand on the desk in the office of Mr. James W See (Chordal), Hamilton, O. The mechanism that operates the covers of the different bottles is interlocking and the opening of one closes the others. See got it from some one who found the stand in England. He thought it might be put on the market and examined the mechanism to judge of the cost of production. The device is exceedingly complex, over twenty parts being employed. See then put on his inventing cap and schemed an arrangement that would do the interlocking by means of a single piece. That invention ought to be on the market. See used to write about making a market for things. Now is his opportunity

Mr. James Sedgeley, well known among railroad men as having long been General Master Mechanic of the Lake Shore and Michigan Southern Railway, died at Washington, D. C., January 12 Mr Sedgeley was born in Maine in 1824. He began his railroad career on the Northern Railroad of New Hampshire, and rose to be master mechanic of that road. He left there in 1865 to take the position of General Master Mechanic of the Lake Shore, and was succeeded by Mr. J. N. Larder, then a young man. Mr. Sedgeley retired from the Lake Shore in 1884, his health having failed. He was very fortunate in outside business investments, and was well off He was for a year vice-president of the Master Mechanics' Association, and was an honorary member at the time of his death. Mr Sedgeley leaves a wife and two daughters

Mr. E. Lord, Assistant Superintendent of Motive Power of the Fort Wayne Division of the Pennsylvania Railroad, has been made Superintendent of Motive Power of the Cleveland, Cincinnati, Chicago & St. Louis. Mr. Lord is a young man, who went through a very thorough training at Renova, Altoona, and other parts of the Pennsylvania system. He has taken his part in all kinds of work connected with locomotives. He has worked as a machinist, as a draughtsman, as a fireman, as an engineer, and as an engineer of tests. These lines of work represent Mr. Lord's experience. Socially, he is one of the pleasantest men we have ever swapped stories with The numerous graduates of Renova, who are holding important positions all over the country, look upon the elevation of Mr. Lord as another proof that Renova men lead the railroad mechanical world.

The men who have charge of boilers or are in any way connected with steam plants owe more than they know to an old, venerable gentleman living at Coatesville, Pa This is Mr. Charles Huston, President of the Lukens Iron & Steel Co. Mr Huston has been engaged in making boiler plate for the greater part of his life, and through his patient and intelligent investigation and experiment many facts were learned about boiler plates that have done much to promote the safety of boilers. For years after he went into plate making no attention was bestowed upon strength for a unit of thickness. Ductility had not been heard of. Mr. Huston labored hard to educate the people on the requirements of boiler material necessary to secure safety He was several times sent from Pennsylvania to give evidence to Congressional committees on boilers. His views had great weight in the framing of existing laws relating to steam boilers.

Among the well-known men who passed away last month, was Mr. Edward Nichols, President of the Brooks Locomotive Works Although he has been president of these important works for nearly five years, Mr Nichols was not known personally to a large circle of railroad men, which appears to have been due to the retiring nature of the man. Mr. Nichols was born at Middlebury, Vt., in 1850, but was raised in New York State. He was educated in the Rensselaer Institute, Troy, N Y., as a metallurgical and mining engineer. He devoted great attention to chemistry and was for some time assistant professor of chemistry in the Institute. Then he went traveling for a time, investigating metallurgical matters. During the Centennial Exposition in Philadelphia, Mr. Nichols held a position on the Reception Committee Next year he associated himself with the Baldwin Locomotive Works and other capitalists in Philadelphia, and as their agent started a blast furnace in Georgia An attack of sickness compelled him to leave the South, and in 1883 he located at Columbus, O., where he had an expert iron practice At this time he married Miss Jessie Brooks, daughter of Mr. H. G. Brooks, originator of the Brooks Locomotive Works. Four years afterward, on the death of Mr. Brooks, Mr. Nichols was elected President of the Brooks Locomotive Works. Here his interests principally centered until the time of his death. He was highly popular in Dunkirk, and his departure leaves a blank in a large social circle. He was a member of the Railway Master Mechanics' Association and attended several of the meetings but took no active part in the proceedings.

N. W. Sample, who, as Superintendent of M P., made himself famous by the work done by his narrow-gauge locomotives on the D & R. G. Ry., has been made general superintendent of that system. It is safe to say that no other road of its size in America has power so uniform as the "Little Giant of the Rockies." All the standard-gauge engines are of one make, and there is one kind and size for freight, one for passenger, and a switcher made up of the parts of the other two. There are no odd kinds or sizes The old narrow-gauge stock is nearly as uniform, being, with the exception of twenty-eight engines, all of one make, though there are several sizes. Though a mountain road, the running repairs have been remarkably low per engine mile. Mr. Sample is one of the few railroad officials who does his whole duty by the directors and the stockholders and yet is in full sympathy with his men, he was always as approachable as the roundhouse foreman, and it was positively refreshing to a man hunting a job to go up and have a talk with Mr. Sample even if he had no work to give. As general superintendent his sphere of usefulness will be widened, but if the motive power goes out of his control, it will be a loss to the road—it is in the hands of a master.

## Standard Sizes in Locomotives.

BY M. A CHINIST.

Much stress is laid, in these days, on the importance of standard locomotives and the interchangeability of their parts.

We constantly hear that engines, built at this or that establishment, are, as a class, interchangeable in like parts.

Railways claim that they have a system of the same kind, but when the time comes to make the exchange, it is, as a rule, found that parts do not do so, they may be duplicate in dimensions approximately—that is, as close as the several workmen may each approximate, by a rule, the exact dimensions given on a drawing This not only applies to work that may be done by rule measurements, in the same shop, taken from drawings, but also applies to a road of several divisions that work from templates, but which were made in the several shops, when the deviations made in laying out the templates are as disastrous to an interchangeability of parts as when the work is laid out from drawings, unless it was possible to put a distinctive mark upon the engine to correspond to a similar one in the templates by which the engine of a template class, as it were, could be recognized. Templates are not only to produce duplicate work, but also to cheapen its productions. The use of a good template system not only will reduce the time an engine may be in for general repairs, but will also facilitate running repairs and by that prevent loss by the engine being out of service, but to get the advantage the system must be perfect, and the question is, what that is. Before taking it up, let us consider, for a moment, what part of an engine it is that requires a close system and how far interchangeability is carried.

Take an average road, and we find an engine with the same diameters of cylinders, that smokestacks, front cylinder-head, and piston followers, steam-chests and piston-rod glands, steam-chests and covers, will interchange because all attaching-holes are one-sixteenth larger than connecting-bolts or studs. Truck wheels, tender and driving springs and truck box, also brass, may be a standard for one or more classes of engines or designs of engines of the same weight and exchange because close fits, connections or adjustments are not required, yet with the margin allowed in fitting parts, it is often the case that these parts are not in common use in several divisions of a road.

Another class of parts that is more affected by the difference in measurements in laying out work from drawings in templates is the rods, valves, yokes, back cylinder-heads, crossheads and pistons, and all motion work Attempting to exchange these parts means refitting; holes do not come in line, piston-rods are too large or too small for the crossheads, and some detail of any of the parts mentioned will generally be found to be out It may be but a trifle, but if it is in connecting holes that a trifle means delay and an unnecessarily enlarged hole. If the piston-rod, then the shoulder has to be trimmed off to enable the piston to fill the crosshead, the distance between the shoulder is altered and may cause doubt in the future when a new piston is to be put in.

Rod keys is another detail that often requires renewal, yet the new keys may fit properly, they are kept in stock with a margin in size over the proper one to allow for fitting due to variation in key-ways

Another class of parts, many of which can be made common to all classes of engines, and the balance to more than one, is the steam-gauge and steam-cocks, pipe-nuts, boiler-plugs and oil cups, not only in their connecting parts, but in their own details, and here again comes in the approximate size of the special tools required to make the work, or a gauge-cock or wash-out plugs, maybe, twelve-thread in one class of engines on divisions of the road, and fourteen on the other, even if of the same dimensions.

This is about the condition on most of the so-called engines of duplicate parts. The original intention was to duplicate them, but the necessity of providing a system for doing so was overlooked, and about all the duplicacy in the engine is in the design

Master mechanics say it is the best that can be done, and that gauges and templates made in the several shops of a road will not agree. If that is the case, then why not have all templates and gauges made in one shop for distribution, and by selected workmen, using improved tools for measurement, and who, becoming specialists in this work, could not only produce duplicate templates, but a system of templates to apply to all the details of a part, and also the many special tools required to duplicate as well as lessen the cost of making standard valves, cocks and cups.

A department of this kind should be closely allied to the drawing room, and, to a certain extent, under its control or advice when a standard has been adopted The templates and tools required to produce and maintain it would be distributed with the drawings

This would simply be adopting the principle that is now universal of procuring standard taps and reamers from makers who have facility for producing duplicates. Those who fail to produce taps in this manner have difficulty in the exchange of nuts or standard bolts, while the product of the work done by specialists never fail to be correct. Were the conditions such that templates and the tools mentioned could be procured in the same way it would be well to do it, but they are not, and the nearer the methods employed by the specialists are used, the nearer we will approach interchangeability.

In place of a system that applies to the exchange of sheets in a tank and forgets the rod keys, intelligent directions must be given as to what parts should duplicate and what need not, but not only is a proper gauge and template system required, but a careful consideration in the drawing room to what or how many details can, without detriment to the efficiency of the engine, be made common to all classes.

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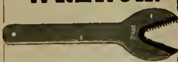

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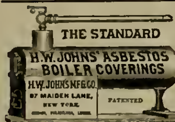


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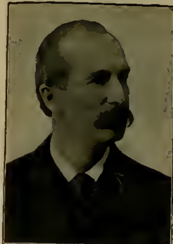
## How Much of a Machinist Should a Locomotive Engineer be?



[Clinton B. Conger is of old New England stock and was born in Plymouth, Ohio, in 1847. He spent his youth on a farm; lost his father in the Civil War, and at 17 found himself virtually the head of a family. Got an academic education and taught school some, but was anxious to handle machinery, and in 1870, at 22, went firing on the P. H. & L. M. R. R., then 18 miles long and being built westward from Port Huron, Mich., and stayed on it through all its vicissitudes till it was a trunk line to Chicago, being now the C. & G. T. Railway. The road at that time was very hard up financially and he had to get along with as little fuel, oil, machinery and wages as possible, because the company was too poor to furnish *all* that was necessary. It is a hard way to learn railroading, but if a man lives through it he knows how. After the C. & G. T. Ry. Co. bought the road, he was sent to Valparaiso, Ind., as locomotive foreman, remaining there two years, till September, 1882, when he came back on the main line as passenger engineer. In November, 1887, the Commissioners of Railroads of Michigan appointed him mechanical engineer in that office, and he held the position with credit to himself and advantage to the railroad men till March, '91. A very strong effort was made by the employés to have him reappointed by the new administration, but his politics were the wrong brand. He was appointed to his present position, that of road foreman of engines, of the Chicago & West Michigan and leased lines, last year. Clinton B. Conger is another example of a locomotive engineer, who goes up because he makes himself "conspicuously useful" in any capacity that he finds himself. He is a man who believes in "getting to the front" as far as he can in the matter of knowledge of his business, and that railroading is a profession even more than law or medicine.]

This question you heard more of ten years ago then at present, and for a very good reason. Then the engineer had to do a good deal of machinist work on his engine himself, now he reports the work to be done on the book, and goes home secure in the idea that his duties for the trip are finished.

Running a locomotive nowadays is most all pulling a train and getting there on time without getting in anybody's way. To do this requires an intimate knowledge of every grade and sag in the road, every curve and switch on the line, and some considerable knowledge of the habits of the other engineers, how fast they run into and through stations, where they stop for water and coal when you are following them close, and on what grades they are likely to stall.

The man who learns this on the left side of the cab *first* and learns the shop work afterward, is more likely to be successful than one who puts in a long apprenticeship in the back shop first, going on the road afterward; because it becomes a habit to think of the safety of the train first, the running rules and regulations are uppermost in his thoughts, as they were learned first in his railroad life.

If a fireman, when about to be promoted, is put in the roundhouse as a helper to the machinist, who does the running repairs or what is better, with one of the pit gangs in the back shops setting up repaired engines, it is a great help to him when he becomes an engineer, but the trouble is, he is wanted there steady every day; as he is liable to be out part of the time as "spare man" on the road; that spoils the shop arrangements.

One disadvantage some machinist engineers labor under is that of being past the age to learn the bottom principles of handling a train and running an engine when they leave the shop. He is then more apt to think of the way his engine is built, her weak parts and how to help them than getting his train in on time when late, or getting over the hills with the extra car all yardmasters think he can pull.

Engines are built to earn money for the company drawing coaches or tons of freight, and they can do it and still be well taken care of by the man running them if he does not know just how every joint is put together. The ones he has to take apart when he breaks down are what he keeps his eye on.

Let him learn the shop work at an early age, and be ready for promotion from firemen to engineer before thirty years old.

To be sure there are plenty of engineers who can do all the light running repairs around an engine, such as reducing and lining up rod brasses, making joints, changing journal brasses, grinding in globe valve seats, keeping their air-brake in good order, etc., but a fair share confine their work to keeping bolts and nuts tight when on the road, oil cups feeding, sure; main rod brasses keyed up so they suit them, and last but not least, setting the wedges just right. But there is a lot of machinist work attempted by engineers which can be done by the shop men easier and better; for instance, lining or closing guides, changing the eccentrics, setting the valves, changing liners under driving-box shoes to make the drivers track square, taking down cylinder packing, etc.

On roads where the engines are "chain ganged" or even double crewed, so much of the work needed each time the engine makes a trip is attended to by the engine inspectors and roundhouse force, that engine men get out of the hang of doing anything except packing and cleaning up. When a man brought up that way leaves the old road with its hundreds of engines, which he may have run one after the other, and goes on a little road, or some branch where he is obliged to take care of his machine and keep it in order as well as draw the train, it is pretty hard work at first. That is the place where a machinist runner comes handy.

There is a good deal said about a man having only one trade, and having a thorough knowledge of that trade. That is quite true; but on the other hand the more an engineer knows about the branches of his business, *if he knows it all well*, the more valuable man he is anywhere. Being well posted makes a man more self-reliant in times of trouble and the regular routine of business. The trouble with the machinist engineer has been that some of them only half understand either trade and did bragging enough for both. When you run across an engineer who is a good machinist, you hear him say very little about it, he is an engineer first and all the time, going in the shop only when he has to or finds a better paying job.

It is a fact that running an engine and repairing one, are getting to be widely diverging branches of the business. Repairing and building them is the same trade it was years ago, except new improved machines, standard sizes and shapes of the different parts of an engine make it cheaper and quicker to repair and rebuild them.

On the other hand, running one is getting to be more of a profession every day. A locomotive now is a combination of so many independent devices that it takes more skill than manual labor to handle one. Because some of the most successful engineers we have now did not fully understand the business when they took the right hand side of the cab years ago, and learned it afterward, it is no reason that an engineer can be as successful with the same amount of knowledge to-day. A man going out on an engine for his first trip with a main-line train, must know nearly as much as a regular engineer if he gets along, as just as much is required of him. He has to do as well or he is rated "no good."

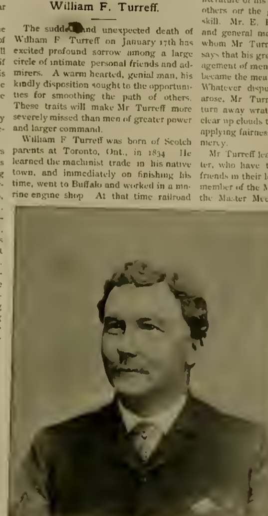
Let us hear the machinist end of this question.

C. B. Conger.

## William F. Turreff.

The sudden and unexpected death of William F. Turreff on January 17th has excited profound sorrow among a large circle of intimate personal friends and admirers. A warm hearted, genial man, his kindly disposition sought to the opportunities for smoothing the path of others. These traits will make Mr. Turreff more severely missed than men of greater power and larger command.

William F. Turreff was born of Scotch parents at Toronto, Ont., in 1834. He learned the machinist trade in his native town, and immediately on finishing his time, went to Buffalo and worked in a marine engine shop. At that time railroad



machinery was considered of secondary importance compared with the appliances connected with water transportation, but it was every year advancing in consequence, and ambitious mechanics began to turn their eyes to railroads as the coming Mecca. In 1853, when he was 19 years old, Mr. Turreff, who had gone still farther West, did his first railroad work in the shops of the Cleveland & Columbus Railroad. This road had been chartered only eight years before and track was laid as far as Columbus. It was the first link of what was afterward worked up into the chain of roads forming the Bee Line, and eventually the Big Four's system.

When Mr. Turreff went to work for the road as a machinist the company had fifteen locomotives and 138 miles of track laid on the soil of the virgin forest through which part of the line passed. He remained eleven years with the company as a machinist, and then started out to learn the ways of other shops and of other railroads. Seventeen years afterward, rich in experience, he returned to the company as a division superintendent and remained on the road till he became superintendent of motive power of a system having 1,478 miles of main line, 340 locomotives and 13,800 cars.

Rather more than a year ago, Mr. Turreff left the Cleveland, Columbus, Cincinnati & St. Louis, and was appointed assistant superintendent of the Western divisions of the Erie system. Owing to the illness of Mr. Ross Kells, Mr. Turreff was in New York with charge of the mechanical department of the whole system. About a week before his death he contracted a severe cold which developed into pneumonia and proved fatal after an illness of four days.

Mr. Turreff attained the highest position a railroad mechanic may expect to reach and with the means within the grasp of every ambitious workman. He had merely a common school education, but he improved himself by reading and study of the literature of his business, and he rose over others on the grade of intelligence and skill. Mr. E. B. Thomas, vice-president and general manager of the Erie, under whom Mr. Turreff had served for years, says that his great strength lay in his management of men. Here a kind disposition became the means of advancement in life. Whatever disputes or misunderstandings arose, Mr. Turreff was always ready to turn away wrath by a soft word, and to clear up clouds that threatened conflict by applying fairness and justice tempered by mercy.

Mr. Turreff leaves a wife and one daughter, who have the sympathy of hosts of friends in their loss. He was a prominent member of the Master Car Builders' and of the Master Mechanics' Associations and took a warm interest in the work done by these organizations. For the excellent portrait of Mr. Turreff we are indebted to Mr. J. C. Davis, of the Congdon Brake Shoe Co., Chicago.

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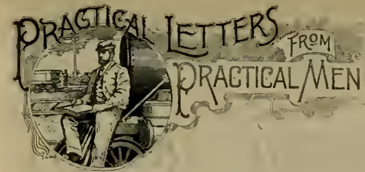
Those who are interested in drills will find the works of the Universal Radial Drill Co., Cincinnati, a good place to visit at present. Business is particularly active in the shop and there are some curious drills in course of construction. There is one for the Grant Locomotive Works with three heads for drilling locomotive frames, unusual ingenuity being displayed in the design. There are six special drills for the Union Switch & Signal Co., one of them having 30 spindles, 20 acting vertically and 10 horizontally. Besides the numerous drills these works are turning out other machine tools, among which we noted a large double-ended engine lathe and two combined turret and checking lathes.

Mr. Henry H. Horton has been appointed Master Mechanic of the Florida Midland Railroad. Mr. Horton was formerly a foreman in the machine shops of the East Tennessee, Virginia & Georgia, at Knoxville, Tenn. His ability as a foreman gives the promise that he will make an excellent master mechanic.

Mr. C. J. Clifford has been appointed Master Mechanic of the Calumet & Blue Island Co., in charge of locomotive and car departments, with office and shops at South Chicago, Ill. Mr. Clifford's jurisdiction has been extended over the locomotive and car departments of the Chicago & South Eastern, Chicago & Kenosha and Joliet & Blue Island roads.




## The "Bull Pups" of Mexico.

*Editors:*

In the article captioned "Long vs Short Eccentric Blades," mention is made of the D. & R. G. narrow gauge consolidation engine. Here on the F. C. N. M. a good many of the same type of engine are used; in fact, I believe some of the engines here were built for the D. & R. G.; 36 inches is a small diameter for a driving wheel, particularly on a division as long as ours—213 kilometers, or about 132 miles. They have the short blade, with considerable lead, making them quick to start but hard to hold down on the short curves, where it takes five rails to keep one of our "bull pups," as some of the boys call them, on the track. The short boiler and wheel base make them look puggy, hence the name.

The intermediate rocker arm is the cause of much lost motion, and a large percentage of break-downs consist of pulling out or breaking the studs that hold the blade on the strap. They are not, as usually, bolted to the straps, but butt on to them. They do splendid work, and while the services of a machinist is a constant necessity they hold up well. The flanges fail first from the extreme shortness of the curves, seldom lasting a year, while the tread of the wheel shows no wear. We burn wood entirely on the southern division, and when our Mexican firemen get a tank of dry pine the "bull pup," as she sails up the side of the mountain, more than rivals the 4th of July fireworks in a good sized Western town.

When they come out of the back shop first you can drop them four or five notches shut off, but as the lost motion runs up gradually to ⅛, ½ or ⅜ of an inch, you have to narrow down to 3, 2 and even 1 notch, and some of them even make less noise if left in the first notch. This is, of course, hard on valves and cylinders, but a long stroke savors so much of dissolution that no one attempts it. They are, as Bro. Hill says, capable of surprising speed; a kilometer a minute, or about 40 miles an hour, is easily made, or was, before our traveling engineer was born.

EUGENE MCAULIFFE.

*Acambaro, Estado de Guanajuato, Mex.*

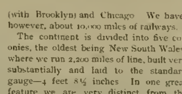
[The engines mentioned on the D. & R. G. were consolidation engines having no intermediate rockers or reach rods, and giving no trouble about laying the lever down among the od cans. Some 10-wheelers, with extra reach rods and hangers did object to running shut off in any position far from the center.]

## Engine-men's Barracks on the New South Wales Railways.

*Editors:*

Ever since I have taken your valuable paper I have been considering the advisability of sending you an article for publication in connection with our New South Wales railways, and I do so now. I understand but little is known of Australia in the States, but some interest may be awakened amongst my brother engine-men when I say that Australia is nearly as large as the United States, although it holds but little more people than are contained in two of the largest American cities—New York (with Brooklyn) and Chicago. We have, however, about 10,000 miles of railways.

The continent is divided into five colonies, the oldest being New South Wales, where we run 2,200 miles of line, built very substantially and laid to the standard gauge—4 feet 8½ inches. In one great feature we are very distinct from the American roads, as instead of the lines being controlled by companies with a care only for big dividends, the lines here are owned by the State and worked for the good of the State. The management is in the hands of a board of three commissioners who to a large extent are non-political, and as they have no incentive to



earn big dividends, they are enabled to give the men, while acting with due regard to the public interest, considerable benefits and privileges, and to-day I believe the engine-men of New South Wales stand in a better position than any men engaged in similar work in any part of the world. If of interest, I could give you more particulars as to their duties and pay later.

I intend only to speak of one feature of the administration of our lines now, and that is the efforts taken to secure the comfort of the men. The commissioners, headed by Mr. E. M. G. Eddy, the chairman of the board, said to be one of the ablest railway managers in England, who came here three years ago to take the chief commissionership, Mr. Fehon and Mr. Oliver have taken a very lively interest in all matters that tend to promote the social and moral welfare of the men, and the outcome of one of their improvements is the introduction of engine-men's cottage homes at the locomotive centers. I send herewith photograph of the one just completed at Picton.

All engine-men have necessarily to spend some little time away from home, and the commissioners, feeling this, have provided the men with homes and expenses while away. The barracks are a credit to the commissioners and the men that inhabit them. These barracks are built of brick, with a veranda three parts around, with slated roof. Three parts of the building is divided into bedrooms, the other part into a dining-room, lavatory, kitchen, pantry and bath-room. The bedrooms are furnished with two single beds, spring mattresses, clean sheets, pillow-cases and blankets, two chairs, dressing-table and mirror, and a large kerosene lamp. The dining-room with large white pine table and forms, with half-a-dozen armchairs, side table, hat and coat racks, and a large fire grate. The lavatory has a slate slab, with porcelain basins set in with plug at the bottom; the water is let into the basins with suitable spring tap. Roller and Turkish towels, soap, brushes and combs and large mirrors are furnished. The bath-room is provided with plunge and shower baths, grated wood floor over a cemented floor; the cemented floor is so made that the water is carried away by a drain at the side of the room to the outside of the building. The water is laid in from the engine supply-tank.

The kitchen is fitted up with a large stove, two large 10-gallon kettles always ready for the men as they come in, pans and saucepans. The pantry or store-room is used to keep blankets, sheets, etc. On the large veranda large lockers and gauze wire netting safes are kept to keep the men's provisions in while staying at the barracks. The care of the rooms is generally entrusted to the widow of a deceased railway man or by the wife of a man who is past active work, so that the double purpose is served of a necessary appointment being made and a helping hand held out at the same time to a woman who, by reason of a husband's past services, deserves well of the railway department. The sleeping compartments are numbered, and the men, when they retire to rest, put the number of their room on a blackboard to guide the caller, so that he will not have to wake up every person in the house before he gets the right one.

QUICK ACTION.

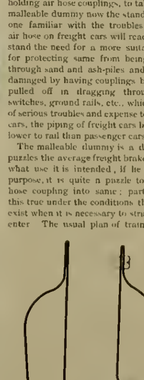
*Sydney, N. S. W.*

## A Dummy Hose Coupler.

*Editors:*

I inclose you blue print of a device for holding air hose couplings, to take place of malleable dummy now the standard. Any one familiar with the troubles had with air hose on freight cars will readily understand the need for a more suitable device for protecting same from being dragged through sand and ash-piles and otherwise damaged by having couplings beaten and pulled off in dragging through frogs, switches, ground rails, etc., which is cause of serious troubles and expense to air-brake cars, the piping of freight cars being much lower to rail than passenger cars.

The malleable dummy is a device that puzzles the average freight brakemen as to what use it is intended; if he knows its purpose, it is quite a puzzle to introduce hose coupling into same; particularly is this true under the conditions that usually exist when it is necessary to strain hose to enter. The usual plan of trainmen is to



hang coupling on the hook of dummy; this allows point of hook to come in contact with the rubber joint of coupling, and but a short journey of the cars is necessary to ruin the joint.

To overcome these difficulties on our own equipment (the South Carolina Ry.) and reduce our repairs to trifles by foreign materials being blown into them, and the excessive renewals of hose and couplings, the device shown was devised, and I think it meets all the requirements. It is not a puzzle to trainmen; its appearance makes its purpose plain; hose couplings are easily introduced and as easily detached, no straining necessary. The gasket is protected and securely sealed to prevent dirt entering pipes.

Being made of tempered steel, they are light, durable and cheap. Arrangements have been made with the A. French Steel Spring Company to manufacture the device.

E. M. ROBERTS,
M. of M.

*Charleston, S. C.*

## Compressed Air in Workshops.

*Editors:*

Please to kindly give us in your paper, some details about the use of compressed air in machine-tool shops, what are the best machines used for that purpose, and at what pressure of air they are working.

CARELS BROS.,
Locomotives and Steam Engines.

*Gand, le Belgium.*

[Compressed air is used very extensively in American shops, especially railroad shops. In most cases the air plant started in a small way using a Westinghouse air-brake pump as compressor. In some shops there are several of these at work; we know of one using sixteen of them. Other shops have larger compressors, generally belt-driven machines. Lines of road using the electro-pneumatic operated block signal have large compressors directly connected to a steam cylinder. The use of compressed air is legion; it is used to test brakes undergoing repairs, to test steam fittings, to handle cranes, to run small engines for special drills, etc., coaches are cleaned by jets of it, for pneumatic riveting and seam-calking, to blow fires, to lift and carry oils, to blow up fires in dead locomotives. Boilers are filled with it when engines are rebuilt, and they are run out of the shops before firing up, and workmen use it to blow chips out of planer slots and away from other work. As a usual thing the pressure is 60 pounds per square inch; this pressure is about right for testing brakes, can be maintained without heating compressor, and is safe to handle. Requiring no drain for waste, as in hydraulics or exhaust pipes as in steam, being cool, and an aid to ventilation, it has many advantages and is destined to be as necessary in a railroad plant as the motive-power itself.]

## A Case of Forgetting.

*Editors:*

It is surprising how much one forgets.

While reading the several accounts of the now celebrated "Cunningham Puzzle" in your paper, it reminds me how easy it is to forget, and some are more prone to do so than others, and judging by how much Mr. Cunningham forgot in the two short months between his two letters, that he is one of the "more," and if it is fair to use these two months as a basis to know how much he would forget in twenty years, it is a wonder that he now remembers of ever running on the M. & O. R. R. at all, and when he says there was no engine house or shop at Columbus, Kentucky, until 1876 he proves his forgetfulness. In September, 1867, there was a shop and also engine house. B. F. Partridge was foreman, and then a man by name of Perkins took his place as foreman. There were lathes and drill press, etc., also a carpenter shop which had several men working in it; there was a young colored man running the shop engine. Now, when he tells you that the M. M. and foreman do not know any more about his breakdown than he has told you, it leaves a very wide margin for doubt, owing to how much one will forget sometimes.

ONE WHO WAS THERE.

*Centralia, Ill.*

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*If you don't know how the thing operates, it is because you threw that circular into the waste basket. But you can get another if you want it.*

*Don't forget to have them specified for the new engines which you are going to have built by the Blank Locomotive Works. The Superintendent says he would like to get them on, as he wants the engines to make a good showing.*

HOW MANY HUNDRED SETS A MONTH DO YOU SUPPOSE WE ARE PUTTING ON?
AND HOW LONG WILL IT BE BEFORE YOUR ROAD WILL BE THE ONLY ONE WHICH HASN'T SENT FOR A TRIAL SET?

**H. L. LEACH, General Agent, 55 Oliver Street, Boston, Mass.**

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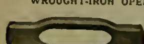
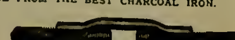


# TURNBUCKLES.



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**The Central Iron and Steel Co.**
BRAZIL, IND.

## Testing Brakes from Rear End.

*Editors:*

Considerable attention has been paid on some roads to testing brakes from rear of train, and our attention has been called through your columns to difficulties that arise from local causes.

We have seen that obstruction in train-pipe may interfere in *either* direction with free passage of air, or, in other words, that brakes will not always operate alike from both ends of train. Now, this is no reason for testing from rear end, because service applications are only made from head end in controlling train, and what else are they for? Passage of air forward is most to be desired. Obstructions in train-pipe should be located at terminals and are of rare occurrence anyway if any sort of attention is paid to testing cars in yards by men whose business it is to do so.

There is another view to be taken of the practice in its effect in general on the delicate and numerous parts of a system of quick-acting automatic brakes in train.

At the head end, our engineer has at his hand an air-valve in its most approved form for the purpose of controlling automatically the release of air from the train-pipe, also, before him are gauges that show what he and the valve are doing or can do.

At the rear end, what have we?

1st. An average brakeman.

(Thos. Carlyle says the average man is a "damn fool"—which being a general remark and applied to all of us, we can have no grievance.)

2d. There are no gauges whereby this average brakeman can tell how much air he is going to release.

3d. There is an ordinary train-pipe stop-cock that opens a slot $1\frac{1}{4}$ inches long, or nothing.

Now, from actual measurement, as compared with the maximum area of service opening in train pipe resulting from use of engineer's air-valve, the train-pipe cock should not be opened more than $\frac{1}{16}$ of an inch.

As a result of the above we have in nine cases out of ten an *emergency* application to determine whether the brakes are in condition for a *service* application, which is not the same thing.

I fail to find that the W. A. B. Co., or anyone else for that matter, recommend the use of the emergency as a regular thing. While not so disastrous on draw-heads and wheels when applied on a train at rest, yet the tendency to disarrangement of parts causes lots of trouble from undue strain. Bang! bang! we hear the brakes go on all around us from brakemen (and other conductors) monkeying with them because they are required to. In vain are they "jacked up" about it. Our average brakeman cannot strain his nerves to adjusting stop-cocks within $\frac{1}{16}$ of an inch. Not only does the practice make trouble, but wastes an enormous amount of air needlessly.

Our overworked air-pumps labor away to make up this waste.

They make no demand for overtime, however, wherefore let us rejoice and be exceeding glad. Thus appears one redeeming feature of testing brakes from rear end.

H. STILLMAN, M. M.

*Dunsmuir, Cal.*

## The Waste in the Train Pipe.

*Editors*

I see some of the readers of the LOCOMOTIVE ENGINEERING are skeptical about the waste in train pipe described by Mr. Paxton in September issue, so it will be necessary for me to do as Alex. Cunningham is going to do ("prove it and swear to it") Mr. Paxton fully described the action of the brakes. I found on disconnecting train pipe at T, where triple valve branch pipe connects with train pipe, a bunch of waste wedged tightly in train pipe at end of T or drain cup farthest from engine. The fact that I had released the brakes just before disconnecting train pipe led me to believe that the motion of the waste was from one end of the strainer to the other as the pressure was increased or reduced from engine, and I still think that such was the case. Whether the entire plug moved or not, the fact remains that air would pass through to rear end of train but would not from rear end to head end. This, I think, is conclusive evidence that there must have been some movement of the waste, either wholly or in part.

Replying to Mr. Synnestvedt, would say that strainer is in drain cup or T when triple valve branch pipe connects to train pipe. If he will measure he will find considerable difference in diameter of strainer and train pipe, and still more between strainer and union swivel on train pipe. If this were not the case, the waste would have passed through train pipe into hose. Mr. Lansing, I should judge, handles nothing but cars equipped with "quick action brake," or he certainly would have found "that strainer." In conclusion, I believe the only way to test brakes is through medium by which they are to be handled on the road.

W. R. SCOTT.

*Newton, Kan.*

## He Still Lives.

*Editors.*

John Alexander's Jim Crow Line official "Useless" survives, but has taken another line under his protecting wing. John Alexander has my everlasting gratitude for painting his portrait. It is doubtful, however, if the line survives the treatment.

ONE OF THE AUDIENCE.

*Boston, Mass.*

## Are Railroad Managers Unmindful of Stockholders' Interests?

*Editors:*

Having taken some interest in the manner in which improvements were accepted on railroads generally, and finding so much indifference shown to a really good thing many times, it leads me to make the above inquiry.

While reading the *Railroad Gazette* of January 8th, 1892, I saw that the Baltimore & Ohio Railroad had closed a contract with the Baldwin Locomotive Works for forty locomotives of different classes, and that none of them were to be of the most improved type, *i. e.*, compound. I do not see how this is, for the B & O R R were the first to use a compound locomotive, and have had one running for nearly three years, also have been testing another that is to go to a committee (appointed by the Convention of Master Mechanics) which is to give it a trial.

This shows that the B. & O. management are not ignorant about these compound locomotives which are showing from 15 per cent. to 40 per cent. saving of fuel in every-day service. I think I am safe in saying that these figures of saving have not been questioned by any one as yet, and cannot see how they can be, as the report of the experts of the Franklin Institute, on this B. & O. compound, demonstrates the above fact, and shows this type of engine to be simple, durable and economical, meeting with universal favor wherever used. So much for facts.

Now let one take a few figures and see how much might be saved on an order of forty locomotives by the company using them, if they had been of the most "improved" type, *i. e.* a compound engine. It will not overrate the matter to assume that these forty engines will each burn four tons of coal per day, and run at least 300 days a year, which makes something worth looking after, if 25 per cent of it could be saved. The forty engines, at four tons each per day, would burn 160 tons, and in 300 days would burn 48,000 tons, which it is fair to assume represents \$2.50 per ton. This would amount to \$120,000, and a saving of 25 per cent. would show a net gain of \$30,000 per year.

These figures may not be exactly correct, but I am sure they are nearly so.

If these things are at all correct, do the railroad managers look to the interests of the stockholders?

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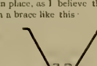

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## Testing Brakes from Rear End.

*Editors:*

Considerable attention has been paid on some roads to testing brakes from rear of train, and our attention has been called through your columns to difficulties that arise from local causes.

We have seen that obstruction in train-pipe may interfere in *either* direction with free passage of air, or, in other words, that brakes will not always operate alike from both ends of train. Now, this is no reason for testing from rear end, because service applications are only made from head end in controlling train, and what else are they for? Passage of air forward is most to be desired. Obstructions in train-pipe should be located at terminals and are of rare occurrence anyway if any sort of attention is paid to testing cars in yards by men whose business it is to do so.

There is another view to be taken of the practice in its effect in general on the delicate and numerous parts of a system of quick-acting automatic brakes in train.

At the head end, our engineer has at his hand an air-valve in its most approved form for the purpose of controlling automatically the release of air from the train-pipe, also, before him are gauges that show what he and the valve are doing or can do.

At the rear end, what have we?

1st. An average brakeman.

(Thos. Carlyle says the average man is a "damn fool"—which being a general remark and applied to all of us, we can have no grievance.)

2d. There are no gauges whereby this average brakeman can tell how much air he is going to release.

3d. There is an ordinary train-pipe stop-cock that opens a slot 1¼ inches long, or nothing.

Now, from actual measurement, as compared with the maximum area of service opening in train pipe resulting from use of engineer's air-valve, the train-pipe cock should not be opened more than $\frac{1}{16}$ of an inch.

As a result of the above we have in nine cases out of ten an *emergency* application to determine whether the brakes are in condition for a *service* application, which is not the same thing.

I fail to find that the W. A. B. Co., or anyone else for that matter, recommend the use of the emergency as a regular thing. While not so disastrous on draw-heads and wheels when applied on a train at rest, yet the tendency to disarrangement of parts causes lots of trouble from undue strain. Bang! bang! we hear the brakes go on all around us from brakemen (and other conductors) monkeying with them because they are required to. In vain are they "jacked up" about it. Our average brakeman cannot strain his nerves to adjusting stop-cocks within $\frac{1}{16}$ of an inch. Not only does the practice make trouble, but wastes an enormous amount of air needlessly.

Our overworked air-pumps labor away to make up this waste.

They make no demand for overtime, however, wherefore let us rejoice and be exceeding glad. Thus appears one redeeming feature of testing brakes from rear end.

H. STILLMAN, M. M.

*Dunsmuir, Cal.*

## The Waste in the Train Pipe.

*Editors.*

I see some of the readers of the LOCOMOTIVE ENGINEERING are skeptical about the waste in train pipe described by Mr Paxton in September issue, so it will be necessary for me to do as Alex. Cunningham is going to do ("prove it and swear to it"). Mr. Paxton fully described the action of the brakes. I found on disconnecting train pipe at T, where triple valve branch pipe connects with train pipe, a bunch of waste wedged tightly in train pipe at end of T or drain cup farthest from engine. The fact that I had released the brakes just before disconnecting train pipe led me to believe that the motion of the waste was from one end of the strainer to the other as the pressure was increased or reduced from engine, and I still think that such was the case. Whether the entire plug moved or not, the fact remains that air would pass through to rear end of train but would not from rear end to head end. This, I think, is conclusive evidence that there must have been some movement of the waste, either wholly or in part.

Replying to Mr. Synnestvedt, would say that strainer is in drain cup or T when triple valve branch pipe connects to train pipe. If he will measure he will find considerable difference in diameter of strainer and train pipe, and still more between strainer and union swivel on train pipe. If this were not the case, the waste would have passed through train pipe into hose. Mr. Lansing, I should judge, handles nothing but cars equipped with "quick action brake," or he certainly would have found "that strainer." In conclusion, I believe the only way to test brakes is through medium by which they are to be handled on the road.

W. R. SCOTT.

*Newton, Kan.*

## He Still Lives.

*Editors:*

John Alexander's Jim Crow Line official "Useless" survives, but has taken another line under his protecting wing. John Alexander has my everlasting gratitude for painting his portrait. It is doubtful, however, if the line survives the treatment.

ONE OF THE AUDIENCE.

*Boston, Mass.*

## Are Railroad Managers Unmindful of Stockholders' Interests?

*Editors:*

Having taken some interest in the manner in which improvements were accepted on railroads generally, and finding so much indifference shown to a really good thing many times, it leads me to make the above inquiry.

While reading the *Railroad Gazette* of January 8th, 1892, I saw that the Baltimore & Ohio Railroad had closed a contract with the Baldwin Locomotive Works for forty locomotives of different classes, and that none of them were to be of the most improved type, *i. e.*, compound. I do not see how this is, for the B & O. R R were the first to use a compound locomotive, and have had one running for nearly three years; also have been testing another that is to go to a committee (appointed by the Convention of Master Mechanics) which is to give it a trial.

This shows that the B & O. management are not ignorant about these compound locomotives, which are showing from 15 per cent. to 40 per cent. saving of fuel in every-day service. I think I am safe in saying that these figures of saving have not been questioned by any one as yet, and cannot see how they can be, as the report of the experts of the Franklin Institute, on this B. & O. compound, demonstrates the above fact, and shows this type of engine to be simple, durable and economical, meeting with universal favor wherever used. So much for facts.

Now let one take a few figures and see how much might be saved on an order of forty locomotives by the company using them, if they had been of the most "improved" type, *i. e.*, a compound engine. It will not overrate the matter to assume that these forty engines will each burn four tons of coal per day, and run at least 300 days a year, which makes something worth looking after, if 25 per cent. of it could be saved. The forty engines, at four tons each per day, would burn 160 tons, and in 300 days would burn 48,000 tons, which it is fair to assume represents $2.50 per ton. This would amount to $120,000, and a saving of 25 per cent. would show a net gain of $30,000 per year.

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## Baltimore & Ohio Coal Car.

The one hopper gondola car illustrated in the annexed engraving is the standard coal car for 60,000 pounds now used by the Baltimore & Ohio Railroad. The car is designed with a view to carrying, without distress, the heavy load specified, and experience with the cars in the severe train service of the mountain roads of Pennsylvania and Maryland indicates that the car is going to prove highly satisfactory. It was originally designed by Mr. E. W. Grieves, Master Car Builder of the Baltimore & Ohio for a coal company, and gave so much satisfaction that, with a few improvements, it was adopted as the standard of the railroad company.

The leading dimensions of the car are: Length over end sills, 27 feet 3 inches; length outside of end planks, 25 feet 3 inches; length of car inside of end planks, 24 feet 9 inches; width over side sills, 7 feet 10 inches; height of side and end planks, 5 feet 1 inch; depth of hopper, 2 feet 6 inches; hopper opening, 6 feet 4 inches by 7 feet 6½ inches; distance between track centers, 17 feet 9 inches.

Yellow pine is used for side sills, center sills, intermediate sills, center springer, bridging, end planks, side planks, furrying pieces and running boards. The specifications require all yellow pine used to be untapped, and to show one face clear of sap; the other side to show not less than two-thirds heart. It has to be free from large or defective knots, wind or heart shakes and injurious sap.

White oak is employed for construction of end sills, draw-bar pieces, draw-timbers, foot-boards, stakes, body-bolsters, side bearing-blocks, slope-timbers, cross-rails, liners, filling-in pieces, brake-step, center sill roof-pieces, side-pieces and door-pieces. This oak must be all free from large or defective knots, bark-edges and heart-shakes. It will not be accepted with heart over three inches in diameter, which must be solid and in center of timber.

All bolt-heads, nuts and threads conform to the Master Car Builders' standard, which is the United States standard for these parts.

The side sills are 6x12 inches between body-bolster and tapered to 5x8 inches at the ends, and framed to end sills with 1½-inch tenons, with 2 inches space between tenons. Each sill is provided with pressed steel stake-pockets, which are fastened with double ¾-inch round iron yokes. Bolsters are secured to side sills by ¾-inch bolts which are put in place before furring is laid.

The intermediate sills are 4x10 inches, tapered to 4x10 on end, and are framed to end sills and bridging in the same way as the ends ills. Body-bolsters are fastened to intermediate sills with ¾-inch bolts. The intermediate sills have 2x4-inch liners fastened underneath between body-bolster and bridging The end planks are strongly secured to sills by strap bolts which lip over top of planks and pass down inside of car and through intermediate sills.

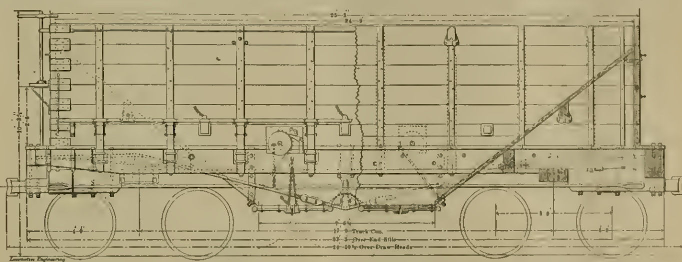
Center sills are 4x10 inches. A very substantial method of construction is followed for securing the draw timbers to these sills

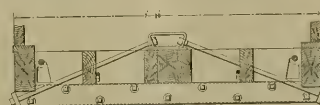
The body-bolsters are compound and made of three pieces of white oak 4½x6½ inches and two pieces of iron ¾x6 inches, bolted together with ¾ bolts. When finished it is 6¼x15 inches and cut off flush with the outside of side sills, and on an angle to receive truss rod washer and gained 2 inches deep to receive the side sills. Bolsters are placed 4 feet 9 inches from outside of end sill. Bolsters are trussed with strap ⅝x3½ inches, forming a pocket to receive 1¼-inch round truss rods, passing outside of bolster and through intermediate sills.

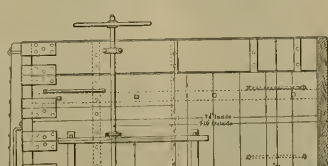
The side planks are 3 inches thick, 10 inches wide and 25 feet 3 inches long, laid on top of furring and fastened to frame of car with heavy strap bolts, and by pressed steel stake pockets. Each stake is riveted to side planks by ⅝-inch rivets with heads on outside of stake. The side and end planks are secured at the corners by seven pressed steel plates placed on the outside of car body. These are fastened by ½ inch rivets passing through the planks.

The car is provided with the American continuous drawbar.

All details of construction have been worked out with masterly ability. The material and proportions are designed to provide a car that will give the best possible service. The staying, bracing and trussing in a way to overcome the natural weakness of every point Mr. Grieves has good reason to be proud of the car.






## Leaving Well Enough Alone.

The advantage of leaving well enough alone was very well illustrated in a case mentioned by one of the Westinghouse Air Brake Co.'s inspectors. The company had equipped a small road in Canada with an entire outfit of brakes, and nine years afterward the superintendent of the road sent word to the brake company that the brakes were not working well. An inspector went to inquire into the cause of the trouble, and naturally asked what attention the triple valves and brake cylinders had received.

"Attention," said the superintendent, "they were never touched. I gave orders when the brakes were put on that no one should ever touch the brakes, and my orders are obeyed on this road."

"You never cleaned them or oiled them?" asked the inspector.

"Never a clean or an oil," was the reply. "I was afraid that if any of my men took the thing apart, they would never get it together again. You put all those things in good working order again and let us see if they can go nine years more without attention."

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People going into Philadelphia, on the Pennsylvania Railroad, will notice on the left near the river, a fine new five story brick building. This is the new factory lately erected by the Berry & Orton Co., for their business of making wood-working machinery. The building has been erected in the most substantial style and is equipped with the best machinery for machinist work. The main building is 123 x 80 feet and there is an L 68x45 feet. Power for driving the machinery is obtained from an engine of 150 horse power. Elevators are used for moving material and workmen to the different floors; heating is done by what Mr. Orton considers the best steam system; electric lights are provided in sufficient number to make working at night nearly as clear as working in daytime. Tracks that come into the yards of the works connect with all the railroads coming into Philadelphia The finish of the offices is particularly fine and artistic, the work having been done by Harlan & Hollingsworth. The new shops give the company about four times the capacity they had before. Mr L. O. Orton superintended all details in the construction of the works.

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Mr. E. W. Hayes has been appointed Master Mechanic of the Fort Worth & Denver City Railway.

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Mr F. H. Marsh, for some time Superintendent of the Yellowstone Division of the Northern Pacific, has been appointed Superintendent of the Chicago, Milwaukee & St. Paul.

WILLIAM P. HALL, President. A. W. HALL, General Manager.
W. S. GILMORE, Treasurer. S. MARSH YOUNG, General Agent.

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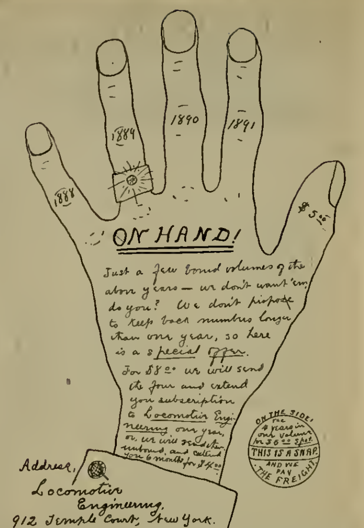


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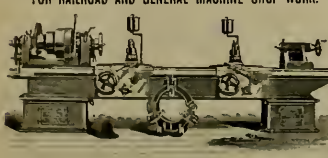

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JOHN WILEY & SONS, NEW YORK.

## Concerning Car Building.

The Baltimore & Ohio have ordered 1,500 cars.

The Boston & Albany have contracted with the Erie Car Works for 200 box cars.

The New York, Susquehanna & Western are in the market for 300 coal and 50 box cars.

The New England Railroad Club will discuss the subject of freight car trucks at next meeting.

The New York Central are reported to be in the market for 1,000 box and 1,000 coal gondolas.

This is magnificent weather for the testing of steam heater apparatus, and we will be surprised if the frost does not bring out some surprising "vindications"—on paper, anyway.

The Missouri Car and Foundry Co. are busy on cars for the Chicago, Burlington & Quincy, the East Tennessee, Virginia & Georgia, and the Savannah, Florida & Western.

The St. Charles Car Co. have received an order from the Missouri Pacific for 200 cars. It is reported that the order will be stretched out to 2,000 before the cars are delivered.

The Norfolk & Western are building 500 cars in the Roanoke Machine Works and they are said to be in the market for 2,000 more cars. Business on that road is very heavy.

The Chicago & Northwestern have ordered 120 new passenger cars from Pullman. This is the beginning of the preparation of this company to have plenty of passenger cars to handle the World's Fair business.

There have been a variety of disputes aired in the courts by steel car patentees of late, but railroad companies do not display the interest in this kind of car that would make patents of much value or worth fighting about.

The Duluth & Iron Range have placed an order for 200 ore cars. The ore-carrying business was very dull last season, but it is expected that it will be very active directly. Several other roads are contemplating the ordering of new ore cars.

The Louisville & Nashville are reported to be in the market for 1,000 freight cars. Cotton moving is slow in the South owing to low prices, but there is a good crop, and the cars must be had to haul it. Other Southern business grows apace.

The Chicago South Side Elevated Railway have ordered 75 passenger cars. They are substantially the same car as those used on the New York Elevated Railroads. The cars will be lighted by the Pintsch light system, which will be duly appreciated by the patrons of the road.

The Dayton Malleable Iron Company intimate to railroad men that they remodel for malleable iron, any pattern used for gray iron. By this means malleable iron castings can be used in car construction or repair without any change in the drawings or measurements.

The Committee of the Master Car Builders' Association, investigating the subject of steel-tired wheels, have sent out a circular calling for information on the subject. Mr. R. E. Marshall, Superintendent Motive Power, P. W. & B. Railroad, Philadelphia, is chairman, and replies should be sent to him.

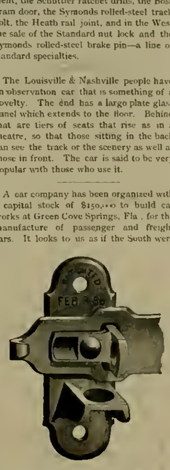
An odd form of flat car has been ordered by a car company in St. Louis. It is 60 feet long and is intended for the carrying of street cars from the makers. The Litchfield Car Works are building twenty of these cars. This company is also building 1,000 freight cars for a Kansas City transportation company.

A number of the unfortunates who have claims against the United States Rolling Stock Company are trying to have Receiver Hegewisch removed. If Mr. Hegewisch manages the property as receiver in the same fashion as he managed it before, the creditors will have some reason to demand a new deal.

Frank Bakeman & Co. report business in a highly gratifying condition. This firm handles the Cushing draw-bar attachment, the Schuttler ratchet drills, the Boss grain door, the Symonds rolled-steel track bolt, the Heath rail joint, and in the West the sale of the Standard nut lock and the Symonds rolled-steel brake pin—a line of standard specialties.

The Louisville & Nashville people have an observation car that is something of a novelty. The end has a large plate glass panel which extends to the floor. Behind that are tiers of seats that rise as in a theatre, so that those sitting in the back can see the track or the scenery as well as those in front. The car is said to be very popular with those who use it.

A car company has been organized with a capital stock of $150,000 to build car works at Green Cove Springs, Fla., for the manufacture of passenger and freight cars. It looks to us as if the South were



overdoing this business of building new car shops. Those in existence are not waxing fat. There is plenty of lumber to be had cheap but very small demand for the cars.

It is reported that an order has been issued by the Chicago, Burlington & Quincy to postpone the delivery of the freight cars under construction for the company at the Madison Car Works. The cars have been equipped with the New York air-brake, which is not working satisfactorily, and the purpose is to have the apparatus made right, or another brake substituted before the cars are put on the road.

Some time ago the Louisville & Nashville people adopted iron bolsters for their passenger cars. There were several good reasons apparent for this change but experience has demonstrated that they were more apparent than real. A fatal objection to iron bolsters is that they make the car ride harder than a wooden bolster. On account of this the company are returning to the use of wooden bolsters.

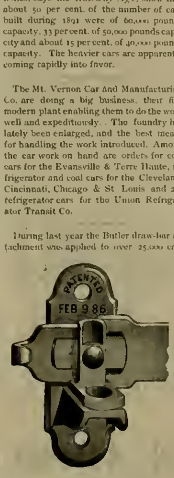
Those who are interested in transporting perishable commodities in good order, would do well to investigate the merits of the Hanrahan automatic refrigerator car, whose headquarters are in the Phenix building, Chicago. This car is designed to act in harmony with nature's laws, with the result that it maintains a low temperature with the smallest possible expenditure of ice. This car is certain to become popular.

The Elmore Car Axle Box Lid Company, Chicago, report that their lid has received a good share of patronage among the large number of freight cars lately ordered. The Elmore lid is standard on several railroads and is a great favorite wherever used. The lid is now made of pressed steel and is self-closing, making a dust-proof cover to the box. Those who have not tried the steel lid are requested to send for a sample.

The orders given out lately for cars have almost invariably specified a capacity of 60,000 pounds. The movement in this direction has been very rapid. Recent statistics, says the *Railway Age*, show that about 50 per cent. of the number of cars built during 1891 were of 60,000 pounds capacity, 33 per cent. of 50,000 pounds capacity and about 15 per cent. of 40,000 pounds capacity. The heavier cars are apparently coming rapidly into favor.

The Mt. Vernon Car and Manufacturing Co. are doing a big business, their fine modern plant enabling them to do the work well and expeditiously. The foundry has lately been enlarged, and the best means for handling the work introduced. Among the car work on hand are orders for coal cars for the Evansville & Terre Haute, refrigerator and coal cars for the Cleveland, Cincinnati, Chicago & St. Louis and 200 refrigerator cars for the Union Refrigerator Transit Co.

During last year the Butler draw-bar attachment was applied to over 25,000 cars




and used on railroads representing more than 50,000 miles of track. All who use the attachment admit that it puts an end to the pulling out of draw heads and couplers. Considering the small cost of the attachment, its simplicity and durability the surprise is that so many railroads delay putting it upon their cars. The saving of draft timbers is calculated to be sufficient in one year to pay for the device.

The 1,500 new freight cars lately ordered by the East Tennessee, Virginia & Georgia are going to be equipped with air-brakes and master car builders' type of coupler. The officers of this system say that there has been a great deal of breakage among the vertical plane couplers in use, but valuable experience has been gained which is likely to reduce the breakage. With all the drawbacks due to the period of mixed draw-bars the E. T., V. & Ga. people say the expense of using the Janney style coupler compares favorably with the link and pin.

The Consolidated Car Heating Co. informs us that it has been favored with a most prosperous business for the four months ending January 1, 1892. They have furnished to railroads 13,459 steam couplers, 459 complete car equipments and 162 locomotive equipments. The Old Colony R. R. has had 99 equipments, the Boston & Maine 175, the Canadian Pacific 45, the Concord and Montreal 64. The Canada Atlantic, the "Soo Line," and all the Vanderbilt lines were also large buyers. On the first of January they had orders yet to be filled for 130 complete car equipments.

There is nothing in the way of improvement of the American railroad car so badly needed as platform gates. Scores of people are killed every year by getting off the wrong side of a train and getting in the way of other trains, falling off platforms when sick or intoxicated, or getting thrown off by lurching of the train, or because there is ice or snow on platforms. Vestibuled trains are all right in this respect, but the platform of the ordinary coach is what needs protection. The Old Colony and one or two other New England roads are well equipped in this way and their example should be followed. It is only a few days ago that a man fell off the platform of an express train in the tunnel approaching the Grand Central station in this city and narrowly escaped death, gates are cheap and efficient—let's have them.

## Dayton Malleable Iron Company's Door Fastener.

The annexed engravings illustrate a very efficient form of door fastener made by the Dayton Malleable Iron Co., for freight cars. The points of superiority claimed for the fastener are:

It has no pins, hooks or chains to be broken or lost—the gravity button taking their place.

It is very strong and perfectly simple; anyone can see at a glance how it works.

It can be put on the door, or the door-post, working either right or left.

It can be sealed with wire or tin seal, or locked with padlock.

It is the cheapest, strongest, and best fastener in the market.

It has double-slotted hasp, so that, if desired, the door can be locked open for ventilation. Single-slotted hasps furnished if preferred; also hasps with offset, for stock cars.

## An Unwelcome Intruder.

In the yards of the New York, Providence & Boston Railroad, at Providence, there is to be seen a modest-looking frame house bearing the inscription "Freight Office." The sign appears to be put there to deceive, for the building is filled with the offices of Master Mechanic Butler. It is an exciting place to locate an office, for at all times of the day and night there are flying cars to the right of you, flying cars to the left of you and switch engines bumping their victims in all directions. It is a good place not to sleep in, and Mr. Butler says that is right, for it is not intended as a sleeping place. The location has its drawbacks, however, even to a man not fond of repose. The other day as Mr. Butler, soothed by the tumult outside, was cogitating on how many engines he would have overhauled during the winter and calculating the expense, the exterior racket became a little more impressive than usual, and suddenly the end of a freight car probed its way through the side of his office, and tried to run the building across the tracks. It only succeeded in moving the master mechanic's office a few feet, but Mr. Butler declares that it spoiled one of the best calculations he had ever made.

Captain John Kerr has been appointed assistant mechanical superintendent of the Grand Trunk Railway with charge of the car department at London, Ont.

The mechanical department of the Northern Pacific Road lost a valuable man in the sudden death, on December 20th, of G. W. Goodman, M. M., at Mandon, N. D. Mr. Goodman succeeded J. E. Phelan as general road foreman of engines and was only recently made master mechanic.

Those who are in the confidence of President Manvel, of the Atchison, Topeka & Santa Fé, say that he is about to infuse gladness to many by ordering twenty-five new locomotives.

## Two Kinds of Locomotive Runners.

Any road engineer who visits the Carnegie works in Pittsburgh and sees the young boys in charge of the little locomotives about the mills is apt to think there is not much ability or experience needed there, but the concerns have some standard gauge switches with grown-up men on them.

Not so very long ago the company bought two 16x22 saddle-tank engines, one Baldwin, the other a Pittsburgh; they were to all intents and purposes alike.

After some months of service it came to be common talk and belief that the Baldwin could pull more than her mate, although the Pittsburgh had a great reputation as a steamer.

Inability to handle certain loads in certain places became a trouble at last, and word was sent to Superintendent Wightman of the Pittsburgh Locomotive Works that his engine could not pull near as much as the Baldwin.

Wightman is not very superstitious, and refuses to believe that 140 pounds of steam will do more work in one 16-inch cylinder than in another because it was made by any certain firm or in any certain place; he was sure his engine would do as much as the other, and just as sure that it could not do more; anyway he would go over and investigate.

The work done by the little mills is hard only in spots, and the "runs" are only a few car lengths—not much trouble about teaming. After listening to his engine for a moment, the builder ordered the smoke-box door opened, and investigation showed the nozzles choked to about an inch and a half in diameter, these were cleaned down to two, the engineer worrying all the time about killing her for steam.

The thing was started now, so they opened the front of the Baldwin and found that the engineer had removed the exhaust tips altogether, said the engine would steam all right, and it gave her more chance to do heavy work for a short time, then they took the tips out of the other engine and now both exhaust direct from the base, and one can "put as many cars up" as the other.

You don't have to sit up nights to figure on which one of those two men was of the most use to his employers, had the best judgment or was the best engineer.

## A Headlight Signal Device.

Darkening the headlight is now a regular signal on all roads using the Standard Code of Signals, and the device here illustrated is intended to facilitate the use of and, perhaps, add to that mode of signaling.

There has been a good many curtain devices gotten up to darken the headlight from the cab, most, if not all, of them being trappy and liable to derangement, and often in the way of cleaning the glass. The device shown here is the invention of Foreman Hyde, a fireman on the P. R. R. at New Brunswick, N. J., and has some good points.

The plan is to raise a tube up around the burner of the headlight. Mr. Hyde made his model to carry two sizes of tube, one inside the other, so that one could be used as a red or green globe to give a separate signal.

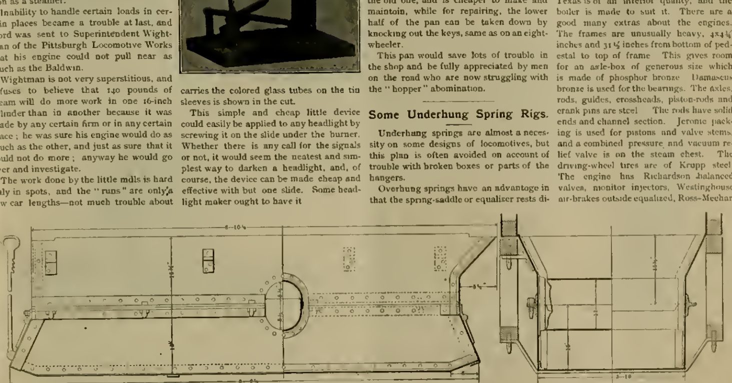
The picture shows the inside slide raised up, the larger one down, the movement being effected by the simple levers shown, connected by wire or cord to the cab through the hand-rail. Only the base that

carries the colored glass tubes on the tin sleeves is shown in the cut.

This simple and cheap little device could easily be applied to any headlight by screwing it on the slide under the burner. Whether there is any call for the signals or not, it would seem the neatest and simplest way to darken a headlight, and, of course, the device can be made cheap and effective with but one slide. Some headlight maker ought to have it

## Improved Ash-pan for Shallow Fire-box Engines.

The engraving shown herewith illustrates a new form of ash-pan designed by W. H. Thomas, Superintendent of Machinery of the E. T., V. & G. Ry., for engines with shallow fire-boxes, the one shown being the size used on his 20x24 consolidation engines.



All who are familiar with the usual "hopper" ash-pans, universally used in this country on engines having an axle under the fire-box, know how difficult it is to keep them reasonably tight, how their shape causes a wedging action of the ashes and cinders, especially if wet, that makes them hard to clear; how hard it is to get ashes out of them on account of there being no opening except at the bottom, how miserably they warp if a little live fire is shaken into them—because it is concentrated at two points, and last, but not least, what an infernal nuisance they are to get down and up again for repairs to the boiler.

The pan shown herewith is a long pan, such as used on eight-wheelers, except that it is unusually deep. It is made in halves, as shown, and a sleeve surrounds the axle, half of it being above, the other half below it.

The upper pan is held to the upper rail of frame by lugs and keys, as shown, while the lower one is held to the lower rail and to the upper half of the pan, as shown.

The angle irons around the center of the pan serve to stiffen it and prevent warping. This arrangement leaves a long free pan that can be cleaned from sides or the ends. It will carry safely a third more ashes than the old one, and is cheaper to make and maintain, while for repairing, the lower half of the pan can be taken down by knocking out the keys, same as on an eight-wheeler.

This pan would save lots of trouble in the shop and be fully appreciated by men on the road who are now struggling with the "hopper" abomination.

## Some Underhung Spring Rigs.

Underhung springs are almost a necessity on some designs of locomotives, but this plan is often avoided on account of trouble with broken boxes or parts of the hangers.

Overhung springs have an advantage in that the spring-saddle or equalizer rests directly upon the top of the box and needs no bolt or other fastening to keep it there.

Master Mechanic Thompson, of the Long Island road, has long used underhung springs with all the advantages of the overhung, for while the spring itself is located below the box, the hangers reach to the top and rest in pockets.

Fig. 1 shows a plan long in use with Mr. Thompson, the four hangers coming down beside the box and being joined below to a steel block, as shown; this plan worked well, but was not easy to get apart when necessary.

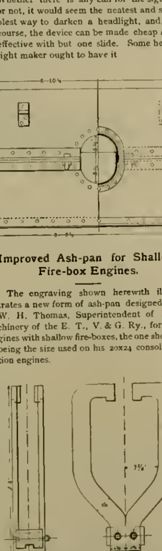


Fig. 1.

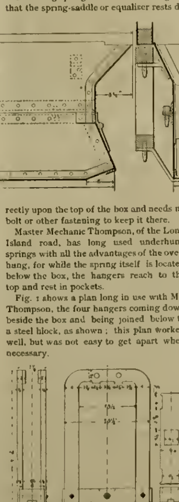


Fig. 2.

Fig. 2 shows another plan for the same thing, but handier and easier to get springs in and out of. The hangers proper are straight, and by this plan the spring can be got up closer to the frame. They are cheap and very strong.

## Cooke Locomotive Works.

Since this company got into their new works they have found their capacity for building locomotives a little ahead of orders, but they are doing a very good business. The shops are very convenient for the handling of material and the tools in use are nearly all good.

In the erecting shop I found some fine ten-wheel engines for the International & Great Northern. The engines have cylinders 18x24 inches and wagon-top boiler 58 inches at smallest ring, made of 9-16-inch steel, and good for a working pressure of 165 pounds. The fire-box is above the frames and is 96x42 inches. There are six hollow stay-bolts at each side of the fire-box, each having an opening one inch in diameter. Four of these are also put in the front and four in the back of the fire-box. A brick arch is used in the fire-box and there are 240 tubes 13½ feet long. This would appear to be a big boiler for the cylinders, but the coal obtained in Texas is of an inferior quality, and the boiler is made to suit it. There are a good many extras about the engines. The frames are unusually heavy, 4x4¼ inches and 31½ inches from bottom of pedestal to top of frame. This gives room for an axle-box of generous size which is made of phosphor bronze. Damascus bronze is used for the bearings. The axles, rods, guides, crossheads, piston-rods and crank pins are steel. The rods have solid ends and channel section. Jerome packing is used for pistons and valve stems, and a combined pressure and vacuum relief valve is on the steam chest. The driving-wheel tires are of Krupp steel. The engine has Richardson balanced valves, monitor injectors, Westinghouse air-brakes outside equalized, Ross-Meehan brake-shoes and the National hollow brake beams on tender. The boiler is covered with asbestos.

Some moguls for the Chicago, St. Paul & Kansas City road that are in the erecting shops are also well worthy of examination. The cylinders are 18x24 inches and the boiler is 54 inches diameter of ½-inch steel. The fire-box has the bottom corners dropped down to admit of a double-riveted mud-ring at these points. The engines bear the traces of careful designing, and apparently no expense has been spared to make them efficient and convenient. The Cooke people are building twenty-five of these engines.

The officers of the Schenectady Locomotive Works are mourning the loss of one of their most valuable assistants, and the workmen generally are regretting the loss of a friend in R. Mitchell Gifford, who died very suddenly a month ago. Mr. Gifford was a comparatively young man, but he possessed the elements from which successful men are made, and in a few years worked himself up to a position of honor and responsibility. He was a technical school graduate. After finishing his educational course he donned overalls and went to work in a machine shop. Then he went to Brasil and ran a locomotive there for three years. Returning to this country about 1880 with a load of valuable experience, he went to work in the drawing office of the Rhode Island Locomotive Works. From that he went at the invitation of Mr. Pitkin to Schenectady, where he was engaged mostly in inspecting, testing and scientific work for the firm. He was water commissioner of the city of Schenectady and was a highly popular and valuable citizen.

## "TESTS."

### What Do They Show?—Of what Value Are They?—Does It Pay to Make Them?

BY I. R. CATECHISM.

The above questions often enter my mind when reading of some wonderful showing that has been made after the most thorough and critical tests which ought to prevent the possibility of any doubt. And then to know that it is only one of the many thousands that have preceded it with the same display of facts, all of which, after a short period, ended in smoke or something of less value.

Any attempt to call your attention to all of them would be ridiculous, for their names are "legion," but I will try to name you a few only in your line that you may see why I would like to have you answer the above questions.

Some years ago there was quite a "revival" in saving of fuel on locomotives, which was the father of many inventions which had that object in view, such as grate bars, ash-pans, smokestacks, spark burners, feed-water heaters, etc., too numerous to mention.

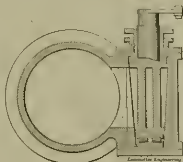
To go a little more into detail, we will look at the spark burner which was championed by the late Chas. F. Pike, of this city. It was put on several roads and several engines on each road, which, according to the *many tests*, showed wonderful saving in fuel—enough, if it could have been kept up, to make any railroad company rich. Then came the Hawkes and Paine sparker with still better results. I think it was put on all of the locomotives of the Fitchburg Railroad Company, and the "Union Locomotive Improvement Co." was chartered to manufacture and improve the locomotives according to these patents, said company paying large dividends (according to circulars issued by them).

Patent boilers had their share of attention, such as the "Phleger," "Dimpfel," "Boardman," the "Amory" and "Weston;" each would show from 25 to 45 per cent. saving of fuel. After a series of tests of the most exhaustive kind the Weston boiler was adopted by the Lake Shore & Michigan Southern R. R., also the C. C. C. & I. R. R. Of later date we have the "Wootten" and the "Strong" boiler, the former, according to the committee of experts of the Franklin Institute of Philadelphia, Pa., shows a saving over the ordinary boiler so great that no railroad could afford to do without it. (See Journal of the Franklin Institute for September, 1891.)

The feed-water heaters have had their share of attention also. Ever since the time of "Ebbert," of Chicago, who, some time in the fifties, put his in the smokestack, it has been followed up by "Clark," of Hazleton, Pa., down through the succeeding generations, each one with a triding change, down to the "Magoon" of Vermont, then the "Taylor" of the Old Colony R. R., finally the "Rushforth" (which is quite likely will be the last for a short time only). Each one of these have saved their 25 to 35 per cent. of fuel in their day, besides helping the engine to do much more work.

The valve motions that have been produced that saved the like amount over the poor and friendless link motion are legion, it would require quite a large book to hold all of their merits. Some of them were the "Independent" cut-off, the "Ross Winan" cam, the "E. N. Dickerson" valve gear, the "Joy," "Walscharet," the "Wilson" (of the Chicago & Alton R. R.), the "Wolfe" (of St. Paul), down to the "Strong," which probably is the worst, and quite likely the last for some time. All have made same saving, from *actual tests*.

The different types of engines have been through this same thing, giving us such as the "Fontaine," "Coventry," the "Hippy-to-hop" engine with its "facets" on the tire of driving-wheels, which was indorsed (after a thorough test) by the former superintendent of motive power of the Chicago & Northwestern R. R.



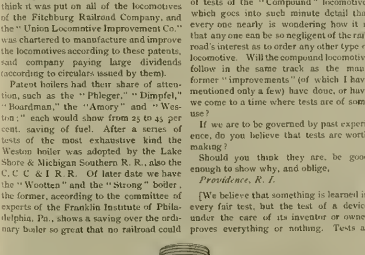
Just now we are having a regular feast of tests of the "Compound" locomotive, which goes into such minute detail that every one nearly is wondering how it is that any one can be so negligent of the railroad's interest as to order any other type of locomotive. Will the compound locomotive follow in the same track as the many former "improvements" (of which I have mentioned only a few) have done, or have we come to a time where tests are of some use?

If we are to be governed by past experience, do you believe that tests are worth making?

Should you think they are, be good enough to show why, and oblige,

*Providence, R. I.*

[We believe that something is learned in every fair test, but the test of a device under the care of its inventor or owner proves everything or nothing. Tests as usually conducted are of no practical value. The final test of the compound will be made in road service by the rank and file of engine-men extending over a large territory and some years of time. If the compound comes out of this test with a record of better service or economy, it will be adopted—just as steel tires, lubricators, pop-valves, air-brakes, injectors and other improvements have been adopted. If it does not show an economy or an improvement in some other way, it will follow the Dimpfel, the Swinerton, the Strong and the Fontaine down the wreck-strewn branch that ends at Oblivion.]

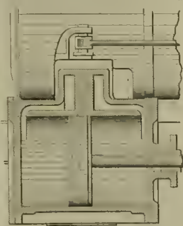


## Brousseau & Patterson's Steam Valve.

The illustrations on this page show the plan and application of an improvement in valves for steam cylinders, the invention of H. Brousseau and G. Patterson, two railroad men of Newberry, Mich.

The valve is of the vertical plug form, two being used on stationary engines and one on locomotives.

The general features are not unlike other valves of the class, but there are some refinements of detail not found in other valves, the principal one being the bearing of coned rollers that carries the valve and prevents its sticking in the shell, or on its seat.



The engravings show the arrangement and plan of the device and a detailed naming of parts is useless, in operation it is like a slide valve, the plug covering and uncovering straight ports.

The principal advantage claimed by the inventors is that the valve is perfectly balanced, is cheap to make and keep in repair, and does away with steam-chest and cover.

For locomotives the valve is made short and large in diameter.

We understand that the device is being tried on one engine.

## A Cylinder Cock Without "Rigging."

The engravings on this page make plain the details of a new cylinder drip-cock recently perfected by Mr. Harry Howell, of Wilmington, Del.

As will be seen, the valve is located in the center of the cylinder's length, and is connected to the ends by pipes and elbows. The pressure of steam in the cylinders tends to close the valves and keep them closed. These two valves are each connected to a diaphragm in the center of the case in such a way that when pressure is applied between them they will force open the drip valves. Pressure used for this purpose can be steam or air, preferably the latter. When steam is used the long valve stem running across the case is brought into use to get rid of the water of condensation, as long as there is pressure between the diaphragms this valve remains closed, when the pressure is relieved this valve is opened by the coiled spring shown, allowing any moisture to escape.

Fig. 2.

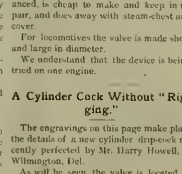


Fig. 3

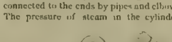


Fig. 4

Through this case there also runs an eccentric rod, one end of which terminates in a handle outside the case, shown in the engraving, this is used to keep the valves open when the engine is dead.

As will be seen, there are no rods, levers, bell-cranks, etc., required to handle this valve. A small pipe leads from the cab to the valve cases, at the cab end it is connected to the pressure through a small three-way cock, conveniently placed. This is always easily handled, requires no holes in the deck, nor is it subject to derangement as much as the light, trappy rigging generally used for operating cylinder cocks.

This valve has been in use for some months on the Maryland Division of the Pennsylvania road, and giving satisfaction.

Byram & Co., Detroit, makers of the well-known Collian cupolas, are about ready to put upon the market a cylindrical core oven which will be the means of preventing the chilling of core ovens when the doors have to be opened for the putting in or taking out of cores. The cylinder stands on end and can be revolved so that only the section to be reached is exposed to the outside air. It is divided into sections which fit the door. By revolving the cylinder every section can be reached in turn, and the oven can be kept free from the admission of air while all the shelves in the cylinder are being loaded or emptied.

It is reported that President Hill, of the Great Northern, is working himself up to the sticking-point of ordering 100 new locomotives. The operative department say that they could find work for the whole lot were they delivered to-morrow.

It is rumored that Mr. E. P. Lord, Assistant Superintendent of Motive Power of the Fort Wayne Division of the Pennsylvania Railroad, has been made Superintendent of Motive Power of the Cleveland, Cincinnati, Chicago & St. Louis. Mr. Lord is a young man, who went through a very thorough training at Altoona and other parts of the Pennsylvania system. He has taken his part in all kinds of work connected with locomotives. He has worked as a machinist, as a draughtsman, as a fireman, as an engineer, and as an engineer of tests. These lines of work represent Mr. Lord's experience. Socially, he is one of the pleasantest men we have ever swapped stories with.

## Schenectady Locomotive Works.

A NEW ERECTING SHOP.

The Schenectady Locomotive Works have lately finished the building and equipping of a fine new erecting shop which adds very materially to the capacity of this rapidly growing establishment. It is a two-story building open throughout in the middle, the second floor forming galleries where light machine work is done. A fine Sellers crane traverses the building, and an arrangement of a platform projecting from the gallery enables the crane to be used for moving material to and from that part of the building. The shop is heated by the Sturtevant system, exhaust steam being used to supply the radiators with heat. The shop is of brick, with substantial stone foundations. The leading dimensions are 315x69 feet, and lean-to 28 feet wide. The building has a monitor roof and is finely lighted throughout. Steam is supplied by Babcock & Wilcox boilers, on which a pressure of 200 pounds of steam is carried, the high pressure being utilized for testing locomotive boilers. There is an Edison electric light plant run in connection with this shop.

A DURABLE FLOOR.

When this building was planned the question of the best kind of floor for an erecting shop received a great deal of attention. The officers in charge examined all the species of floors that were reputed to be most durable, and they decided on concrete, with a coating of cement on the top upon which a plank covering is embedded.

A POINTER ON EMERY WHEELS.

A great deal of work is done here on emery wheels, and they have a way of making the wheels that is worthy of notice. They cast a plain center of good iron, roll the periphery in glue and then in emery, dry properly, and the wheel is ready for use. When the emery wears off, the glue is removed by a simple process, a fresh coating applied followed by the emery, and the wheel is as good as new. None of these wheels have ever broken, and they run much cooler than the common emery wheel. For the grinding of guides, they could not find any other emery wheel that would give satisfaction.

UTILITY OF MILLING MACHINES.

An experience was gone through in these shops with milling machines that is edifying. Channel side rods are becoming universal, and it was the practice in finishing these rods to start the channel with a milling cutter and then plane out the greater part of the stock to be removed. Several years ago they tried to do the entire work by milling, but found it slower than planing. Some months ago a new unusually powerful milling machine was purchased, and the intention was to use it for beginning the cutting out of the rod channels. As an experiment the whole of the channel was cut out by this machine, and it was then found that milling was cheaper than planing.

I have repeatedly heard this question of the relative cost of milling and planing discussed by men in charge of machine shops, and I know that there is great diversity of opinion about it. One man insists that it is cheaper to mill certain work than to plane it, and another is of the opposite opinion, and tells that he can prove the correctness of his conclusions by figures that George Washington never rivaled in truth. May the diversity of opinion not be due to the different kinds of milling machines used?

While on the subject of milling machines I might remark that it would abundantly pay many railroad companies that have milling machines in their shops to send the foreman to visit locomotive builders and other manufacturers of machinery to see the many uses a milling machine may be applied to advantageously. There is too much depending on a machine-shop foreman to learn by intuition all the capabilities of a strange tool.

VENTILATED CABS.

An improvement that will greatly promote the comfort of engine-men is used on the greater part of the large locomotives that were under construction in these works. This consists of a hatch placed on the top of a cab, which can be partly opened during hot weather.

MAKING ASH-PANS TIGHT.

Another improvement effected on all engines having the fire-box above the frames, is a sheet iron liner, that extends from the mud ring to the inside of the ash-pan, effectually filling the openings that permit so much dirt to be blown out from most engines of this kind. There will be fewer hot boxes when this small improvement is put on all locomotives that need it.

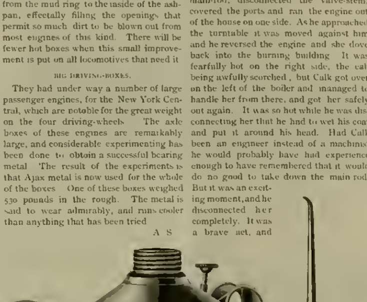
BIG DRIVING-BOXES.

They had under way a number of large passenger engines, for the New York Central, which are notable for the great weight on the four driving-wheels. The axle boxes of these engines are remarkably large, and considerable experimenting has been done to obtain a successful bearing metal. The result of the experiments is that Ajax metal is now used for the whole of the boxes. One of these boxes weighed 530 pounds in the rough. The metal is said to wear admirably, and runs cooler than anything that has been tried.

A. S.

## A Life Saver.

Not long since the shops of the N. Y. S. & W., at Wortendyke, N. J., burned, there were also four locomotives in the shop that were ruined. C. Calk, a machinist on duty that night, showed what he was made of in saving an engine. The 14 was in the roundhouse, with steam up, but she was jacked up in front and her truck was pulled out ahead of her, one cylinder-head was off and the piston-packing out. Calk had no help, but he went into the building, ran the truck to place, lowered the engine upon it, took down the main-rod, disconnected the valve-stem, covered the ports and ran the engine out of the house on one side. As he approached the turntable it was moved against him and he reversed the engine and she dove back into the burning building. It was fearfully hot on the right side, the cab being awfully scorched, but Calk got over on the left of the boiler and managed to handle her from there, and got her safely out again. It was so hot while he was disconnecting her that he had to wet his coat and put it around his head. Had Calk been an engineer instead of a machinist he would probably have had experience enough to have remembered that it would do no good to take down the main rod. But it was an exciting moment, and he disconnected her completely. It was a brave act, and showed his fidelity to and value as the servant of the road, and we are glad to note so far the responsible officers have not discharged him, made him serve time or pulled him off "pending investigation." The "14" ought to hold Calk in grateful rememberance, too, he saved her life.



## Some Improved Engine Oil Cans.

Men who have slopped oil all over a boiler head trying to oil the valves on a fast-running locomotive, or those who spoil the polish of a nice lubricator by spilling oil in trying to fill it, will probably be interested in the simple devices shown here.

The large "filler" can is a neat thing for valve oil or as a handy device for engine oil to fill small cans from.

It has a screw top, and a spout-closing and venting valve similar to that shown in the long oiler.

The tallow pot form of valve oil can is a dirty, slobbery thing at best, and its usefulness went out with tallow and the advent of the sight feed lubricator.

These cans are made by the Rau Manufacturing Co., Chicago, Ill.

Mr. J. B. Renniff has been appointed Master Car Builder of the Toledo Division of the Lake Shore & Michigan Southern.

Mr. O. O. Winter has been appointed Superintendent of the Minneapolis Terminals. He was formerly on the Fort Worth & Denver.

Mr. J. F. White, who recently resigned the position of Master Mechanic of the Fort Worth & Denver City Railway, was presented with a gold-headed cane and a diamond stud by the employés of the mechanical department.

Some time ago the New York, New Haven & Hartford obtained possession of several small roads that are now operated by the controlling company. The enginemen on these roads had smaller pay than the main line, and efforts were made for adjustment on a uniform basis. These efforts resulted last month in Grand Chief Arthur, of the Locomotive Engineers, and Grand Chief Sargent, of the Firemen's Brotherhood, holding a conference with the officers of the road. A satisfactory adjustment of the pay was effected without difficulty.

Mr. Ross Kells, Superintendent of Motive Power of the New York & Lake Erie, is again in bad health and is in the Danville Sanitarium under treatment. He has been given six months' leave of absence.

During the month of December all the locomotives belonging to the Chicago & Northwestern made an average of 4,700 miles in train service.

Mr. M. R. Clapp a well-known railroad supply man has made an engagement to travel for the Baker Heater Company, of which Mr. W. C. Baker is President.

In Europe and in some parts of Canada the boiler-head of a locomotive is called the "face-plate."

The Canadian Locomotive Works at Kingston, Ont., are building some engines for the Canadian Pacific.

The Schenectady people are very busy, and orders are in that will keep them in work for half the year. They have lately received an order for twenty engines for the Chicago, St. Paul, Minneapolis & Omaha.

The people of the Canada Southern Division of the Michigan Central are boasting of a mogul engine with cylinders 19x24 inches and driving-wheels 68 inches diameter, recently built in the company's shops at St. Thomas. They say that this is the largest mogul ever built in Canada, but the Grand Trunk and the Canadian Pacific are yet to be heard from.

A new class of ten-wheel locomotive is being designed by the Pennsylvania mechanical department. It will be called Class X, and will be specially adapted for the fast freight trains of Western lines. This company has been in the habit of contracting for from 75 to 100 locomotives annually, but they now expect to build in the new shops at Altoona all the locomotives required by the roads for years to come.

The Baldwin people are building a compound rack-rail locomotive for the Pike's Peak Railroad. They are also building the locomotive equipment for the Chicago South Side Rapid Transit Co., consisting of twenty locomotives, compounded. Each engine weighs about twenty-eight tons. Among other work in Baldwins are two switching engines for the Minneapolis & St. Louis, five compound moguls for the Calumet & Blue Island, and 40 engines of different classes for the Baltimore & Ohio.

When the Secretary of the Railway Master Mechanics' Association submitted his annual report at last convention, there were only two deaths reported during the preceding year. This was a remarkably low death rate among over four hundred men, most of them past the meridian of life. The appearances now are that the year of a singularly low death rate will be succeeded by one abnormally high. Nearly every month since the convention one or more deaths of members have been recorded and last month there were four deaths. Several of those who are gone will be missed at next convention for they have gone regularly to the meetings.

## Notice to Club Raisers and Club Members.

The club business has grown to such proportions that it is impossible to keep the list in clubs. Hereafter all names received from club raisers will be put in the general list, which is alphabeticalized both as to names, towns and States. So, if John Jones writes a card to change his address from Norwich, Conn., to Horton, Kan., we can find him. As it has been, he might have been a member of any of forty clubs gotten up in some of the New England States. Another advantage of the new system will be that every subscriber will get a notice of the time of his expiration. It has often happened that in the event of the death or removal of a club raiser a whole club was cut off without notice.

Club raisers will have to keep a list of their subscribers, as these cannot be furnished next year. New subscriptions and renewals count the same to them, and we are just as glad to receive subscriptions through them as from individuals, but where they fail to notify a subscriber of his expiration, we will do so, as this is but fair to the readers.

LOCOMOTIVE ENGINEERING.


## An Improved Safety-Plug and Low-water Alarm.

"Wonst," said the old-timer, slowly taking a chew of seed-leaf, as he leaned back in the Ananias corner, "Wonst, when we were building across the desert, I had a green Dutchman put on with me as fireman.

"He had the engine fever bad enough and was awful anxious to please me and keep the engine howling.

"He had been wipin' in the house and had heard the firemen tellin' hair-raisin' stories about havin' to put out their fires to keep from thawing the crown-sheet out, etc.—the water there was dreadfully ornery stuff—and Jacob was exercised over the water level any how—kinder suspicious like.

"One night we stopped at a lonesome section-house to eat, but Jacob carried his lunch and did not go in.

"As I got down to go, the pop went up with a roar, and I hollered to Jakey to watch the glass and if it went down much to 'put a little water in her to cool her off.'

"When I come back, Jakey was settin' on the end of a tie eatin' his lunch, and you just ot to seen him. He was as black as a nigger, all his moustache was gone, and his yellow hair singed off clean up to his cap.

"'You bade your schweed life she dond got the pest from me, already,' he said, proudly. 'Phen dot water-klass id commends to yump, I youst put in dot water like you toldt me—you don't got no purnt krown-sheed mit dis engine phen Yacob Kritsman vas der firemand—undt ton't you furged it.'

"When the water in the glass dropped after the pop shut, Jakey thought some conspiracy was on foot to burn that old cold water Hinckley, and he just nipped it in the bud. He had fired pad after pad of water into the fire-box regardless of the 'kick,' and the fire was black out.

"'That's right,' Jakey,' said I, 'don't you take any chances,' and then I fell down in a fit—of laffin'."

## The Secret of his Prosperity.

The men who enter railroad service from the top are not generally popular, and they are seldom noted for knowing much about the business they follow, but there are exceptions. One of the brightest exceptions to this rule is Mr. M. E. Ingalls, President of the Big Fours and the Chesapeake & Ohio Railroads. Mr. Ingalls began his railroad career as president twenty years ago of a poverty-stricken road, which good management made prosperous. Various other lines were drawn into the orbit of its prosperity, and an aggregation of impecunious small roads were bound up into the lucrative Big Four's system. Much of the success was due to Mr Ingalls far-sighted management. With the success of his efforts, the author attained fame and prosperity. His treatment of people connected with the roads is of a character to make everybody rejoice in Mr Ingall's good fortune.

Before coming to Ohio Mr Ingalls was a lawyer in a small town in Maine, where he was raised. Before leaving home he had not risen above his companions far enough to dazzle their eyes. He now tells a story against himself to illustrate the truth of the saying that, "a prophet has no glory in his own country."

After being nearly twenty years away from home, he paid a visit to his native village. Many of the old worthies were still there, and Mr. Ingalls went the rounds shaking hands with the acquaintances of his youth. All were glad to see him, and many were the congratulations expressed in homely phrase. No discordant note was heard in the tune of welcome till one of the hardest politicians among the natives was called on.

"Why," exclaimed the politician, "they tell me, Ingalls, that you have become a railroad president. Is that so?"

"Yes," replied Mr. Ingalls, "I am now president of a railroad."

"Does it pay well? How much of a road is it?" were the next questions.

"It pays well, and there are about two thousand miles of track."

"Well, well," groaned the politician, biting off a generous chew, "it is wonderful what a little money and a great deal of cheek will do for a man."

## Fast Traveling.

Our Fifth Vice-President has a friend in London, the Rev Rohab Romenaught, who is the sympathetic manager of the Royal Eleemosynary Institute for Literary Idiots. They were school-boys together at Harrow-on-the-Frog, and being of congenial temperament, they still correspond at rare intervals, although seas between them roll, as the reverend manager always says.

Our Fifth Vice-President went out yesterday and left his desk unlocked, and we straightened it up a little. The following is an extract from a letter written by Rohab which we found therein:

"My soul is harrowed by the pernicious influence which the natives of your adopted country are exercising upon our people. I am afraid that the falsehood and exaggeration that characterizes the conversation of Americans are undermining the truth and modesty that have always been the glory of Englishmen.

"I was painfully impressed with this dismal influence during a visit I made to your friend, Mr. Hartfat, at the Hotel Metropole. I sent up my card and your friend came down stairs. He is evidently a man of education, but the freedom of his manners appalled me. He seized my arm and led me, partly by physical effort and partly by force of his will, to his room where, without asking my consent, he introduced me to several other Americans and two or three of my own countrymen. They were all smoking cigars in the most barbarous fashion, and drinking a strange beverage which I weakly consented to indulge in, and it exerted a mortifying effect upon me.

"I confess, with sorrow and contrition, that I remained in the company of that ribald band for hours, and I weep to think of the violations of truth and veracity that characterized the anecdotes and stories related by some of those young men. I shall repeat part of a conversation, which I hope and pray is not the kind of talk to be heard in the home sanctity of your people.

"The subject of fast railway traveling was mentioned, and, of course, all the world knows that in England alone can fast, comfortable and safe railway trains be found. The controversy was brought about by one of the Americans mentioning that a train was run from New York to a town called Chicago in twenty-four hours.

"This coused one of my countrymen, who had evidently been contaminated by contact with his trans-Atlantic associates, for he exclaimed

"'If you want to see speed, travel on our Flying Dutchman; the telegraph poles, as you pass them, remind you of the teeth of a dressing-comb.'

"'That is a rapid gait,' said an American, 'but it does not begin to touch the fast trains we are now running in the States. Out West our railroad trains are run by electricity generated by the Falls of Niagara, and the ordinary way-train speed is a thousand miles an hour. They tried the full speed of the electric current, but heavy trains running thousands of miles per second were dangerous. But I tell you a thousand miles a minute is getting there.'

"'In what way was the full current velocity dangerous?' queried one of the company.

"'The trouble was that the high velocity induced such a strong current that it would take everything along. Trees, stocks, farm-houses, cattle and men would be all picked up by the current and carried along. Why, the first time the full current was tried the train left an entire new town when it stopped, in which there were three churches and twenty-one saloons.'

"'Could you not control that force in some way and make it useful?'

"'We expect to, and half-a-dozen of dry goods clerks have formed a company with ten millions capital to work it out. It is a great scheme. Everything to be transported will be put on the side of the track. The current generator will flash past, and corn, stock, lumber, iron and everything to be transported will pass along quicker than the twinkling of an eye.'

"'But how will you keep the track, ballast and things not wanted from——'

"'As I was saying, I am satisfied with a thousand miles an hour gait. But it is going. Why, a month ago when I was leaving home in Kansas City my wife came to see me off. Just as the train was starting I leaned down to kiss my wife, and the train got going so sudden that instead of my wife's lips, I kissed a cow's tail fifty miles out. That is our pace in the States!'

"I would ask," concluded the Rev Rohah, "if there is any truth in these stories, or if they are pure fabrications? The scientific press tells so many wonderful things about electricity that these tales may be true. If they are based on fact, please send me notes with more particulars and I shall prepare a lecture on the subject for the institute of which I am the unworthy manager."

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He stood and looked at the steam roller that was working on the asphalt. "Great thing, ain't it?" said a bystander. "Great nothing!" was the reply. "You must be powerful slow in these parts. Why, out to Slam Center they'd shoot an engineer that couldn't go no faster'n that."

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A Michigan paper under the heading "interesting and pleasing railroad items," mentions that more railroad employés have been killed and injured on a certain division of the Lake Shore in the last six months than have occurred before in that number of years.

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One of the night trains out of Chicago carries so many inebriates to the Keeley Bi-chloride of Gold Cure at Dwight that the boys have named it "the jag train."

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There was some very sensible person in the Vanderbilt party that passed over the Michigan Central in a special train last month. A present of $35 was given to the train men on each division.

## In the Niles Tool Works.

One of the busiest shops I have lately visited is the Niles Tool Works at Hamilton, O. They have within the last year made several important additions to the shops, which greatly increase their capacity and improve the convenience of the shops as a manufacturing establishment. The ground addition comprises a new side 100x 400 feet, part of the addition being two story, the whole giving 2,000 square feet of additional floor-room. The main part of the works now comprise five parallel shops 216 feet wide and 400 feet long. Two of these shops are served by traveling cranes that traverse the whole length. In the erecting shop there are two 25-ton cranes, and two 20-ton cranes handle work for the shop having the large tools. The foundry, pattern shop, pattern storage house and other buildings detached from the main part of the works, make up an extent of buildings that appear as great as the main shops. In all of the buildings, the visitor is struck with the good facilities provided for handling work and materials.

It is necessary to have powerful appliances for handling the work, for some of the tools made are enormously heavy. The works have been engaged upon some ponderous tools for the Government, and there was on the floor a planer that weighs 150 tons—as heavy as two large locomotives. This splendid tool is for the Lake Engine Works of Buffalo. It planes a piece 12 feet square and the table travels 26 feet. It has double heads on the rail, and there is a side head with a vertical and horizontal feed, and an extra side attachment for planing very large work that will not go under the cross rail.

The parts that attract a railroad man, however, in these works, are the tools that are destined to labor for years on material used in the building and repair of railroad rolling stock. Watching the growth of these tools from the rough castings and forgings to the finished machine is interesting and attractive. Here we see the numerous painstaking operations that are contributed by recurring skillful hands, the aggregate securing accuracy and durability in the product. The finished tools stand up like old friends dressed in holiday garb, for their numerous twin brothers have made the writer's acquaintance in various shops from Maine to California.

The different forms of lathes, planers, boring mills, drills and slotters were as familiar as a Rogers locomotive, but I was introduced to one tool which was a comparative stranger. This was the screw-cutting turret lathe, which is becoming very popular with railroad men and is one of the most useful tools that can be put in a shop.

Hamilton, where these shops are, is little more than an hour's ride from Cincinnati. We do not know how a railroad man visiting the latter city could do himself more good than by going out and having a ramble through the Niles Tool Works. A. S.

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A notice has been issued by the Westinghouse Air-Brake Company, intimating that the prices have been reduced for engine, tender and freight car equipment. The engine equipment now costs $250, tender or freight car $40. The price now asked for the engine equipment is a very good illustration of the reduction of cost that results from perfected methods of manufacture. When a mechanic looks over the apparatus supplied for $250, he is certain to be surprised that all the parts could be made for the sum named.

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The East Tennessee, Virginia & Georgia have ordered a compound locomotive from the Baldwin Works and one from the Schenectady Works, both of the same general dimensions. The engines will be run against each other as a test of the relative value of the two classes of engines.

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Mr John Richards, editor of *Industry*, has been elected President of the Technical Society of the Pacific Coast.


(9) R. G. Y., Chicago, says

If I have a gold lid taken out of my watch and an iron one put in, and then pay $5 for the change, how much am I charged for having my watch protected from magnetic influence? *A* We give it up. We suspect, however, that the protection is not worth the price paid.

(10) S. Woolmington, Cleveland, O., asks:

There was patented some time in 1851 a locomotive boiler with flues extending back into the fire-box. I would like to know what became of it, and if there is any used now *A*—This was the Dimpfel boiler, water tubes extending from the crown sheet over the grates and ahead, through an opening to near the front of the boiler—practically the crown sheet was the length of the boiler. It was tried on several engines but was an utter failure. None have been built for over thirty years.

(11) A. E. H., San Marcial, N. Mex., asks

Where is the "center of motion" of a locomotive?—*A*. Our correspondent probably refers to the center line of motion, often referred to. The center line of motion is a line drawn through the main axle and the link block, and often inclines from the axle *down* in front, this is to admit of getting the links up for back motion, or other reasons.

(12) D. A. P., Weldon, N. C., writes

1. I heard two engineers speaking about Alex Cunningham's break-down recently. One said that she would have had but two exhausts, and the other said she would have had three, and the exhaust from lame side would be heavier than the two from good side when engine was linked up, which was right? 2. Would an engine running reversed, pump as much pressure in her steam-chest with cylinder cocks open as she would with them shut, in a given distance? *A*—1. The engine would have had three exhausts, one heavier than the rest. 2. No, if the cocks were big enough she would expel all the air there.

(13) W. H., Humboldt Bay, Cal., asks

After working one kind of water in a locomotive boiler for three or four years and then change to another kind of water, will it have any foaming effects or not? *A*—This depends entirely upon the kind of water used, or rather upon what the water contains, generally a change from comparatively bad to good water will cause forming or loosen up scale and cause leaks. 2. Are surface blow-off cocks generally used, and of what use are they?—*A*. No. They are excellent things when there are impurities in the water that float, such as oil, as this can be pretty well cleaned out, they are of little use where impurities are held in solution.

(14) Pan Handle, Columbus, O., asks

1. Was there ever engines built without lap and lead? 2. When was lap invented? 3. What is the object of using lap? 4. What do you mean when you say a valve is line and line? 5. How do you give an engine lead? *A*—1. The earliest stationary engines had neither laps nor lead, but we know of no locomotives without laps. 2. Probably by Watt, late in the last century. 3. To get work out of the steam while expanding. 4. No single-valve engines are now built without lap, line-and-line inside means that the inside edges of the exhaust cavity are line and line with the inside edges of the two steam ports, or the outside edges of the bridges, which is the same thing. 5. By adjusting the valve motion so as to cause the valve to open the port before the piston has quite completed its travel. On a locomotive with link motion this is generally done by advancing the eccentric on the shaft.

(15) J. S. C., Albany, Ga., asks

1. Suppose you were running an engine with pony truck and broke cross equalizer back of long equalizer, and had no chain, what would you do?—*A*. If I had no way to fasten forward ends of front springs down, would block on top of forward driving-boxes. 2. If you were running an engine and broke a water-gauge cock, and had no round file, would you trust to reducing steam pressure and plugging with wood by keeping steam pressure low?—*A*. A small hole plugged with soft wood that fits the whole entirely through split-up on the end will usually swell enough to stand full boiler pressure.

(16) J. Ludlow, Ky., asks

1. If you were running an engine and were to lose a driver, pedestal, brace and wedge, what would you do?—*A*. If it was a main driver, would disconnect that side. If it was other than main driver, would take down side rods and run in light. 2. Suppose you are running an engine with spring or metallic packing in valve-stem and piston stuffing-boxes and they began blowing and popping and blowed *very*, *very* bad, how can it be helped if you had no new rings and could not get any?—*A*. If you have nothing to put in and can't get anything, we know of nothing except to run without anything or disconnect.

(17) Brakeman, Ravena, O., writes

Last night we broke a brake beam on the rear car of a passenger train and had to "cut-out" the air-brake. There was no handle on triple valve cock and I cut the hose between rear car and one next to it, shut the cocks, hung up the hose and bled off the brake. When the engineer was told he refused to go until we cut the brake out at the triple and connected up the hose again, we had a dispute about it and agreed to leave it to you, who was right, and why? *A*—The engineer was right, by having the air in train pipe of the rear car the train would be stopped before damage could be done if the rear car broke off, and again the conductor's valve would be operative from the rear car in case of emergency. You had cocked and primed a deadly boomerang which only needed touching off by the rear car breaking loose on some grade.

(18) P. J. C. S., Kaukauna, Wis., writes

There is considerable discussion here about the position an engine should stand when keying the main rod. The old rule of keying on the dead center is claimed by some as bad practice, they claiming that as the pin receives the greatest pressure at this point, it will wear the most there, and it should be keyed on its largest diameter. Where should she stand to present this condition? *A*.—The back lower eighth or upper forward eighth presents the widest part of a worn pin between the forward and back halves of the main rod-brasses, and is therefore the safest place to key the back end of the main rod, but always key side-rods on the dead center, or rigid points. Keying back end of main rod on center can be done safely on new engines and has been done with care on old ones, but it is easy to pinch a brass too hard during part of the revolution on a worn pin and cause heating.

(19) E. B. M., Philadelphia, Pa., writes

One of our trains (Penna. R. R.) running between here and Washington, has an air-brake puzzle attached. The train is a four-car one. Going south the engine is attached to the baggage car, at Washington the engine turns and takes the same train back to Philadelphia, but pulling from the other end, baggage car then being in the rear of train. Going south the brakes work all right, but coming north they "creep on" and cause trouble, yet all the conditions are apparently the same. What causes it? *A*.—The train-pipe cock on the baggage car leaks, when this is next to the engine it does not affect the train because the leak is not to the atmosphere. When this end of the car is at the rear the hose is not in use, and the leak escapes through it and sets the brake. A similar case has been reported where the conditions were opposite, and it was found that one hose was spongy and porous, causing quite a leak, pretty well muffled. This train gave trouble when this bad hose was next to the engine, and none when it was the rear of train—because then it was out of use.

(20) Mr. M. C. Glenn, Burlington, N. C., writes

Suppose we have a train of 30 cars equipped with the automatic brake, train line pressure is 70 pounds, reservoir 90 pounds per square inch. This train parts, and brakes go on. How much pressure will it take to relieve brakes on the 30 cars? And please explain how to make calculations for this. We have a man on this division who says it will take 130 pounds of air to release these brakes. *A*.—This depends a great deal upon the travel of the brake-cylinder pistons. Suppose they traveled 10 inches, the 70 pounds of air in each auxiliary reservoir would be expanded into the cylinders and reduced in pressure correspondingly, while if the travel was but 2 inches, the *volume* of air would be but slightly increased, and the pressure decreased. The pressure increases or decreases inversely as the volume—in other words, if you expand your auxiliary capacity to double, the pressure will decrease just half. If the travel of the pistons under the train you mention averages 8 inches, the pressure would expand, in an emergency application, to about 50 pounds, and it would require, perhaps, 5 or 6 pounds more than this to release them, just enough more to overcome the friction in the triples, no pump gets up 130 pounds in service, you ought to know that.

(21) B. M. G., Pittsburgh, asks

What do you calculate is the depreciation of a passenger car on its original value in ten years, provided it has been kept all the time in first-class repair. *A*—Five per cent. a year is the ordinary rate of figuring depreciation. In the first five years the real depreciation is likely to be greater. After that the annual rate becomes smaller.

The Vanderbilt system of roads has adopted the Gould coupler and platform for all their passenger equipment—cars and locomotives. The Gould platform is what was formerly the Cowell.

A prominent professor of optics has been forced to the conclusion that a train man may pass an examination for color blindness by the use of real signals that will be perfectly safe and reliable even though the same man may fail in matching colored threads.

The numerous friends of Mr. N. E. Chapman, of the Latrobe Steel Works, who has been at a health resort in Indiana for some months under treatment for rheumatics, will be pleased to learn that he is now quite recovered and is back to duty.

The Flint & Pere Marquette Railroad system occupies a strategical position in relation to the transportation facilities of the State of Michigan. Centered in the heart of the lumber and salt section of the State, the system reaches, on the east, Toledo, Detroit and Port Huron. At all of these places close connection is made with all the Eastern trunk lines. On the west, by the company's superior line of steamers, direct communication is had with Chicago, Milwaukee and Manitowoc. These steamers are in commission all the year round, and in the winter, when the regular transportation boats between Chicago and Buffalo or Canadian points, are laid up, this company, in connection with the Green Bay, Winona & St. Paul Road, forms an important link in a short and direct route for grain and flour from the Northwest and the Atlantic seaboard. The numerous branch feeders and logging spurs, in connection with the demands of main line traffic, call for great care and ability to make an economical showing with the necessarily diversified power. Under the able management of General Manager, W. H. Baldwin, Jr., the physical condition of the property has been greatly improved, and that, too, in the face of greatly reduced operating expenses.

Mr. Robert McKenna, the veteran Master Car Builder of the Delaware, Lackawanna & Western, at Scranton, has been confined to the house with illness during the greater part of last month.

Mr. M. D. Watson has been elected President, and Mr. C. W. Higgins Treasurer, of the Schuttler Mfg. Co., Chicago.

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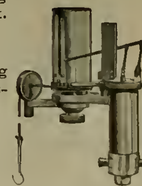

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## SAFETY VALVE.

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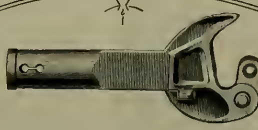
Muffler.

# THE JANNEY FREIGHT CAR COUPLER



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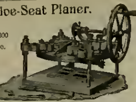
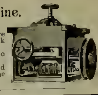
## Valve-Seat Planer.

Over 300 in use.



## — DAVIS —
## Valve Port Milling Machine.

This machine will mill out ports in valve faces of steam cylinders, duplicating work exactly and in the shortest possible time.
It is operated by a rope belt similar to that used for driving drills, etc.
It is much lighter than the cylinder and can be readily placed in position using the stud-holes to attach to for that purpose.



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## Horizontal & Radial Drilling Machine.

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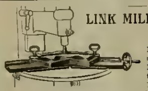

For rapidly and accurately Milling out Links to any desired radius. Can be used on Drill Press or as an attachment to our Heavy Universal Milling Machine.

*A link 20 inches long can be finished in four hours.*

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*Indispensable for Locomotive Builders and Master Mechanics.*

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No more time required to place brass than screw up an ordinary vise.
Any desired thickness of cut can be taken, jointing the faces perfectly true.
No files required.

## CRANK-PIN MACHINE.

For turning off Crank-Pins IN POSITION, keeping the original centers of the Pin.

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**For Fitting New or Old Cylinders to Locomotive Boilers.**

It will drill all the holes in smoke boxes and cylinder flanges necessary to bang one pair of cylinders at one setting of the machine.

Quickly set and operated.
Driven by hand or belt power.

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## FOR CAR HEATING.

Low in price and always reliable. No complicated parts. Easily understood. Durable. Has no equal.

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## SELDEN'S PATENT PACKING.

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Open Hearth, Crucible and Eureka Steel Castings, Railroad and Machine Castings. Locomotive Cross-Heads and Gearing a Specialty. GUARANTEED KNUCKLES FOR M. C. B. COUPLERS.

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***...e Strength of a Chain is its Weakest Link.***

*...y putting in one cheap link. You MAY save a few cents by putting on one ... You may also repair this break with ANOTHER cheap link or valve. ... the valve COST YOU NOTHING? Decidedly you CANNOT. Why ... ENKINS BROS. VALVE, STAMPED WITH TRADE MARK? You accomplish nothing by getting an IMITATION Jenkins Bros' Valve—there are over fifty on the market—in fact, you have only SPENT A LITTLE MORE MONEY and still your chain BREAKS AT THE SAME LINK.*

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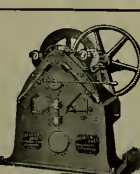

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## Locomotive Boiler Work.

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LOCOMOTIVE ENGINEERING.

A Practical Journal of Railway Motive Power and Rolling Stock.

VOL. V. No. 3. NEW YORK, MARCH, 1892. PRICE, { 20 Cts. Monthly. $2 00 per Year.



## Lehigh Valley Compound Locomotive.

The Lehigh Valley Railroad Company have long been noted for their fine locomotives, and for keeping in the front with all improvements introduced in locomotives. In pursuing this policy they have lately turned out of their shops at Wilkesbarre, Pa., a compound consolidation locomotive built after the designs of Mr. F. W. Dean, the well-known mechanical engineer. The engine is shown in the annexed engraving. The engine is of the two-cylinder type of compounds, the high-pressure cylinder being 20 inches, and the low-pressure cylinder 30 inches diameter, with a stroke of 24 inches.

In ordinary working the steam passes into the high-pressure cylinder, and after doing its work there exhausts into a receiver, part of which is formed of a horse-shoe pipe in the smoke-box. From the receiver the steam is supplied in the ordinary way to the low-pressure cylinder. The arrangement of the receiver and intercepting-valve will be seen in the small cut on next page. It will be seen that Mr. Dean puts a series of rings round the outside of the receiver-pipe to increase the capacity of the same for intercepting heat of the smoke-box. The intercepting-valve moves vertically, and will therefore wear indefinitely. This is the second engine that has this form of intercepting-valve, and both of them are noted for starting promptly. The receiver is unusually large, having 2¾ times the volume of the H. P cylinder.

The boiler of the engine is of the Belpaire form, of steel, with butt joints. The diameter at the smallest ring is 58 in. The fire-box is of steel 6 ft wide and 11½ ft. long. There are 252 tubes, 2 in. diameter and 11 ft. 2½ inches long. The grate area is 69 sq ft, and the total heating surface is 1,658 sq. ft The steam carried is 175 lbs The driving-wheels are 50 in. diameter. The wheel base of drivers, 14 ft. 9 inches, total wheel base, 22 feet 10 inches. Weight on drivers, 109,088 lbs; on truck, 16,464 lbs

The engine was built by Mr. Alexander Mitchell, under the immediate charge of Mr Frederick Roth, master mechanic in charge of the shops. The machine is in every way highly creditable to Mr Roth and to the other men employed under him.

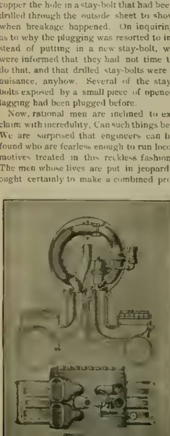
Dean Compound on Lehigh Valley Road

## Tempting Boiler Explosions.

Explosions of locomotive boilers have been so common of late that there is general nervousness among the men in charge where high pressures prevail. We have heard the question put very often within the last two months, what are we going to do to prevent accidents to our boilers? To us the answer is very simple. Inspect the boilers regularly and systematically and remedy in time the defects that lead to explosions. Objections are raised to this course, on the ground that the men held responsible do not have time or facilities to inspect boilers with the regularity considered necessary. In that case we say that it is time State inspectors were put in charge of the locomotive boilers belonging to roads that do not consider themselves in the position to adopt the precautions necessary for preventing their property from becoming dangerous to the community.

Nearly all boiler explosions are caused by broken stay-bolts. There is gross carelessness on many roads about the inspection that ought to detect broken stay-bolts, and we are sorry to find that the proper remedy is not properly applied when fractured stay-bolts have been discovered. While strolling about an engine-house belonging to a big railroad lately we happened to see the jacket and lagging removed from the outside of a fire-box. Being of an inquisitive disposition, as becometh a newspaper man, we climbed upon the running board to see what was going on. A workman was engaged on the delicate operation of plugging with a piece of copper the hole in a stay-bolt that had been drilled through the outside sheet to show when breakage happened. On inquiring as to why the plugging was resorted to instead of putting in a new stay-bolt, we were informed that they had not time to do that, and that drilled stay-bolts were a nuisance, anyhow. Several of the stay-bolts exposed by a small piece of opened lagging had been plugged before.

Now, rational men are inclined to exclaim with incredulity, Can such things be? We are surprised that engineers can be found who are fearless enough to run locomotives treated in this reckless fashion. The men whose lives are put in jeopardy ought certainly to make a combined pro-



Arrangement of Dean Compound.

test against the practice. Where things of this kind are done, the matter for surprise is not that boilers explode, but that they explode so seldom.

## Defective Air-Brakes.

There has been considerable excitement concerning brakes in the West during the last month. The Chicago, Burlington & Quincy, which specified the New York Air-Brake for a lot of freight cars, tried the brake on a fifty-car train and it took over fifteen seconds for the application to reach the last car. This, of course, is not a quick acting brake, and would not handle a long train safely. In consequence, the railroad company have refused to accept the brake, and the brake company is said to be getting out a new triple valve.

Tests were made at different times and places by the Chicago & Northwestern and the Chicago, Milwaukee & St. Paul Companies of the Lansberg brake, and it was found far behind the M. C. B. requirements for an automatic air-brake.

Owing to this information about the effects of the brakes mentioned, the New York Central and several other Eastern roads have established a rule not to use on their trains any air-brakes except the Westinghouse. When cars having other air-brakes on are offered for transportation the cars will be accepted but the brakes cut out.

## How to Become a Successful Fireman.

By W. H. WHALEN.

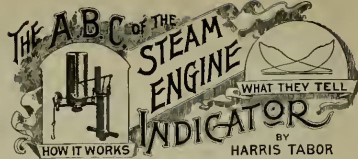
He should be a temperate, honest man, of at least medium size, and should have a good education. He should go to his engine an hour before leaving-time, and should examine the fire, grates, ash-pan and front end, if the engine is of that make, and should see that there are tools and supplies for the trip, and in fact *know* that everything is in readiness. He should have his fire laid, that is, have the grates covered with incandescent coal, the thickness to be governed by the amount of work the engine is about to be called upon to perform.

After they have started and the lever has been cut back, he should give her a light fire, and if the engine is working hard repeat this often, having the coal cracked about the size of an egg. Open and shut the door in the shortest possible time, avoid heavy firing, as it is wasteful in all ways, and a great source of annoyance to the engineer, especially in bad weather. Nearing each station he should allow the fire to burn down, so to avoid smoke and popping, while steam is shut off. When the engine is again started, be governed by the same rules as at the beginning of the trip. After being out fifteen or twenty miles he should see that the grates are loose by "*just moving them*," then after twenty-five or thirty miles shake them *slightly*, repeat this a few times during the trip. He might vary from these rules slightly according to circumstances, knowing that as he cannot shape them to him he must shape himself to them. And while taking coal or water, cleaning ash-pans or front-ends, or any other work he may be called upon to perform, do it with dispatch.

These rules may be followed to the end of the trip, and they will be *all right* where there is good boiler feeding being done. But when the "feed" is shut off with the engine, and started with it, or just before, or is wide open or shut off at all times regardless of conditions, they will not. The way to do in this case is to give the engine enough of coal, that is "try and keep her hot," regardless of smoke, waste, or anything. He should not bother the engineer with talk that does not concern his work or the engine, he should teach himself to think about his work as he does it, he should learn the "peculiarities of the engine" and the cause for the same, he should recognize nothing as a mystery, but the effect of some cause, his duty is to learn the cause. After the engine has been housed, he should get it ready for the next trip whether he goes out on it or not. But he should be given a regular engine to fire, as he can give better satisfaction to the company, the engineer and himself, and in this case he can afford to keep it clean, and I would advise him to do this, as it will make his work on the road more pleasant. Let cleanliness of person and engine be his motto.

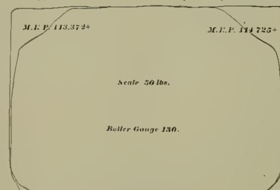
After his work is done he should go at once to his home, if he has one, if not, he should waste no time in getting one, and if he is in need of rest get it at once, after this has been done, and he has not been called for duty, he should spend his time in studying or reading something treating on his work. In this way he will command the respect of his associates, as well as the officers of the road, and it will enable him to attend to his own affairs, a great requisite in a railroad man.

[The above article was written at the request of a railroad officer by one of the successful enginemen of his road.]




In the second paper attention was called to the irregular action of the link and its effect on the diagram. It was shown that all the valve functions were influenced by a change in the position of the link the travel of the valve is also controlled by the link, when the reverse lever is "down among the oil cans," and in position to give the latest cut-off, the valve will be at its maximum travel, and will give the greatest port opening; when linked up to the middle notch, the valve's travel will be valve when cutting off early in the stroke that makes the steam line on the card fall away so rapidly.

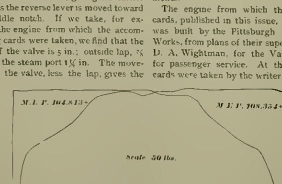
It is a source of regret with many engineers that the link motion cannot produce fine, symmetrical diagrams such as are obtained from Corliss and other stationary engines of the better class. They shut their eyes to the good points in the link and see only its defects. If they would study the conditions to be met by the motive power department of our railroads—




9.22 Miles per hour.
Reverse lever in 7th. notch.
Throttle ⅓ open.
Grade 47½ ft. per Mile.

reduced to its lap and lead, at any point between these extremes of the reverse lever the movement of the valve will be proportioned to the position of the link, and the port opening will correspond to the reduced movement, giving an earlier cut-off as the reverse lever is moved toward the middle notch. If we take, for example, the engine from which the accompanying cards were taken, we find that the travel of the valve is 5 in.; outside lap, ⅞ in., and the steam port 1½ in. The movement of the valve, less the lap, gives the conditions that vary with each mile of road-bed, calling for a large engine here and a small one just beyond—they would see the wonderful adaptability of the locomotive of the present day to meet the requirements.

The engine from which the series of cards, published in this issue, were taken was built by the Pittsburgh Locomotive Works, from plans of their superintendent, D. A. Wightman, for the Vandalia road for passenger service. At the time the cards were taken by the writer she was in

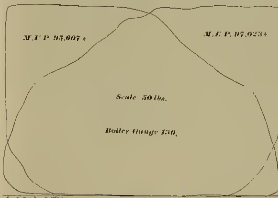



7.19 Miles per hour.
Reverse lever in 5th. notch.
Throttle open.
Grade 30 ft. per Mile.

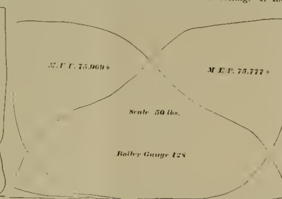
port opening, the sum of the laps ⅞ in. plus ⅞ in; equals 1¾ in., and this amount taken from the travel of 5 in. leaves 3¼ in., which is ¼ in. more than the sum of the port openings, an excess of ⅛ in travel beyond the required 1½ in. at both ends. This extra travel insures freer admission of the steam for induction, and makes the exhaust opening that much larger. If we assume the lead in mid gear to be ¼ in., the valve will travel the sum of the laps and leads ⅞ in. plus ⅞ in. plus ¼ in. plus ¼ in. equals 2¼ in. Here we find a variation in the travel of the valve of 3¼ in., more than three-fifths of the total movement. It is this reduced travel of the service on a freight train between Terre Haute and Indianapolis. The general dimensions were as follows

| | |
|---|---|
| Cylinders | 18 x 24 in. |
| Steam ports | 18 x 1½ in. |
| Travel of valve | 5 in. |
| Outside lap | ⅞ in. |
| Inside " | ⅛ in. |
| Lead, full stroke | 1/16 in. |

The first card of the series was taken with the reverse lever in the last notch. The throttle was only one-third open, but at this slow speed it is doubtful if the steam line would have been any higher with full throttle. It will be noticed that the steam lines are straight up to the point of cut-off, which is about seven-eighths of the stroke. The terminal pressure is about 90 pounds, and the mean effective, or average pressure throughout the entire stroke, is 113 and 114 pounds. This card represents about the maximum power of an 18-inch cylinder, with 130 pounds boiler pressure, for train starting and grades. This large mean effective pressure is very often called upon. The second card was taken with the reverse lever in the fifth notch. We see at once a marked difference in the formation of the cards. The terminal pressure is 75 pounds instead of 90, and the mean effective has fallen to 104 and 108 pounds. Running along the steam line we find that the cut-off took place earlier in




11.06 Miles per hour.
Reverse lever in 4th. notch.
Throttle ½ open
Grade 17½ ft. per Mile.



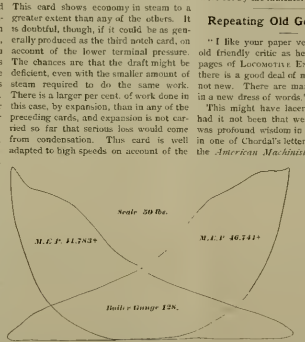

7.37 Miles per hour.
Reverse lever in 3rd. notch.
Throttle ½ open
Track level.

the stroke, and more work was done by expansion, which accounts for the reduction of 15 pounds in the terminal. Release is somewhat earlier, and the exhaust-valve closed enough earlier to make a decided difference in the appearance of the compression line. This is the first stage in cylinder reduction. The third of series, taken when the reverse lever was in fourth notch, shows clearly that all the functions of the valve commenced earlier in the stroke, and, as in the previous case, less work has been done during the revolution. This progress toward less work and earlier valve action continues as the reverse lever approaches the center notch.

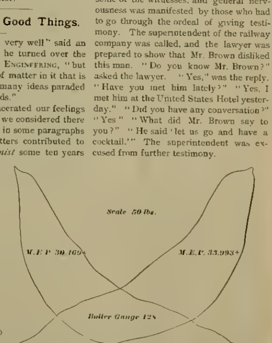
If we take the whole series of cards, from seventh to first notch, it makes an interesting study. We have found that as the engine "is hooked up" the apparent defects of the link motion are brought into prominence. We say apparent defects for the reason that investigation lessens the evils the link has been charged with. The conditions of running must be considered with the cards, if they are to be discussed intelligently; we must not assume that a seventh notch card represents the running on a level track, nor that the first is generally used in starting; we must take the conditions as they occur in running, and if we do this, we shall lose none of our respect for the valve-gear of the standard American locomotive.

The maximum, or seventh notch card, is the most extravagant in the use of fuel. We have only to consider the pressure at which the steam is released and blown into the atmosphere to understand how great this waste is; the terminal pressure on this card is greater than the initial pressure in the average stationary engine. The conditions under which this card is made may be classed as train-starting and grade-pulling, and occasionally low boiler pressure. It is fortunate for the coal heap that the piston speed is generally very slow when the lever is in this notch, and in consequence the horse-power developed small, notwithstanding the enormous foot-pound energy developed with each revolution. On ordinary roads the loss from working the valve in this notch cannot be great, as it is in use so little of the time. The fifth notch card is more economical, but this is too wasteful for ordinary work; it divides time, or should, with seventh notch. The fourth notch card is more pleasing to the eye, and is decidedly more in harmony with smaller coal bills; it is a beautiful diagram, showing very fine engine performance. The third notch card could not well be better. The slow speed at which it was taken has brought out all the features of the diagram very distinctly, but the engine gave good cards at all reasonable speeds. This third notch card ought to cover a large range of work, it shows a fair amount of expansion, and its terminal pressure is high enough to blow the furnace fire under average conditions. It is, by odds, the most economical card thus far considered. The first glance at the next card, with lever in second notch, tells the story of small port opening from reduced valve travel. The steam lines are not as well maintained up to the point of cut-off as in the preceding cards. The speed is much greater, which will, in part, account for the reduction in these lines, but at the same speed the reduced valve travel would show on the card. This card shows economy in steam to a greater extent than any of the others. It is doubtful, though, if it could be as generally produced as the third notch card, on account of the lower terminal pressure. The chances are that the draft might be deficient, even with the smaller amount of steam required to do the same work. There is a larger per cent. of work done in this case, by expansion, than in any of the preceding cards, and expansion is not carried so far that serious loss would come from condensation. This card is well adapted to high speeds on account of the liberal compression and lead which serve to cushion the reciprocating parts of the engine. When the valve is unbalanced engineers, as a rule, dislike to run "hooked up" to this notch, and with reason; the higher pressure of the boiler on top of the valve and the lower pressure in the cylinder, on the opposite side, tend to make the valve hard to handle, especially with a full throttle. Under these conditions of unbalanced pressure the wear of the valve is excessive. The last of the series brings us to the first notch, with more expansion and compression shown than in any of the others. In this case the release was so early that all the steam above atmosphere was out of the cylinder before the piston reached the end of the stroke. The fireman would have a sorry time on a long run under such conditions, but his coal consumption would be small.

We have seen that the position of the reverse lever from seventh to first notch has gradually reduced the engine capacity from a mean effective pressure of 114 pounds to 33 pounds, nearly three and one-half times. This reduction has been at both ends of the cylinder, expanding at one end and compressing at the other. There is no loss in compression, and there is a decided gain in expansion. The compression is a help to smooth running, and in that way gives an unquestioned gain. It is doubtful if any valve-gear can take the place of the present link and give as good all-round results. These cards show a remarkable case of valve setting. If the reader will compare mean effective pressures marked on the opposite cards he will find a uniformity rarely seen. The valves were set by the indicator.




34.31 Miles per hour.
Reverse lever in 2nd notch.
Throttle open
Grade 30 ft. per Mile.




14.75 Miles per hour.
Reverse lever in 1st. notch.
Throttle open.
Grade 30 ft. per Mile.

## Repeating Old Good Things.

"I like your paper very well" said an old friendly critic as he turned over the pages of LOCOMOTIVE ENGINEERING, "but there is a good deal of matter in it that is not new. There are many ideas paraded in a new dress of words."

This might have lacerated our feelings had it not been that we considered there was profound wisdom in some paragraphs in one of Chordal's letters contributed to the *American Machinist* some ten years ago. We commend the words to our critic. Chordal says:

"The apprentice boy in a machine shop with a weakness for reading trade literature finds in the simplest every-day matter a subject of novelty to himself, and in the course of time his mind becomes stocked with material gathered there item by item, each one as old as the hills to the world, but as fresh as the daisies to him.

"An apprentice boy sits on a block at noon reading a mechanical paper, and is thoroughly interested in an illustrated article on lining up engine guides. Some old gray-haired fellow looks over his shoulder, gets a general idea of the illustrations, and sneeringly remarks to the boy, 'Pshaw, that thing's a thousand years old. Is that what you fellows read about in those papers?' If the boy is smart he will reply 'I am 14 years old, and this is the first I ever knew of this guide business. How old were you when you found it out?'

"When this same boy gets to be, say, fifty years old, he may possibly get disgusted with this kind of shop literature, and begin to think that the editor ought to be kicked for putting old things in the paper, thinking that they can be passed off for novelties. He may forget his own experience.

"Professional literature forms the annals of professional progress. The artisans' literature is not, and need not be consecutive in any of its arrangements. It presents a series of items which each individual arranges in his own mind for his own individual annals of progress.

"The real fact is that the literature of the artisan to be of any real value must contain repetitions on literary subjects, and there is a fine problem involved in finding out how often a repetition should occur."

We have among our readers the apprentice boy and the old workman, also the fireman and the old engineer. Behind them are the mass of other readers who will not suffer from having old stories told in new words. Men forget things so quickly that old memories will stand feeding with the knowledge that is new to the younger generations.

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There was a curious case heard in a Boston court. A railroad company was trying to obtain some privilege and it was vigorously opposed by Mr. Brown, a business man. The lawyer for the company was trying to make out that Mr. Brown was opposing the privilege on account of personal antipathy to the company and its employees. He had been making it hot for some of the witnesses, and general nervousness was manifested by those who had to go through the ordeal of giving testimony. The superintendent of the railway company was called, and the lawyer was prepared to show that Mr. Brown disliked this man. "Do you know Mr. Brown?" asked the lawyer. "Yes," was the reply. "Have you met him lately?" "Yes, I met him at the United States Hotel yesterday." "Did you have any conversation?" "Yes" "What did Mr. Brown say to you?" "He said 'let us go and have a cocktail.'" The superintendent was excused from further testimony.

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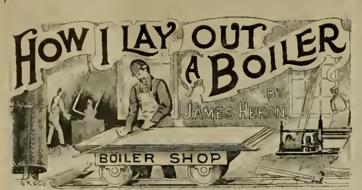
An engineer in Chicago writes as follows

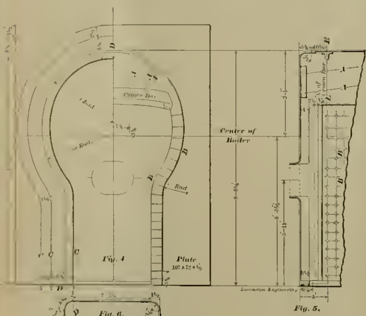
Why is it that we cannot get good valve oil for locomotives? I am running a locomotive on a road that was buying good valve oil, and we were able to make the run over the division comfortably on a pint. A big corporation bought up our road, and, when the change of management took place, they began giving us the oil used by the big road. The stuff is said to cost more than the good oil we formerly had, but it will not go half the distance, and there is no end of trouble with dry valves and groaning pistons. This does not appear to be good business. Why is it that so few railroad companies use vacuum oil and valvoline? It is not because these lubricants would not be best and cheapest. There are some things about railroading that no fellow can understand.




## Laying Out the Back Head.

The large engraving shows the boiler we will lay out in the course of these articles, one piece at a time, and is used here the outer door-sheets. This means a saving of labor, as there are no holes to be drilled by hand when the boiler leaves the boiler-shop.

There is no necessity to locate stay-bolt lines are not the same distance apart in inner and outer sheets. Now I get two pieces of iron, 1x⅜-in., and 1x½-in., one of each, this represents thickness of plate to be used for side sheets. I bend one to shape of back flue-sheet, the other to shape of back head. I lay these on stay-bolt lines, Fig. 4, and mark lines on pieces, putting a center punch mark at each bolt; then I straighten them out and mark straight plate from them, this gives me stay-bolts in side-sheets vertically. Before finishing side-sheets, as regards rivet holes, I will have to first lay out back heads. The flanger has to be kept going. One-half of Fig. 4 shows lines laid off to guide flanger as to size of sheet when finished, also showing how to get proper length of material, so that when sheet is flanged there will be no trimming of same.




Height of boiler, 8 ft. 6½ in., ½-in. off for thickness of plate of wagon top. Height of back head, 8 ft. 6 in., 4½-in off for radius of corner outside, leaving 8 ft. 1½ in.; to this add 6¾-in. required to form quarter circle at corner, as at *D*, Fig 6, and and 2¼-in. for loss, and you have length of sheet required. Now punch all holes, and before cutting out door-hole punch one hole in center of same, then get inside sheet, find center of same, square off bottom; mark center mud-ring hole and center of door hole; punch these two holes and bolt inner and outer sheets together, and mark off stay-bolt and door holes. These must come opposite when boiler is fitted up. *E E*, Fig. 5, gives starting point for crow-feet and first crown-bar, of which I shall write later. Hearth-sheet, mentioned in last paper, should read throat-sheet.

J. Heron

## Pennsylvania Railroad Enterprise.

The mechanical officers of the Pennsylvania Railroad at Altoona are working on the designs of a compound locomotive for the use of the company. The engine will prise, are sparing no expense in finding out all that needs be known about compound locomotives. They have just ordered a ten-wheel compound from the Schenectady Works, that the merits of this engine may be thoroughly tested.

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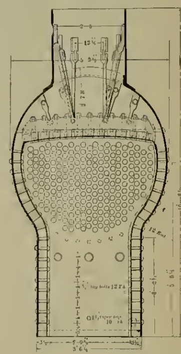
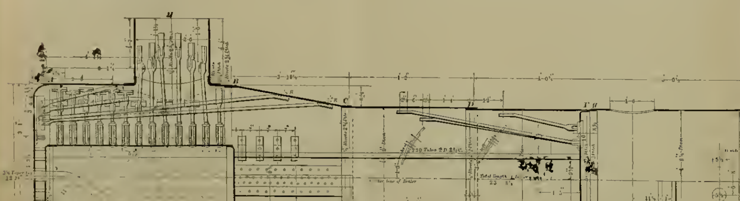
Accompanying an order for LOCOMOTIVE ENGINEERING we have received from Mr. M. R. Jefferds, London, a long letter giving



an interesting account of the opposition encountered by those who are trying to introduce the American style of tubular iron car into England. The tubular iron car represents the American type of freight car, and English railway companies are naturally prejudiced against the thing to begin with. Mr. Jefferds is mak-



BOILER. MODEL SOFT COAL BOILER.

better to show the student what is aimed at

Fig. 4 shows plate 107x72x½-in. This sheet is to form door-sheet, or what is more commonly called the back head. On this plate I lay down full view of boiler looking from back By this means I can locate all holes in proper place and see that all parts clear each other, such as vertical and longitudinal braces, as at *A A*, Figs. 4 and 5, also washout, gauge-cock, in fact all holes that have to be put in inner and holes on sketch, as in any well-regulated shop your blue print will show them. If not, you have to use your own judgment. What I want to point out to you is how to get your starting points. In the last paper I showed you how to find stay-bolt and rivet holes in side sheets longitudinally, now we want to get them vertically.

I lay lines down representing center of stay-bolt, always following surface of sheet as at *B B*, Fig. 4, so as to have bolt square with surface of plate. Note that

be of the two-cylinder type, and will have the Lindner starting-valve arrangement.

There are five Vauclain compound locomotives at work in service mixed with other simple engines of the same capacity. There is no difficulty whatever experienced by the men in handling the compounds The engines are chain-ganged, and give entire satisfaction. The saving of fuel effected by the compounds is about 20 per cent.

This company, with their usual enter-

ing a gallant fight to convince railway companies and shippers of freight that the car of large capacity is the proper way to move freight cheaply, but his prospects of success are exceedingly dubious.

The English are intensely set in their ways, and the small cars have been in use so long that the people would think some institution was going to the dogs if a change were made. Then their freight-houses, sidings, turn-tables and means of handling are suited for small cars.

## A Lesson on Heating Surface.

By JOHN ALEXANDER.

My boy Fred seems to have inherited the cursed taint of the Alexanders—not scrofula, or consumption, or gout—but a burning desire to "invent something."

It is not a year ago that he sent me a wooden model of a new valve motion—Fred is running now, you know. But he seemed to have done a good deal of hard thinking, and not very much good reading, for he re-invented the very identical motion that I did twenty years ago, and that was patented, still further back, by a better man than I, who knew about as little about what was wanted on a locomotive.

A contraption that will let a locomotive cylinder make a Corliss card won't let it pull a train successfully. I explained this to Fred till he "tumbled," but bless you, my dear sir, here he is again with a combined brick arch, water-table, and feed-water heater that just makes my old heart ache.

Feed-water heating on a locomotive is a dead failure. I don't know as I know just why, only that it won't work, never did, and never will. I don't mean that they won't heat the water—any on 'em will do that—but I mean that they don't and they can't do it for nothing, with waste heat or anything like that.

The Lord knows that I tried my level best to get things into that curly head of his right, but where in Sam Hill he ever come to think that a petrified iceberg in the shape of a brick arch would do any good and not do harm, I don't know.

Time and time again have I explained to him that the heat absorbed by the fire brick, and given off in cool times to ignite the gases and aid combustion was where the advantage was—not in making the products of combustion go around another corner?

Haven't I sat up nights to explain to him how a heater placed in the shape of a table in the fire-box would act as a cold blanket to keep ambitious gases that wanted to burn from doing it, and condemn them to die of chills and fever?

Haven't I showed him the drawings of these traps, tried long before he was born, and all pictured out in Daniel Clark's railroad Bible? and now he goes and makes an ass of himself to his proud old father.

Why, my dear sir, it ain't three years ago that he dug up a pile of blackened pipes from the woodshed loft, and I sat down and told him the history of a blamed old fool—by himself—just to get a few facts about heat and combustion, and heating surface, and *effective* heating surface, straight in his skull, just to keep him from *not* profiting by the experience of his ancestors, just to anchor a red buoy on a shoal discovered by a shipwreck, just to be sure he would be a better mechanic than his illustrious father—it's a poor boy that can't be better than his father—and here he comes to me with his blasted ice-cream freezer attachment, and expects my approval and blessing, and, maybe, thinks I'll be proud of his inventive genius. But I won't.

Perhaps it may do a bit of good to the inventive young roosters who read Locomotive Engineering if I should set down again, and take and tell that story of the pipes and the fool that made 'em. So here goes.

It was away back when this same Fred was a baby. Mrs. A. and I were fixed up cozy in a little three-roomed nest, taking comfort by the square mile, and only worrying about the pay-car and this precious Fred that is now trying to make fool of himself.

Noting with what peculiar care the madame prepared the bath for this young rooster—it was before the days of water-backs and heaters, for us—I conceived the idea of supplying her with hot water, in wholesale lots, for nothing.

An Incident of the Blizzard—Old-Fashioned Snow Bucking.

Our road were just putting on the air then, and the shops were full of three-quarter inch pipe, and I borrowed a couple of lengths. These I cut up, and with the aid of elbows I made a little square pen of pipes that just fitted into the fire-box of our little cook stove—that dear, little, old, No. 7, that was such a comfort when Mrs. A. deigned to make sweet rusks and fig cake.

The pipe was arranged in a spiral from bottom to top, and the two ends were brought out of a hole drilled in the end of the fire-box opposite the door. These ends connected to pipes that were carried along the wall and entered a 30-gallon whisky cask set on a corner shelf on a level with the stove.

I carried water from the well for that heater reservoir and the coil of pipes kept 30 gallons, more or less, boiling like a glass of ginger pop.

Mrs. A. was very much pleased over the heater. It was so nice to draw all the hot water you wanted, when you wanted it, instead of waiting for the deliberate act of a cast-iron tea-kettle that thought twice and then counted one hundred before it spoke. She was proud of her inventive husband, and inside of three days had promised that I should make one for each of four or five of the neighbors.

Before this dire contagion had got beyond our own doors, the cold, naked truth was kicked into me, and I learned something about *effective* heating surface.

I was going to be home for Sunday, and Mrs. A. condemned and beheaded a loud-talking and polygamous young rooster of her own raising, and prepared his carcass as a burnt-offering to the patron saint of a dinner-pail victim named John. She made him (the rooster) false vitals of bread crumbs, oysters and sage, and shut him in the oven of that famous little baker with the idiot attachment.

I took care of the baby while Mrs. A. prepared the feast. Often did I notice her go to that oven and probe in an inquiring way to see how the baking progressed, but that rooster did not get above blood heat.

At last in disgust and anger she called me. Something was wrong. The fire was good, the water in the barrel boiling, but the rooster wouldn't cook. I preached to her that there was some little thing the matter, there was a cause for the trouble. I lay on my stomach and scraped the space under the oven. I examined the dampers and both of us got hungry. In sheer desperation the cold-blooded rooster was taken out, drawn, quartered and fried, while I swore a bloody oath that I would never pay the rent till the measly landlord cleaned out the chimney.

In the middle of the week I came home from a 36-hour wrestle with the "renakaboo" run, and Mrs. A. danced a little as she told me the joyful news that the stove was all right again and baked "just lovely."

I was a little suspicious of women monkeying with the science of things and asked her what she had done. She replied that the landlord had cleaned out the chimney, but added that she thought she had ruined the heater, for it had run dry and the pipes got red hot, but that it was all right, because she filled the barrel next morning and it was working now the same as ever.

The next Sunday I did the baby act, as usual, while the dinner was being concocted. After a while I heard a 20x24 sigh, and pushing open the kitchen door beheld the flushed face of the madame. She was glaring at a long broom straw covered with a pasty mess that she had drawn from something in a pan that looked like the crater of an extinct volcano.

"It's fell," she said dolefully, as I approached her, and recognized the stuff in the pan as the mummy of an angel cake.

I sat down and thought I went over the chimney, the drafts, the fuel and the heater.

"It never acted so until after you put in that heater," said Mrs. A.

"What's the heater got to do with it? Ain't the grate just as big? Don't it burn as much wood, and more, too?" I said warmly.

But I thought I would try an experiment, not so much for myself as to allay any doubts in the mind of my partner.

I drew the water out of the barrel and dumped the fire, and asked Mrs. A. to mix another cake.

By the time the cake was ready I had disconnected the pipes, and had the pen of pipes out in the back yard, and a raging fire of kindling. That time the cake baked.

Just as I balanced the third quarter section of that delicious dough upon the tips of my fingers Mrs. A. asked me what I thought about the heater, and why it prevented the oven from getting hot.

I looked at her wisely and asked her if she didn't know. That's the way engineers do with firemen when they ask questions too deep for 'em.

She didn't know, but I had at last seen the light, and so I lectured her something in this wise.

The reason the oven wouldn't bake was because the heater had absorbed the heat and conveyed it, through the medium of the water, to the barrel and there stored it up, the same reason that I cannot eat this cake to-day and keep it till to-morrow, the heat can't be in two places at the same time.

Manifestly the pipes of water were more effective heating surface than the walls of the oven, and carried away the heat, when they were removed the oven got the benefit. Perhaps if I had used less heating surface that would have heated the water well enough, and not have so seriously crippled the oven.

This law holds good on a locomotive as well as on a stove, you can't use the same heat twice; the *effective* heating surface does the business, the rest is useless, perhaps a detriment.

We know that the heating surface should be in proportion to the grate surface, we know that when you get ten square feet above or below sixty square feet of heating surface to one of grate you burn more fuel to evaporate a pound of water, but I never knew any one who could tell just why.

We know that boilers with enormous grates, and about forty feet of heating surface to one of grate, have given poor results in actual service, and we know that boilers filled with water-tubes, etc., until there was shown eighty or ninety square feet of heating surface to one of grate, did no better, and showed no loss in evaporative effect when 25 per cent of their heating surface was cut out.

I believe that we could get along with far less heating surface than the average in use if it could be arranged to be more effective, put where the fire could get at it on one side and the water on the other.

But trying to make a cold arch feed-water heater, and figure on increasing your heating surface at the same time, in this age and day, is going backward, and if Fred don't know it by this time I will take him through a few experiments that will bring him back to earth, for, after all, his case is mild; he is not claiming per cents of saving yet.

When an alleged inventor figures out just what per cent. his device is going to save, before one has been made or tried, I always see in my mind's eye the Incurable Ward at the State Insane Asylum. This percentage business is killing people.

## In the Rhode Island Locomotive Works.

The Rhode Island Locomotive Works are better situated than any of the others that we have visited lately, for the shops are working to their full capacity on full time. Although orders for locomotives have been scarce generally these works have enough orders on hand to last several months. They are building some of the standard six-wheel switchers for the Chicago, Milwaukee & St Paul, and they are likely to build a compound and a simple engine of the same capacity for this company, to be used in tests by the Master Mechanics' Committee on Compound Locomotives. Several Forney suburban engines have lately been built here for the two Brooklyn elevated railroads, and one of this class was under construction for the Franklin & Megantic, a small railroad in Maine. The principal work in the shops during our visit was a group of eight-wheel passenger engines for the Boston & Albany, with cylinders 20x26 inches, driving wheels 58 inches, boiler 52 inches diameter at smallest ring, and deep fire-box 72 inches long inside, the total heating surface being 1,270 square feet. The engine finished weighs 91,000 pounds, 61,500 being on the drivers. These engines are built from drawings furnished by the company. The engines are finished with all the latest conveniences and they look very handsome, the only weak point being that the cylinders approach so close to the boiler in size.

H. L. Leach, P. O. Box 2225, Boston, Mass., has recently perfected a working model, designed for instruction and advertising purposes, showing the operation of the different styles of Leach's sand-feeding apparatus for locomotives, and the manufacturers solicit correspondence from railroad men who wish to make themselves familiar with the device. A compressed air plant, while desirable for its proper operation, is not a necessity, for a healthy man can blow all the wind necessary for its successful operation.

## J. Davis Barnett.

J. Davis Barnett started railway work young, getting most of his book knowledge after working hours. Spending three years in the pattern shop, foundry and drawing office on the Great Western Railway of England, at Wolverhampton, London and Swindon He came to Canada in the fall of 1866, entering the erecting shop of the Grand Trunk Railway, at Montreal, as an "improver," thence working his way through the drawing office from junior to senior After doing occasional out-door relief duty on divisions, he was promoted, thirteen or fourteen years ago, to assistant mechanical superintendent, which position, at various locations, he has since occupied, except that previous to the absorbtion of the Midland Railway of Canada by the G. T Ry, he, at the request of the latter, filled the position of mechanical superintendent of the Midland. This is practically more than a quarter of a century's service with one company. He has taken an active interest in the American Railway Master Mechanics' Association, of which he is a past president, the Canadian Society of Civil Engineers, the I. C. E & I. M E. of England, and the British and American Association for the Advancement of Science.

Mr Barnett is a single man, very much devoted to his mother, both of his parents being still alive. He is something of a bookworm, and one of the best read men in the country. His library is the most extensive private one in British America

Mr. Barnett has immediate charge of the locomotive works of the Grand Trunk at Stratford, Ont.

## The Rogers Locomotive Works.

In the erecting shop of the Rogers Locomotive Works there are some very large consolidation locomotives for the Nashville, Chattanooga & St Louis They have cylinders 22x24 inches, driving-wheels 50 inches diameter, and 60-inch boiler with Belpaire fire-box 11 feet long The boiler will be safe for 175 pounds of steam, and would evidently be safe under 200 pounds. There are a great many good points about the engine that are well worthy of imitation. They represent the ideas of Superintendent of Motive Power Cullen as necessary for a good freight engine

A six-wheel switching engine for the government is in the shop nearly ready for shipment. It has a straight boiler and saddle tank

A number of small switching engines for Cuba are nearly ready They are entirely covered in with a large cab.

These works have several orders for locomotives to go to South America. Like other locomotive builders, they are figuring on the building of compound locomotives, but the designs are not finished.

## New and Old Tools.

By T B. PURVIS, Jr.

No one in this progressive period will maintain for an instant that an old tool is as good as a new one No one will say that the work done with an old tool is better than that done with one of the latest improved machines of its particular kind, and those of us in the railroad business who are surrounded by old lathes, planers, etc., are led to exclaim "What are we going to do about it?" Are we going to throw up the sponge and call ourselves beaten because we can't have as good as our neighbor? I think not. We are going to make the best of the situation and wrestle with the old things as long as they are here. A little ingenuity displayed in the right direction will sometimes transform these old scraps into quite useful machines.

No doubt some shops feel greatly the need of a boring mill for boring tires and finishing driving-wheel centers A very nice tool to have—if you can get it—but if you can't get it, and you have an old single-head wheel-lathe—one about thirty-five or forty years old will do—you can rig up a boring-bar with spliner attachments, and by rearranging your tool-post, you can finish a driving-wheel center ready for the shaft in about ten hours. To be sure, when you get your boring tool feeding pretty lively, and an eighth-inch feed traveling across the face or down the rim, I must admit that the old thing shakes and trembles, and makes an unearthly noise, but it gets there all the same, and we don't mind the noise, but on the contrary, rather enjoy it, because it reminds us of bygone days when this old friend was obliged to toil day and night in order to keep the tires up in shape I know it used to consume two or three days turning one pair of wheels, and when we put in the new double-header we didn't like the thought of routing out the old one, and so it stood and rested about ten years, and now we use it for finishing driving-wheel centers

I am reminded right here of the case that came under the observation of Mr. Davis, and cited in his paper before the New England Club, where the man was, on an average, two days and when very hard, four days in turning off one pair of tires.

Now, if this was on an old time single-head lathe, the man did fairly well, but if it was a modern tire-lathe, there must have been something wrong somewhere, and I am not inclined to lay the blame on the man either. Perhaps he thought that he was doing all that could be done.

At this point the foreman should have shown his hand. See if he was using tools best adapted for the work, that the lathe was speeded just right and that he had the *proper amount of feed on*, and when these points were made, he would find that instead of turning one pair in two days, he would turn two pairs in one day, and by a little extra crowding could get out three pairs, providing they were not extremely hard. To do this your lathe must make one revolution in two and one-half minutes, must feed one-eighth of an inch across tire at each revolution, and no time be lost in working out the flanges.

This time has been made on Krupp tires with the indispensable Mushet for tools In fact, first-class time must be made when you take a consolidation engine in shop, turn off tires and get it out in two and one-half days.

This refers to tires that it is only necessary to take one cut from, as ours are never allowed to wear below three-sixteenths of an inch

All are aware that the ordinary every-day railroad shop machinist is not a rusher, that the finer the feed, and the slower the speed, the more contented he seems to be, and I don't remember of having seen one who enjoyed being told to "put on five or six more teeth," or "throw your belt up on the next speed," but it pays to look after these matters a little

To return again to old tools.

We have an old planer at our place that came to us second-handed many years ago, and it stood unused and unnoticed for a long time. We never were fortunate enough to get a radius attachment for planing links, so we rigged one of our own design and make on this old planer, and the work it turned out would surprise you.

We also use it for another purpose, with counter-shaft and wood-drum overhead, and an emery-wheel and pulley attached to cross-head; we surface guides, etc., with it and won't growl if we can't get a better one. I realize that it would be a nice thing to have a double-head axle-lathe, but as long as we can turn six a day in our old machine, we are not going to find fault with anyone because our neighbor can can turn out twelve in ten hours with his new one.

If you have an old slotter that will accommodate only one driving-box at a time don't use it for this purpose at all, but rig up a radial-head and put it on the cross-head of your best planer, and do as many boxes with one operation as your table will hold.

If you haven't a special planer for rod brasses, speed up one of your smaller planers to twenty-eight or thirty feet per minute, put in as many pairs as your chuck will hold, and use a double-tool that will cut down the inside of both flanges with one operation. The time gained on one dozen pairs will surprise you.

If you have no improved tool for sharpening your reamers—here is something that will do it first-rate

Refit the carriage on the V's of your oldest lathe, place wood-drum and counter-shaft overhead, and with a small pulley and emery-wheel held in a fork at the tool-post, your reamer on the lathe centers, one movement of the carriage the length of each cutting edge of reamer, will make it as good as new.

I do not desire to be classed in opposition to new tools; on the contrary, I am an advocate of them, and any new method that will produce the manufactured from the raw material cheaper; but because you haven't as good or as improved machinery as the A. or B shops have, I don't think that it is just the thing to lapse into a state of "innocuous desuetude" or go about groaning all the day long, and allow some smaller shop to distance you, but take the bull by the horns and with a small bit of ingenuity and a big bit of push and energy, you will be surprised how the old traps can be fixed up.

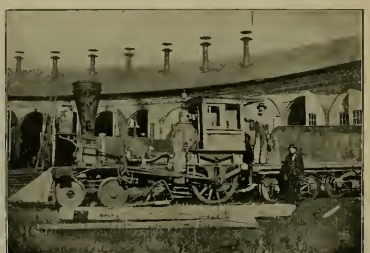
## The Diamond Stack an Efficient Spark-Arrester.

A very tedious and remarkably important law-suit has just been decided at Fort Wayne, Ind. The case turned upon the efficiency of the diamond stack as a spark-arrester as compared with the extension smoke-box The White Wheel Works were burned down, and being at the side of the Nickel Plate track, it was, of course, claimed that the fire originated by a spark from some of the railroad company's locomotives. To the claimants this would be much more likely to happen than the setting fire of the place by a spark from the owner's cupolas The insurance companies paid $50,000 for fire damages, and then joined with the owners of the wheel works in suing the railroad company to recover payment for the loss.

The excuse for the suit was that the railroad company used the diamond stack on their locomotives, and that it was not so efficient a spark-arrester as the open stack and extension smoke-box. A host of experts in the shape of engineers, master mechanics, superintendents of motive power and scientists were examined as to the good and bad character of the two forms of spark-arrester in question. After all the evidence was in and properly digested the decision was made that the diamond stack is as good a spark-arrester as the extension smoke-box. It was decided that the advantage of the extension smoke-box was that it promoted cleanliness and saving of fuel. This decision makes the diamond stack legally as good a spark-arrester as anything in use. The question has been before the courts several times.

## The Old "Pioneer."

Mr. William Smith, Superintendent of Motive Power of the Chicago and North-western, sends us the following points about the historical locomotive "Pioneer" shown in the annexed engraving:



This engine was built by M. W. Baldwin, in Philadelphia, in June, 1836, for the Utica and Schenectady road, and was afterwards bought by the Galena & Chicago R. R. It was the first locomotive bought by that company, and was purchased by them in 1852.

The engine was in service for thirty-five years, and is now laid up at Turner shops, in good working order. The engine stands as represented in the photograph, but her flues are in good working order, and any day that we want to put on a little "style," all we have to do is to fire her up and start.

When the "Pioneer" was bought there was only about two miles of track laid, and that was the strap-rail. Afterwards the company began pushing the road to Turner, and then to Elgin, and then the "Pioneer" ran between Chicago and Elgin.

The first engineer that run her here was P Ebbert, a brother of the first master mechanic of the road, and he afterwards became assistant to his brother, Mr. John Ebbert. Patrick Degan succeeded Mr Ebbert as engineer of the "Pioneer" Both of these gentlemen are now dead. Mr. R W. Bushnell, Master Mechanic of the B. C. R & N., at Cedar Rapids, ran the engine for a short time.

At the time the "Pioneer" was running three or four freight cars was considered a good train for her. She has been known to take five freight cars from Chicago to Turner, a distance of thirty miles, and that was considered an exceptionally heavy train, as it is up grade in some places. She used to take in seven cars from Turner to Chicago, and she was considered a great mogul then to be able to handle so many cars. These cars would be loaded with iron, ties, or anything in the line of railroad business. The cars, to be sure, in those days were nothing near the size they are now, but I have been told by parties that saw her do the work that the cars were 26 or 28 feet long.

The engine has a hook motion, and is worked with two small horizontal bars about the size of damper rods. They pass through the cab and work backward and forward into a notch. The engineer, in order to work these bars, has to stoop down, and it would appear to me that he would have to be an expert to stop the engine at any particular point he wished to.

The engine is what you might term a half crank inside-connected engine. Her main rods are not any heavier than the eccentric blades of our large engines. The guide-bar is hollow and forms the pump; the plunger working through the center of the guide-bar. There are four studs in the steam-chest, one at each corner.

The engine was brought by lake to Chicago, and after her arrival here visitors flocked from far and near to see her. I am informed by those who were on the ground at the time, that wherever the engine happened to be, it was like a country fair, so many people came to see her.

This engine would show a wonderful contrast providing she was placed alongside of one of our modern locomotives in the World's Fair. I think it would attract as many visitors as a good many other articles on exhibition.

## Reminiscences of the "Pioneer" Locomotive.

Mr. R. W. Bushnell, Master Mechanic of the Burlington, Cedar Rapids & Northern, who was previously on the Chicago & Northwestern, sends us the following notes:

My first remembrance of the "Pioneer" which at all interested me was when she was taken into the roundhouse for general repairs. This was at Chicago, on the Galena & Chicago Ry., in the year 1855, if I recollect right. I was then working in the back shop, but, as I was desirous of going on the road, Mr. John Ebbert, M.M., offered me the "Pioneer."

The engine was of Baldwin make, and built in the year 1836, and of the following dimensions: Cylinder, 11 x 18; 2 drivers, 54 in. diameter; boiler, 37 in., with 108 1¾ flues 7 ft. 6 in. long; weight, 24,000 pounds.

The engine originally had but one eccentric on each side for the forward and backward motion, and these were placed under the foot-board with the usual levers and starting-bars peculiar to that motion. At this time the engine was given two eccentrics for each side, and these were placed outside and attached to a pin in the hub of the drivers. The reach-rod, or reverse-rod, was made like a sand-box lever, with notches and a catch in front of cab to hold it in position.

The engine was also fitted with an Ebbert's patent heater, a product of the inventive genius of Mr. Peter Ebbert, the foreman of the roundhouse.

The heater consisted of vertical pipes, placed around the inner side of the inside pipe of the smokestack, and connected at top and bottom with return bends, the pump forcing the water through these pipes to the boiler.

The stack was of the ordinary pattern for wood-burners of those days; but in order to get ample surface for the water heater, the inside pipe was made very large to get as many pipes in as possible. To cap this, and retain heat in the stack (I suppose), the cone was made unusually large. You can imagine the possibility of an engine making steam, handicapped with such an apparatus as this in the stack.

Well, after a seemingly long time to me, the engine was at last ready for service. Mr. Ebbert, the inventor of the heater, was to take her out on the first trip, and I was installed as fireman, after which I was to take the engine and run her. I cannot relate all the incidents of that trip, but were they written in a book, verily they would fill a volume; and should a person relate them as they occurred, he would be placed at the head of the procession in your special column for liars. You can bet there would be no lounging on the seats while the talk was going on, for all would be on their taps to gather material for future occasions, and there would still be fun enough left to entertain a large audience.

We started for Sterling (110 miles from Chicago), the terminus of the new line then building to Clinton. How long we were making the trip I cannot say, but there were several lodgings in my bill for the round trip. We would run along for a few miles until out of steam, then stop and wait until steam came up again from natural draft, then we would proceed and repeat the operation. When making a meeting point, to save steam the water was allowed to run down, and in some instances it went so far beyond our vision that we had to restore it to sight by manipulating the plunger of the pump by hand with the bell cord.

At last we reached Sterling, and Mr. Ebbert, whether from disgust or business demands, as he alleged, took the first train back to Chicago and left me with the engine in charge of Mr. Burgess, who was foreman there, to take back to Chicago; telling him at the same time what a nice run we had out and what a pleasant trip he would have in going back with her. Burgess tumbled to the situation at once, and after Ebbert was out of sight removed the bonnet from the stack, took out the cone and reduced it to the size of a small wash basin. Our trip homeward was not so eventful, still there was enough of it to make fun for the boys and enliven their usual Sunday morning gatherings for some time. Some were so thoughtless as to tell that Burgess went into the field and hired a farmer to leave his plow and take his four horses and help take the engine over the hill. I never confessed; still it was current among the boys and many of them believe it unto this day.

The engine was intended for hauling the pay-car, superintendent's car and other light work. Before going out again, Ebbert discovered that the cone had been reduced, ordered it out again and had it enlarged, and herein lay the agony of my soul. The heater in the stack and the large cone almost precluded the possibility of the engine making steam. As this was my first trial as an engineer, these things weighed heavily upon me and cast a shadow over my prospects.

At this time the telegraph had not come into use with us for handling trains, and the boys when away from terminal stations would often make their own arrangements as to meeting points to suit themselves, regardless of card time or rules. This would often result in trouble to themselves, collisions of their engines, and a disagreeable contact with the "Old Man." The greatest divergence from card time was when coming to stations where they got their meals, and at other stations where trains met and where the men would meet around the table for a social conference and take dissolving views of the sweetening at the bottom of the glass. Half an hour or so of such gatherings was not an unusual occurrence. These arrangements were all very well when the same men were on the runs to meet each other, but when a strange man came out who knew nothing of their special agreements, chance only saved them from disastrous results.

I well recollect how one such an arrangement was abruptly ended. At one of the terminal stations the way freight left so early in the morning that the boys could not get breakfast. It was, however, arranged between the crews of the opposing trains that this train would stop at an intermediate station for breakfast, and the other train would hold back for them at the next station, which was their regular meeting point. But to facilitate their work and get breakfast the train which had the right to the road was held. One morning the superintendent unexpectedly appeared at the latter station and wanted to know why the train which had the right to the road did not proceed. The boys, ever ready with an answer, said they saw the smoke of an engine just beyond the station, and were waiting for them to come in, thinking they had broken down. The superintendent was somewhat incredulous, but the train soon coming in, the trainmen having their excuse at their tongue's end. A broken spring-hanger served as a pretense for the delay; the superintendent was satisfied, but this ended the special agreement of the boys on that division, and the telegraph soon coming into service prevented these little divergencies.

To get back to the "Pioneer": A new superintendent came on the road and was to go over the line. I was delegated to haul him with the "Pioneer." When coming to those uncertain points where the boys were liable to come in ahead of time, I would lay back, and the superintendent would come forward with his time-card and watch and urge me to go ahead. The appearance of smoke in the distance soon convinced him that I was acting according to time-card rules, taking the safe side in case of doubt. Our first trip was over the line to Sterling, then back to Dixon and then over the Illinois Central to Freeport. We reached Dixon in the evening, and when within a few miles of Freeport, the fire turned black, the steam went down and the engine stalled. Here we were on a strange road in a dark night, and not knowing just how far we were from the station. Fortunately we were only a few miles from the end of the journey. After standing awhile steam came up and we started, but soon came to a stand again for want of steam. After another trial or two, with the help of an easy grade, we finally reached the station. I reported the condition of affairs to the foreman and went to my lodgings. In the morning the engine was steamed up, and the foreman reported her all right. We coupled up to the car and started, but had barely passed the city limits when the fire and steam went back on us, as on the evening before. We however managed to get back to town, and I put the engine in the house and the superintendent put his car on the regular train and went to Chicago. After examining the front end, pipes, netting, etc., the foreman pronounced "nothing the matter with her;" but upon further examination I found the back half of the petticoat had collapsed and closed up the petticoat so that the exhausts were turned back into the flues. This remedied, we were soon on our way to Chicago, which we reached without mishap, except one little affair, which, but for the interference of our good fate, might have ended the future of the "Pioneer" and, perhaps, the days of the man and myself.

When reaching Elgin the freight was not due to leave the junction for some minutes. This was twelve miles away. I said to the fireman, "I think we can venture to the Fox River switch," which was about a mile away. We had scarcely got the switch open when a headlight appeared from around a curve and shone full in my face, and our engine only reached the limit post when the freight shot by us at twenty-five miles an hour. An examination of my watch showed that the freight was barely due to leave the second station east of us. This was another of the convenient divergencies the boys had from card time. Such were the chances a fellow took when running a wild train before the days of the telegraph.

Another incident occurred near this place, which also came near terminating the history of the "Pioneer." I was with the pay-car at Elgin (H. H. Porter was paymaster) coming east. A tail-end collision between the freight and a gravel train bunched several trains at this point, and necessitated my taking with the pay-car twenty empty flats to the next station. As we were about to back the cars on to the side track I looked back and saw Mr. Porter with his money-box rushing down the bank as fast as his feet could carry him. I stepped to the other side of the engine and saw the freight coming around the curve behind me. I immediately gave the engine steam ahead, and had scarcely got a move on her when the freight engine came crushing into our rear end, piling up flat cars, engine and box cars promiscuously. A misunderstanding among the trainmen was the cause of the accident. The number of flat cars behind the "Pioneer" relieved her from shock, and she came out of the battle unscathed.

The fates were again with us. Had we been a few car lengths further back on the side track, the "Pioneer" would have been doomed for the scrap heap.

A demand for the engine on a small branch out from the junction relieved me from running her, and also, perhaps, from an untimely end.

## The Progressive Plan.

Superintendent L. F. Loree and S. O. Noragon, foreman of engineers on the C. & P. division of the Pennsylvania road, have just instituted an innovation that the patrons of the road will surely appreciate. The firemen on the road, and there are 110 of them, are given an examination every year as to their fitness for promotion to the position of engineer. The examinations are very thorough. It is the purpose of the investigations to have two competent men on the engine at all times.

The examinations have resulted in some curious findings. One fireman who had been on the road eleven years only ranked 30 per cent. in the examination. Another who had been on the road but five months stood 75 per cent. The list of questions to be answered cover fifteen sheets of type-written copy.—*Cleveland World.*

## Collateral Security.

Mr. David McCargo, General Superintendent of the Allegheny Valley, tells of a very smart retort made by a young lady who was enjoying the novelty of a ride on one of his locomotives.

The lady and a gentleman, well known as a Pittsburgh capitalist, got up on the fireman's seat and the train started out. The road is noted for curves, and the gentleman put his arm around the lady's waist, remarking that this precaution was necessary to prevent her from being thrown off the seat by the lateral swing of the engine.

"Oh, I understand," remarked the girl, "there is lateral danger and you give me collateral security."

"Hardening cracks are more often the result of uneven heating than of any defect in the steel. Do not determine the quality of any steel by the appearance of the fracture of a piece. The grain, whether fine or coarse, depends principally on the heat at which it was finished by the hammer or rolls. Do not try to harden any bar of steel without first removing the scale from it." The above pointer is from a little catalogue of sizes of steel recently issued by the Crescent Steel Co., of Pittsburgh, Pa.

A dreadful boiler explosion happened to a locomotive belonging to the Chicago & Alton last month. The engine was pulling a freight train near Joliet when, without any warning, the boiler exploded, killing the fireman and head brakeman instantly and severely injuring the engineer. We have been unable to find out the cause of the accident, but it was no doubt due to broken stay-bolts or similar defects.

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## Smoke.

Smoke, like the poor, is always with us. The outward appearance of American cities every year make it more apparent that the smoke nuisance has come to stay. There may be some amelioration of the malady effected, but a thorough cure is hopeless. The increasing number of manufactories and metallurgical industries that must use bituminous coal serve to make the atmosphere of our cities more murky every year, and the increasing number of hard-worked locomotives pour upon rural scenes clouds of smoke that cannot be hid, and the eyesores of railroad origin move the rustic statesman to impose penalties. There are many nuisances far more injurious than smoke to the public health that are seldom heard of because they are not conspicuous. Smoke appeals to various senses, so that the objectionable features of the article are not likely to be overlooked.

For this reason there have always been periodic outbreaks against smoke ever since "sea coal" began to be used as fuel. There is an epidemic of acrimony against smoke in American cities at present, and it seems to be an opportune time to make some reflections upon the smoke question.

All bituminous coal contains resinous, tar-like ingredients that are known to chemists as hydro-carbons. These burn at a comparatively low temperature and make the flame and smoke of a fire. When the coal that has been put in a furnace or fire-box becomes heated to a certain temperature, the hydro-carbons are released and escape in the form of smoke and gas, the visible black part, which forms the smoke, being composed of very fine particles of pure carbon. The temperature required to release the hydro-carbons is not sufficiently high to convert them into flame. Under conditions favorable to smoke forming, these gases pass off as they are released from the coal. They contain very valuable heating qualities, and it is important in the interests of fuel economy that the hydro-carbon gases should be burned. The conditions necessary to convert these gases into flame are a hot fire and a supply of air at some point between the surface of the fuel and the entrance of the flues. The oxygen taken from the air is essential to the burning of the gases. Without that element the gas will pass off uselessly without generating heat, no matter how hot the temperature may be. When the volatile gases leave the coal the greater part of them are in an invisible condition, but on reaching the cooler portion above they go through a sort of condensing process and become smoke.

The means of preventing smoke, then, are the maintaining of a high furnace temperature and the providing of a liberal supply of air. In a furnace made for experiment, it is no difficult matter to regulate the supply of air just to suit the requirements of the gases passing from the fuel. When this is done smokeless combustion of soft coal is successfully carried out, and the fuel gives its highest heat-making duty. Those who have carried out experiments of this kind are ready to say that smoke prevention is merely a question of care and intelligence on the part of firemen.

Any one interested in smoke preventing can make interesting experiments with a common kerosene lamp. Cutting off the supply of air or cooling the chimney will show points about combustion that are far more impressive than a written article upon the subject.

The fire-box of a locomotive doing hard work, or the furnace of a factory boiler that has to be forced all the time presents difficulties in burning fuel economically that do not seem to be realized by those who experiment in laboratories. A high furnace temperature and a generous supply of air are antagonists not likely to exist together in the harmony that produces a smokeless fire. If there is a light fire and a strong blast, so much air will pass through that the fire-box temperature is likely to be reduced below the igniting point of the gases, and smoke will result. If the fire is thick, sufficient air will not be supplied to all the gases passing off, and they will go into the tubes in the form of smoke. The medium between these extremes is the center of economy; but it is next to impossible for a fireman to maintain the favorable conditions. If the fire has to be forced it is utterly impracticable. When a fire-box or furnace is large enough, so that steam can always be maintained with a mild draft, smoke can be prevented and the fuel burned economically. There are few fire-boxes or furnaces worked in this way.

When a fireman does his work in such fashion that the smokestack is constantly pouring out a stream of black smoke, the chances are that he is an inferior hand and an expensive man for his employers. Fuel can generally be burned to best advantage about half way between the black smoke and the smokeless conditions, that is, with a moderate amount of smoke. A brick arch or other means of mixing the gases as they pass through the furnace brings the point of economy toward the smokeless conditions. The firemen who work on roads where premium is paid for fuel-saving may be left to find out what kind of firing makes steam with the least consumption of coal. They have discovered that strict smoke-preventing and fuel-saving do not go together.

At present the representatives of railroad companies and owners of furnaces in cities are searching for the means of satisfying the demands of health authorities for the abatement of the smoke nuisance. With railroad men the trouble generally is, that the firemen have received no training whatever about how to keep down smoke, and the well-known provisions for regulating the admission of air to the fire-box have not been provided. When a spectator can stand on a height overlooking yards, where the switching engines belonging to a variety of railroads are at work, and see those belonging to certain companies painting the atmosphere black, while the engines belonging to other roads cause little smoke, the impression received is that there is bad management somewhere. The degree of smoke-prevention practicable would satisfy most sensible people if it were only carried out. If real and absolute prevention of smoke is called for, larger boilers or less duty for those in use is the remedy.

## Loss Due to Coupling Driving-Wheels.

Our versatile correspondent Mr. Wm. Barnett Le Van comes to the front in another column with an interesting article in support of his favorite theory, that locomotives with a single pair of drivers are the proper kind of motive power for high-speed trains. There are a great many good features about locomotives without coupling-rods, but there also are many shortcomings. The French engineer quoted by Mr. Le Van as finding that the frictional losses due to coupling the driving-wheels amounted to 25 per cent. of the total indicated horse-power is certainly making out an extreme case. If we remember rightly, Mr. Regray experimented with engines having one pair of drivers against others with two pairs coupled. If he had happened to try a decapod locomotive, the friction of the rods and extra driving-wheels would have used up more power than the cylinders developed, and the engine would have been useless. This may be carrying the line of reasoning to an absurd length, but it is no more absurd than the claim that 25 per cent. is wasted by the increased friction due to the side-rods of four-wheel connected locomotives.

The imputation is made by Mr. Le Van that the great fuel economy of British locomotives, as compared with those used in this country, is due principally to the absence of side-rods. We are not, by any means, prepared to admit that British-made locomotives are more economical of fuel than our own when doing the same work. It has not been found so in foreign countries, where British and American locomotives were worked together. The economy of the Webb locomotive, as compared to others on the Pennsylvania Railroad, is alluded to as if it afforded a striking contrast. The Webb engine is a compound, without coupling rods. The engine uses about 20 per cent. less fuel than class K engines when pulling the same train. This is just about the saving effected by other compound locomotives when working against simple engines on the same class of trains on other railroads. The Webb locomotive either saves no fuel through the compound working or she shows no marked economy of fuel over American engines when worked under similar conditions.

We believe that there is loss of useful effort due to the coupling of driving wheels together, and we are inclined to think that American locomotives are harder on fuel than those operated in Europe, but we feel certain that the magnitude of both sources of loss is greatly exaggerated.

## Taking Care of Air-Hose.

There are very few roads nowadays that do not pay considerable attention to the repairs of the brake apparatus, and most of the good lines have air-brake inspectors, whose duties are utilized to prevent rather than cure defects.

Great care is taken to see that the proper leverage is applied to cars; that the pistons travel between 6 and 8 inches; that the triples are oiled, etc., etc.; but who ever heard of an inspector, or anyone else, doing anything about a hose until it failed?

Surely nothing receives harder usage than the average brake-hose. Grease, the sworn enemy of rubber, is poured through them, heated by a pump whose air passages are choked by dust and grease, water collects in them; they are subject to varying pressures; are often located where they chafe against brake-beams or other apparatus, and they are expected to last for ever.

It would seem an easy matter to establish a limit for keeping hose in service; a time limit would seem to cover the necessities of the case. Certainly a hose should not be allowed to run until it fails. A limit should be established for the hose used between engine and tender, as these especially are subject to more ills than their neighbors on the cars that are uncoupled and drained regularly.

The writer was on an express train recently where the quick action went on with a bang when the train was within less than half a mile of the terminal—a hose between engine and tender had ruptured, there was no extra hose on the engine, and the train lost twenty minutes while they took the hose of the rear car and put it in place of the one that failed.

The old hose was porous and pulpy, showing the effects of grease, water and heat, having been in use since the engine came out of the shop.

The engineer of this train reported delay "on account of failure of brakes." Was it not a failure to inspect? A failure to prevent a delay that could be plainly foreseen? A failure to have some means to determine the safe life of a vital part of the air-brake mechanism—the very part that in the nature of things should be expected to fail first?

## The Reading Deal.

The greatest railroad deal ever effected was made last month by the Philadelphia & Reading Railroad Company securing control of the Lehigh Valley and the Jersey Central Railroads. The deal is extraordinary in more ways than on account of its magnitude. As an idea of the work done by these roads can be better obtained through the number of locomotives and cars used than by the mileage, our readers who are not familiar with the properties in question will understand the following statement: The Philadelphia & Reading Railroad consists of about 850 miles of track, which is operated by 650 locomotives and about 30,000 cars. This company has obtained control of the Lehigh Valley Railroad, which has about 1,855 miles of track, 610 locomotives, and, according to the *Railway Equipment Guide*, over 40,000 cars, and the Central Railroad of New Jersey, which has 630 miles of track, 420 locomotives and over 34,000 cars. In addition to that, the Reading or its friends have secured control of the lines leading from Pennsylvania to New England by the Poughkeepsie bridge and the New York & New England Railroad.

For years past the Philadelphia & Reading Railroad Company has been noted principally as being in a chronic semi-bankrupt condition. The present President and General Manager, Mr. McLeod, has done wonders to straighten out the company's financial embarrassments, but still the present deal very closely resembles the Scripture prophecy where lean kine came out of a river and swallowed up the fat ones. The deal puts almost the whole of the railroads handling anthracite coal under one management. Not a few consumers of this necessity of life are nervous about the effect of the combination on the price of coal. It will be well for all concerned if the enormous power thrown into the hands of one set of men is used wisely.

## Insure Reliable Air-Brakes.

In our January issue, after reviewing what has been done towards providing reliable air-brakes for freight trains, we urged that no new form of air-brake should be accepted by railroad companies without first undergoing tests to demonstrate its efficiency. Events have shown the soundness of the position we took on this question. A variety of air-brakes were coming into service, the owners claiming that they were as efficient as the Westinghouse automatic quick-acting air-brake, and that they were interchangeable with it. The Chicago, Burlington and Quincy had ordered a large number of New York air-brakes on new cars under construction. When the first lot of cars with that brake on were delivered the railroad company's mechanical officers made tests of the brake on a fifty-car train, and it was found that the quick action did not reach the last car in less than seventeen seconds. A brake of this kind is, of course, not safe to make an emergency stop with on a long train.

The New York Air Brake Company then got out a new triple valve, and tests were made with it last month on the C. B. & Q. and on the Lehigh Valley Railroad on fifty-car trains. The application was satisfactory on both roads; but all the brakes could not not be released by the engineer. From 10 to 50 per cent. of the brakes had to be released by bleeding.

Cars belonging to several fast freight lines, and some belonging to railroad companies have been equipped with the Lansberg brake. Within the last two months this brake has been subjected to tests by the mechanical officers of the Chicago, Milwaukee & St Paul, the Chicago and Northwestern, the Cleveland, Cincinnati, Chicago & St. Louis and of the Atchison, Topeka & Santa Fé, with the result in every case that the brake was declared away behind the M. C. B. requirements. In fact, this brake is not quick-acting under any circumstances.

The result of these discoveries has been that several railroad companies have given notice to their car inspectors and trainmen that none but Westinghouse brakes must be used in the controlling of trains.

A committee of the M. C. B Association on air-brakes has taken up the question, and it is likely soon to be forced to a practical settlement. Mr. G. W. Rhodes, who is chairman of the committee, speaking at a meeting held lately, insisted that all brakes offered to railroad companies should have to pass a practical test before being adopted. His idea was that, either through the agency of the Master Car Builders' Association or of the American Railway Association, there should be located at some central point a test rack, the equivalent of a fifty-car train, where tests of all brakes seeking patronage should be made. In his opinion, this was essential. For instance, some car-building company in filling an order might desire to place a cheap brake upon the cars turned out by them, but if it were requisite that any given brake should pass a satisfactory test at such a central station as that to be provided for, inferior devices would be barred necessarily from introduction. If cars were offered with a break of unknown efficiency, the question could be asked, Have you passed successfully the test at our standard test department? If the answer was in the negative, the railroads would be warranted in refusing the cars equipped with a brake not possessing the required certificate of efficiency.

This is putting the demand we made two months ago into practicable shape. We see no reason why a brake company, prepared to do a legitimate business and willing to provide a reliable brake, should object to the terms proposed.

## Standard Nuts and Bolts.

The Railway Master Mechanics Association have a committee investigating the subject of bolts and nuts, and they have directions to report at the next convention on the best size for nuts and bolt-heads, rough and finished. Some people might think that inquiring into this subject was like investigating the best form and size of screw threads, but the cases are not parallel. There is no disposition now to agitate in favor of screw threads different from the U. S. standard, but there is not nearly so much unanimity in regard to the sizes of nuts and bolt-heads. The standards for these were established at the same time as the standards for screw-threads, but some manufacturers of bolts were a long time in adopting the standard sizes, and this has led to confusion that is by no means ended to-day. A report on standard nuts and bolt-heads, with discussions on the subject by conventions and railroad clubs, would have a very good educational effect upon railroad men.

The more enlightened and progressive class of railway mechanics have been as ready to recognize the advantages of uniformity in screw-threads as the leaders in any line of engineering. Yet there are men in charge of important railroads who have not exhibited any of this spirit. Manufacturing concerns, that make anything for sale with bolts and nuts as parts, have been forced by the prevailing practice of the country to use standard sizes, consequently U. S. standards are universally adhered to in the trade outside of what might be called close corporations. Railroad companies we sometimes find to be very close corporations in their adherence to vicious practices. It may be highly flattering to insular egotism to specify the standard threads or nuts of the X. Y. & W. Railroad, but to men of enlightenment and good sense it is highly ridiculous.

While investigating this subject we have been very much surprised that there are still very large railroads in the United States, claiming to be first-class in every respect, that do not have a standard screw-tap in their shops, or at least a tap that would be considered good by a manufacturer. There is still in use for locomotive repair work all sorts of bastard sizes, and the men doing repairs waste more time annually searching for, or making nuts to suit threads different from the standard, than would pay for the scrapping of all odd sizes. On roads of this kind, the fact that there are standard sizes of nuts and bolt-heads is unknown. This condition of things comes from the reluctance of narrow minds to scrap a thing as long as it can be used. There is no more expensive policy possible, yet it is followed on the plea of economy.

Before looking into the condition of affairs we thought it would be insulting the intelligence of the men in charge of railroad rolling stock to ask them, at this late day, to discuss the propriety of adopting standard screw-threads and standard nuts and bolts. We have changed our minds, and consider that no subject could more profitably receive attention. If the investigation extended to the relative cost of purchasing bolts and screw-cutting tools from manufacturers, and the making of them in railroad shops, very interesting facts would be elicited.

## Rules of Locomotive Inspection.

The only way to use locomotives satisfactorily when chain-ganging is practiced is to introduce a system of thorough inspection at division points. The New York Central have lately established a system of inspection of running engines, and the following orders have been issued to the inspectors by Mr. Wm. Buchanan, Superintendent of Motive Power

1st—Examine grates in fire-boxes; see that they are properly connected, and that all bolts and keys are in place and grates not broken. Examine ash-pan; see that dampers are in good condition, and that the ashes do no not escape in the axle-box or wedges

2d—Examine all parts of engine and tender, all bolts and nuts, see that they are in proper position, and nuts screwed up; also that all pins and keys are in good order, provided when necessary, and none left out from any part of machinery Give particular attention to all bolts and nuts in eccentric straps and blades, and closely examine side-rods and crank-pins.

3d—Examine air-brake equipment throughout, and see that pump works properly, that pipes and connections are in good order, and no leaks in same; also that triple valve and reservoirs are properly drained. Examine steam-heating pipes, valves, etc.; see that they are in good order.

4th—Examine all spring and spring-hangers under engine and tender, see that they are not broken, and that bolts and keys in same are in good order. See that tender and engine pilot are correct height from rail.

5th—Examine bumpers on engine and tender; see that springs on hook-bumpers are in good order; also that all bolts, nuts and keys of same are in good shape; also see that link and pin for coupling are provided where necessary.

6th—Examine engine truck and tender journal and boxes, also brasses in same. See that they are all in good condition and each box properly packed; also that cellar bolts are in place and adjusted so that they will not lose out.

7th—Examine particularly driving-box cellars; see that they are properly packed and oiled. Examine top of driving-boxes, see that they are not filled with dirt and are provided with proper amount of waste, and if tallow or any other hard lubricating material is found on top of driving-box remove same and clean out holes.

8th—Examine all wheels and axles under engine and tender, see that tread of wheels is perfect and that there are no flat spots; also that flanges are not worn sharp and wheels not loose on axle.

9th—Examine driver and tender brakes and test same; see that brakes are properly adjusted so as to be effective, also that bolts in tender-brake are not badly worn, and that they are provided with proper keys.

10th—Examine and report all leaks in boiler and fire-box, leaking wash-out plugs, boiler connections and mountings.

11th—Examine weekly pipes in smoke-box and netting in same and in stack

NOTE—Inspectors on finding defects must immediately report the same to the person in charge, and will keep a record of all or any defects found by them, entering the same in the Inspection Book provided for this purpose, and under date of discovery, and in the same manner, under date, of when defects are remedied.

## Train Robber's Flight with a Locomotive.

A train robber running away with a freight locomotive on one track pursued by trainmen with an express engine on another track, was an actual occurrence on the New York Central Railroad last month. The imagination of dramatists or novelists never conceived anything more exciting or more dramatic.

A man, who was evidently an old trainman, boarded the American Express Company's special express matter train on the New York Central at Syracuse, concealed himself on the top of the cars, climbed over the express car, and by means of a rope ladder got down beside the window at the side of the car. This he smashed, and called upon the messenger to surrender. Instead of doing this, the messenger pulled the bell-cord and grasped his own revolver. A duel began, and the messenger was shot in the head and leg. The conductor of the train heard the whistle signal and stopped the train. The robber, who had got inside the express car, opened the side door and fired shots at the trainmen when they attempted to go near him. The conductor sent one of his brakemen back to the nearest station to telegraph an alarm, and gave the engineer a signal to go ahead, thinking they could capture the robber at a stopping-place where assistance would be got. At the next station reached the train was stopped and the express messenger was found to be badly wounded. The robber had disappeared. The train proceeded. When a stop was made at the next station an excited crowd collected, the news of the robbery having reached ahead. Among the crowd was noticed a man who had been seen on the platform at Syracuse. A sharp trainman reasoned that the stranger must have come on this train, and as there were no passengers, he must be the robber. On an attempt being made to arrest the man, he pulled out two revolvers and backed towards a freight engine that was at the station, pulled the pin, ordered the men off, and taking possession of the engine started out.

The express trainmen also acted promptly. They secured a shot-gun, uncoupled the engine from the passenger train and pursued the robber. There are four tracks on the New York Central, and the fugitive was on the freight track and the pursuing engine on the passenger track. The long-legged passenger engine soon overtook the freight mogul. When the robber saw his pursuers approaching he suddenly applied the brakes and reversed the engine. As the passenger engine flew past he fired a volley of shots into the cab. The passenger engine was quickly stopped and reversed, the robber following the same tactics. As the engines passed the second time the shot-gun was fired at the robber, and he returned the compliment with his revolver. No one was hit on either side.

The trainmen did not feel like continuing this novel sort of duel, so they returned to the station and got a sheriff and a reinforcement of guns. Then the pursuit was renewed. The robber deserted his engine at a road crossing and made for the woods. After an exciting chase he was captured and safely landed in jail.

The Vanderbilt roads centering in Buffalo have an arrangement of joint inspection of cars that is calculated to materially facilitate the movement of cars. The new plan is to keep cars moving forward as much as possible. When it is found that a car must be repaired before proceeding farther, instead of sending it back to the yard of the delivering road, it is repaired by the receiving road. Several modifications of the M. C. B. rules of interchange have been agreed upon. It is understood that the plan was worked out by Mr. A. M Waitt of the Lake Shore

A party signing himself "A Machinist" has gone to the trouble of writing to the *Railway Age* about hot pins on locomotives The funny statement is made that hot pins are nearly always caused by the lack of judgment in keying brasses. When men write to papers, pretending to throw light on subjects they are profoundly ignorant of, they deserve to be criticised. The correspondent referred to uses a wrong signature. If he wants people to know exactly his professional standing, he ought to subscribe himself "Ass."

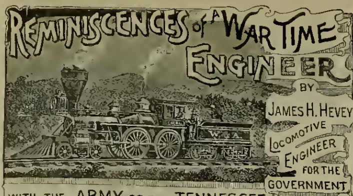
Railroad companies continue to display scandalous apathy toward supporting the recommendations of the M C B. Association Executive Committee in favor of gauges for the standard car coupler. Those that want to show themselves alive in the smallest way to the interests of interchangeable parts ought to order these templates from the Pratt & Whitney Co., without delay. The interchangeability in this case means finally the ability of one make of car coupler to couple with that of another make.

There is a point connected with the adjustment of the piston travel of air-brakes that ought to be more generally understood. If the travel is adjusted when a car is loaded and the brake is hung from a part of the car above the springs, the travel is different when the car is empty. The same is the case with a loaded car whose brake has been adjusted when the car was empty. If the piston is set at 6 inches on a loaded car it may stand at 4 inches when the same car is empty. If the piston is set at 6 inches when the car is empty it will probably stand at 8 inches when the car is loaded. It is good to make a note of these things.

### Luminous Paint.

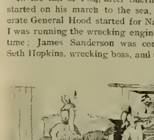
A foreman car painter writes us "I have been experimenting with luminous paint but have not hit it very well. There was some talk that luminous paint would be a good thing for switch targets and a great variety of other railroad things, and I have been trying to mix up color that would be luminous, but it does not shine at night worth a cent. I have use phosphorus as the base of my operations. Can you give me some pointers?"

The only pointers we can give are extracts from our scrap-book, which say. "For orange luminous paint, 46 parts varnish are mixed with 17.5 parts prepared barium sulphate, 1 part prepared Indian yellow, 1.5 parts prepared madder lake, and 38 parts luminous calcium sulphide. For yellow luminous paint, 48 parts varnish are mixed with 10 parts prepared barium sulphate, 8 parts barium chromate, and 34 parts luminous calcium sulphide For green luminous paint, 48 parts varnish are mixed with 10 parts prepared barium sulphate, 8 parts chromium oxide green, and 34 parts luminous calcium sulphide. A blue luminous paint is prepared from 42 parts varnish, 10.2 parts prepared barium sulphate, 6.4 parts ultramarine blue, 5.4 parts cobalt blue, and 46 parts luminous calcium sulphide. A violet luminous paint is made from 42 parts varnish, 10.2 parts prepared barium sulphate, 2.8 parts ultramarine violet, 9 parts cobaltous arsenate, and 36 parts luminous calcium sulphide. For gray luminous paint, 45 parts of the varnish are mixed with 6 parts prepared barium sulphate, 6 parts prepared calcium carbonate, 0.5 parts ultramarine blue, 6.5 parts gray zinc sulphide. For oil-color paints, use equal quantities of pure linseed in place of the varnish; the linseed oil must be cold pressed and thickened by heat. All the above luminous paints can be used in the manufacture of colored papers, etc, if the varnish is altogether omitted, and the dry mixtures are ground to a paste with water The luminous paints can also be used as wax colors for painting on glass and similar objects, by adding, instead of the varnish, 10 per cent. more of Japanese wax and one-fourth the quantity of the latter of olive oil. The wax colors prepared in this way may also be used for painting upon porcelain, and are then carefully burned without access of air. Paintings of this kind can also be treated with water glass."




### Two "Scares" at the Front.

In the fall of 1864, after Sherman had started on his march to the sea, Confederate General Hood started for Nashville I was running the wrecking engine at the time; James Sanderson was conductor, Seth Hopkins, wrecking boss, and Charley



Burnett, fireman. We had a train-guard of forty men in command of Lieut. Theodore Wilson, of the Fortieth Indiana Infantry, and were lying at Dalton, Ga., awaiting orders.

Chestnuts were beginning to ripen, and early one bright morning, several of the men and myself took axes and started for the woods, intending to cut down some of the trees for the purpose of securing the nuts. The men had partly cut some of the trees, when we were hailed from the road by a member of the First Georgia Cavalry, (there were two regiments recruited at Dalton in 1864), who warned us to get away from there, as Hood's whole army was coming up the Resaca road. We did not at first pay much attention to the warning, thinking perhaps he had an interest in saving the timber, he noticed that we made no move to "get out o' thar" and returned to us and called me to the road to see for myself. On going out to the road one look satisfied me, for as far as I could see the road was full of Confederate cavalry.

As quick as possible we made our way to Dalton. Our scout had spread the alarm, so that when we arrived all was hurry and bustle. It was every one for himself. As the fires were never drawn in the engines, it did not take long to get steam enough to get away. We had a code of whistle signals for calling the different members of the crew, also for calling the whole crew, this signal I sounded and all the crew responded except Hopkins. I called him several times, but he did not show up. Several trains had already left. The operators had gathered up their instruments and left on the first train for Chattanooga. A report came that the tunnel, at Tunnel Hill, had been blown up and we would have to go by the way of Cleveland. Citizens were leaving with their traps. The Eighth Missouri Battery had mounted and manned the guns on the breastwork overlooking the town. Infantry and cavalry were hurrrying in every direction.

By this time we had concluded that Old Seth had skipped on some other train. Everything had left except an officers' train of five coaches and ourselves. It was now a question of who should get out first, the special or us, as usual the officers got there first, leaving us to bring up the rear.

Leaving Dalton we heard the boom of one of the guns from the battery. We passed a large number of "refugees," some mounted, more afoot; all loaded down with plunder of some kind. When we reached Varnel's water-tank, we found trains strung out a long distance waiting for water which was being pumped by two very diminutive mules. As we had a good force of men and plenty of buckets, we started a bucket-gang from a convenient pond. In this manner we got two tanks of water, one for ourselves and one for the officers' special, and the men all got a drink of officers' whisky. All this time we had been worrying about 'Old Seth."

Having an errand to the caboose of the derrick car about this time, I made a discovery. On this caboose we kept coiled a 4-inch hawser, possibly a hundred feet long; it made quite a pyramid, and was so coiled that there was a large circular opening in the center. The whole coil was covered by a canvas tarpaulin. Thinking I heard something move, I raised the canvas and there, coiled up nicely, I found "Old Seth," who put up his hand, cautioning me not to make a noise, at the same time chuckling to himself about what a safe place he had secured.

I got on my dignity and demanded his reasons for not showing up when I called

him. He informed me that he had that rope coiled in that cab expressly for the purpose he was now using it." Because, you know, George (he always called me George), that no bullet could get through this coil of rope." I told him it was not using me right to cause me so much uneasiness on his account; that we came near getting captured by waiting for him. "Well," said he, "didn't that pesky critter on the hoss tell you to 'git!'"

"But, say, George, where are we? Are we safe now, and can I come out?"

I told him we would not be safe until we got to Chattanooga, and he did not leave his safe retreat until we were sidetracked there.

We arrived at Cleveland, where all was hurry scurry to get away; every train was loaded with refugees. The fort at Cleveland was dismantled, and the guns sent to Chattanooga. We arrived there about 10 o'clock that night, and every man was pressed into the service of throwing up breastworks.

The whole thing was a scare, except for a small skirmish at Dalton, where the depot was burned and a few negro soldiers killed.

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I want to relate a comical incident that took place at Stephenson, Ala., in the fall of 1864. It had been raining almost continuously for several days; the mud was hub-deep to the army wagons and about the consistency of corn meal batter; I was sitting on my engine reading when I was accosted by a native, a genuine mountaineer, with. "Say, mister!"

I looked out and saw in the middle of the wagon road a very lank specimen of a mule, on which was a woman and two packed baskets.

"Is there a steam horn on your kar, mister?"

"Yes," I answered, for I knew he referred to the whistle.

"Mister, will you please toot your kar horn, my wife likes to hear it"

Now, I had that whistle so it was a terror on the screech; I asked the man if it would not frighten the mule. "No; nothing ever 'scart' that mule."

With this assurance, I let her screech. In less than a minute that mule was over a hundred yards from the woman and the baskets, which were landed in the mud. The man made no effort to assist his fallen spouse; he looked very much surprised, and I said to him.

"You made a mistake, my friend, your mule fooled you."

"No, stranger, he fooled the old woman; but I say, stranger, that is the first 'pesky' thing that I ever 'seed' that would scare that mule."

The last I saw of the pair they were following after the mule.

James H. Hevey

### The Way the Yankees Tied Up a Rebel Locomotive.

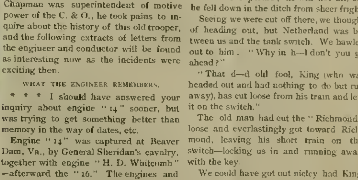
The Chesapeake & Ohio road recently cut up engine "14," one of the old timers, and a wounded veteran of the war. The "14" was wounded and left on the field for dead at Beaver Dam, Va., during the progress of the Battle of the Wilderness. Her engineer and conductor are still alive, and from them the story of her mishap is gleaned.

Some four years ago, while Mr. T. L. Chapman was superintendent of motive power of the C. & O., he took pains to inquire about the history of this old trooper, and the following extracts of letters from the engineer and conductor will be found as interesting now as the incidents were exciting then.

WHAT THE ENGINEER REMEMBERS.

* * * I should have answered your inquiry about engine "14" sooner, but was trying to get something better than memory in the way of dates, etc.

Engine "14" was captured at Beaver Dam, Va., by General Sheridan's cavalry, together with engine "H. D. Whitcomb"—afterward the "16." The engines and cars were burned and a cannon ball was




shot through the boiler of the "14" just back of her checks and under her dome. This happened while both armies were at or around Spottsylvania Court House, and just before or during the Battle of the Wilderness. I was running the "14" at the time she surrendered, but my conductor, Capt. C. S. Anderson, remembers the circumstances better than I do, and will enjoy telling you about our narrow escape and the foot race we ran through the fields and woods with the bullets of Sheridan's cavalry whizzing around our ears.

R. J. GOODWIN.

*Charlottesville, Va.*

THE CONDUCTOR'S STORY.

* * * It is with mingled feelings of pleasure and sorrow that I recall the incident of our war experience at Beaver Dam, in May, 1864.

Grant and Lee had fought along down the line from Culpepper to opposite Beaver Dam, in Spottsylvania County, when General Superintendent Whitcomb got orders to move supplies from Gordonsville to Beaver Dam.

We had everything in the shape of power that we could rake and scrape, even to the little old "Richmond," with old man King on her. Well, we got four or five trains to Beaver Dam one afternoon, and all was bustle. Some of the trains were waiting orders, some unloading, and some waiting to get up to the pile of bacon—the largest some of us had seen.

I remember that Rob Goodwin and I were on the depot track nearest to the west switch. "Lex" Netherland was just ahead unloading, and the empties were ahead of him on a long siding that has since been taken up, it ran cast, but had a "cross-over," or "run-out," near the depot.

Some one said "Three hundred Federal prisoners are coming, and in sight" At once there was a dispute as to who should take them to Richmond. We had wasted ten or fifteen minutes in this discussion, when all at once, over the country road opposite the depot and the other side of the trains, we heard firing, which increased rapidly—it was Sheridan's cavalry firing on our guard

It was some minutes before we could realize what had happened, it was all so sudden, but it lasted only a few moments, and then we commenced to figure on escape.

Rob and I wanted to back right out of the west switch, and I ordered the negro brakeman to throw the switch; he ran past the rear of the train, but a bullet reminded him of his exposure; he was not hit, but he fell down in the ditch from sheer fright.

Seeing we were cut off there, we thought of heading out, but Netherland was between us and the tank switch. We bawled out to him. "Why in h—l don't you go ahead?"

"That d—d old fool, King (who was headed out and had nothing to do but run away), has cut loose from his train and left it on the switch."

The old man had cut the "Richmond" loose and everlastingly got toward Richmond, leaving his short train on the switch—locking us in and running away with the key.

We could have got out nicley had King taken his train, as the firing was done by Sheridan's advance guard only—the main body had not yet come up.

When we saw there was no hope of getting the engines away, we all started in a general southern direction, on foot, scattering through the woods and fields.

Night soon came on, and the cavalry burned everything, the bacon lighting the country around for miles.

Bob and I stuck together, and, after dodging about for a time, concluded to go into Philips graveyard, near the cut west of Beaver Dam, and watch until the Yankees left. We were soon driven out by skirmishers, and came near being killed, the whole line firing at us as we ran down the hill. I fell into a ditch, and Bob fell down on top of me, but I laid low; it was dark, and I thought it was a Yankee, sure. Bob seemed to think I was a "Yank," for he got up and ran like a whitehead.

I ran, too, but in a somewhat different direction; we came together after a while, and went to the house of the father of one of the railroad men named Hall, and spent the rest of the night.

We trudged back to Beaver Dam the next day, getting in there in the afternoon. We found that about thirty-five cars and all the engines had been burned; all the car irons lay on top of the trucks, spaced off the proper distance, like skeletons, just where the fire had left them.

I remember the "14's" cannon shot; it was an ugly looking hole right through the boiler; I never expected to see her run again.

Mr. King and the little old "Richmond" received great praise and glory from the public for their nerve and daring in making their escape, but they got many a curse from us for running away and leaving their train in front of us.

CARTER S. ANDERSON.

*Richmond, Va.*

The "14" was an 8-wheeler; cylinders, 15x22 in., 60-inch drivers, and weighed 55,400 lbs. She was built in June, 1855, by the New Jersey Locomotive & Machine Co. at Jersey City, N. J. The engraving shows form of boiler and the patch over her "wound."

## New Shops for Cedar Rapids.

The Burlington, Cedar Rapids & Northern Railway Company are about to expend $100,000 in making shop and yard improvements at Cedar Rapids, Ia. Among the things to be done are the building of a new car-erecting shop and a new twenty-five-stall roundhouse. Both buildings will be put up in first-class style, and equipped with the most approved tools. Beside the shop there is a large stagnant slough, which is a source of disease to the shop men and to the citizens generally. A great portion of this will be filled up and turned into yards and sites for buildings.

The new car shop will be 221 x 86 feet, and 32 feet in height. It will be of brick, with an iron truss roof. The shop will have a capacity of 22 box cars per month, if the company should decide to build their cars. For some time to come it can be kept busy with repairs.

The Supreme Court of Texas has rendered a decision that ought to rouse every railroad man in Texas to demand an amendment of the law. The case was know as that of Turner *v.* Cross & Eddy, Receivers of the Missouri, Kansas & Texas Railroad. John Turner's mother was suing for damages for the death of her son, who was killed on the railroad named. The case went to the Supreme Court on appeal, and the judges decided that the receivers were not liable to pay the damages because the law mentions specifically as liable owners, proprietors, etc., but says nothing about receivers. The decision is an iniquitous straining of a technicality to defeat justice. The first thing that Texas railroad men should do is to have the wording of the law amended to take in receivers. Their next duty is, to have judges appointed to the Supreme Court who are not likely to strain the law to favor corporations and against popular rights.

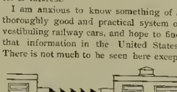
Col. Hain, of the New York Elevated roads, has issued an order prohibiting the practice of chewing tobacco by the trainmen, and it is stated that among other questions asked an applicant for work the one, "Do you chew tobacco?" is an important one.


## From Holland.

*Editors:*

I have long been an interested reader of your valuable paper, and note that in your new heading you include "rolling stock," so I expect to have your opinion on a matter of interest.

I am anxious to know something of a thoroughly good and practical system of vestibuling railway cars, and hope to find that information in the United States. There is not much to be seen here except



in some spare cases, such as the state trains of monarchs, where leather bags of accordion shape are being used.

I would be much obliged if you could give me any information, either print or drawings, of these weather-proof inter communications between railway cars as used in America.

TH. A. BERTRAND,

Managing Engineer Dutch State Ry. Shops, Loco. and Rolling Stock Dept.

*Utrecht, Holland.*

[Our illustration shows the modern American vestibule, the photograph being taken from the Pennsylvania's limited train. The end platform and entrance to American cars makes the vestibule particularly adapted to them, the hood or roof extension over the platform is strongly framed and able to carry the top of the vestibule extension. The combined door frame and friction plate in this style of vestibule, the Pullman pattern, is made of wrought iron about ¼-inch thick and 6-inch wide on the face; this frame is supported and pushed out from the end of the car by four rods running back into spring pockets in the car frame. When the cars are coupled together these door frames of iron are pressed closely against each other, making a very tight joint, but permitting of free movement of each car. The platform proper has folding doors on each side into the vestibule; over the ends of the platform and to the front of the vestibule, as well as on top, a rubber sheet, folded like an accordion, is used. The Wagner vestibule is like the Pullman in appearance, but has no buffer springs to secure contact; the door frames are free to move, within certain limits, and are clamped together, the movement due to running being all accounted for in the rubber connections. These vestibules are lighted, and have a rubber mat from one platform to the other; it is perfectly safe and easy to pass from end to end of a vestibuled train; keeps the cars clean from cinders and prevents fully one-half the noise being heard. Vestibule trains, however, are more difficult to ventilate properly.]


## Boiler Explosions—The Cause and the Remedy.

*Editors:*

When a boiler explodes it is always from *one cause*, and that is, *the strength of the boiler was not equal to the strain that was brought to bear upon it.* There are very few cases on record where there was any undue pressure on boiler at the time of explosion, and that proves the fact that nearly all explosions result from depreciation of strength of boiler during its time of service.

The question is often asked, "Who built the boiler?" which often leads to an unjust criticism upon the maker. The question that should be asked is, "Who has had charge of the boiler since in service?"

The deterioration of boilers occur from many causes. Some that may be termed *natural*, and many that should be classed *unnatural*. The former come under the head of unavoidable and the latter negligence.

When boilers are constructed in a form best suited for durability, they require much less attention than other boilers, which are constructed so that it is possible to use them under special conditions, regardless of form. This type of boiler is often used on locomotives, and are limited to a certain space and width of fire-box, regardless of size of the cylinder part of boiler. The 40-inch boiler has the same width of fire-box as the 72-inch, and this prevents the possibility of having a good design of boiler.

When the shape of any boiler is such that an undue strain is put upon it with every change of heat or pressure, it then commences to tear itself to pieces as soon as it goes into service, and the difference between the life of such a boiler and one of the best form possible is as great as the difference between old age and quick consumption.

It is out of the question to have all boilers made in the best form for durability, and meet the many requirements that are demanded of them, and when this fact is plain it then becomes the duty of those having charge of boilers to govern their work accordingly.

The worst form of boiler can be kept in safe condition by proper inspection and repairs, the cost of which will be in proportion to the form and amount of pressure carried. One of the greatest troubles that exists in having boilers cared for, is that those having charge of the work will base their opinion and actions on who made the boiler, and how long some other one has run without repairs, not taking into consideration that they are of very different form and in different service.

When you come to the locomotive boiler, it will be seen that nearly all explosions are caused by the failure of stay-bolts, and when this is not the cause the next most prolific cause is the hot crown sheet, which becomes weak by over-heat, and the result is it goes down, leaving the stay-bolts. The only remedy for this is to keep water on the crown sheet when there is a fire under it, and that is much less trouble than it is to always keep good stay-bolts in a boiler, which is one of the most important points, and requiring more judgment than any other thing in the care of boilers. It can only be done by constant inspection by careful and competent inspectors, the best of which will make some mistakes, but when doing so they will generally be on the side of safety, as in case of thinking that a bolt is broken when it is not, this always results in getting a new one in place of an old one, which if not broken, is much more likely to break than one just put in.

There are many locomotives now running with boilers from twenty to twenty-five years old, and are apparently good, and in fact prove themselves so by not giving any trouble. Such boilers have been cared for properly, as the design of them warranted.

When those having charge of boilers become aware that different forms of them require different care, then and then only will the number of explosions become less.

In the majority of cases the builder does not have anything to say about the form of the boiler he makes, and when anything happens to one through negligence in its use and care, then the builder is often unjustly censured.

This idea of economy in using high steam, as is done by many, is one of the most fruitful sources of the deterioration of boilers; for in many cases where it was intended to carry only 125, when engine was new, they have been loaded down to 150 after many years' service, without making any extra provision for strength, except giving the engine a repair and painting. Every cause will produce an effect. How long must this state of things continue?

FAIR PLAY.

*Philadelphia, Pa.*

## Metallic Packing Diseases.

*Editors:*

Your answer to Question 16 in February number is just a little misleading. You say run without anything or disconnect. What's the matter with replacing the worn-out rings with hemp? This can be done by taking off the gland and spring, and filling the stuffing-box with whatever may be handy in the shape of packing; this will answer to get engine and full train over a 200-mile division. It will be necessary to disconnect the valve-rod from valve-stem, in order to get spring out of box, and the same will have to be done with the piston. You will, no doubt, say this kind of work would not be practica-

ble, but under ordinary circumstances, valve-stem or piston can be changed from metallic or spring packing to the old style of hemp, or "hay consumers," in twenty minutes. "NEMO."

*Marquette, Mich.*

[We should say decidedly that taking piston-rod out of cross-head on the road was impracticable; the valve-stem might do. If Jerome packing is used new rings can be put in at any time without disconnecting stem or rod. With small chance to compress fibrous packing into a hole recently occupied by metallic, we have little faith in its staying there long. We tried it.]

## How Much of a Machinist Should a Locomotive Engineer be?

THE MACHINIST END OF THE QUESTION.

*Editors:*

Clinton B. Conger, Esq., has an article on this ques ion in your February number, and throws down his gage to the machinists by saying "Let us hear from the machinist end of this question." I humbly accept the challenge, though I fear I will prove but a poor champion.

In the first place, I am a machinist who believes that it is not absolutely necessary for an engineer to be a machinist also, but I see no good or valid reason why a machinist should not make as good a man with an engine as a man from off the farm, or out of the wiping gang, sand-sifters, or coal-heavers, from whose ranks the engineers, as at present constituted, are largely recruited. It seems to need no argument to prove this; it is patent of itself; yet we hear it constantly asserted that machinist runners "are no good;" on the other hand, most machinists insist that no man but one who thoroughly understands the machine should be allowed to run it. I differ from this view, because it matters not how expert as a machinist you are, if you are so fortunate as to be running, you are not expected to work as a machinist in these days, but experience as a machinist ought not, and I think cannot, justly be considered a drawback to such a man, while I can't see that a man's experience as a farmer, or a sand-sifter would be of *any* advantage to him as an engineer; therefore it follows that the machinist is, or should be, the better man.

The machinists are not the only men that fail as engineers; the only thing that gives color to the accepted belief that machinist runners "are no good" is the small proportion of them that ever get a chance, hence the failures are made more conspicuous. I would like to prick that fallacy expressed by Mr. Conger: "He is then more apt to think of the way his engine is built, her weak parts, and how to help them, than getting his train in on time when late." This is a delicious morsel that the anti-machinist men lay close under their tongues. I have heard it time and again, and I am sure there is no more misleading slander against the machinist than this. The engine is not expected to break down, no man can tell when she will give way, unless it be some disintegration that would be plain to any one, no one understands this better than a machinist, consequently I am firmly of the opinion that our machinist-engineer doesn't trouble his brains about what, when, or where she is going to give out.

I have seen an engineer set a jack under the back driving-axle to jack the engine up in replacing her on the track. I have seen an engineer in taking down side-rods work himself hard for a half-hour or more trying to get the keys out so the straps would pull off, when in this case the keys were no obstacle to taking off the straps, as it was the back ends he was taking down, and the key was back of the pin, the keys fitted snug, and were burred a little by set-screw. I have seen an engineer report that his injector-throttle could not be opened, when it was already wide open. An engineer once wanted me to tighten down the expansion-plates so they couldn't work. Another one asked me to tighten down bottom end of right-heel brace, "it kept working." I explained to him that it was built that way, and was doing just what it ought to do; "Then, for God's sake," he said, "fix the left one, so it will work, for it is tight." I knew an engineer who was unlucky enough to slip an eccentric, and he absolutely knew nothing of how to proceed to set it; he threw away every wrench on the engine and was towed in; because he had "no wrenches to fit the set-screws," he was discovered in this ruse, and discharged for it. Now, I submit that men who aspire to run locomotives should at least be machinist enough to avoid such shallow pitfalls as these.

Now, there is no denying the fact that the large majority of engineers are fully the equal in lack of mechanical ability of the several individuals mentioned above, hence the strenuous efforts put forth by some of the more progressive ones, such as Mr. Conger, John A. Hill and others (who certainly, by their faith and works, prove the necessity of it) to bring them up to a higher standard, which is a point we should all strive for, both machinist and engineer; and while it is not necessary for an engineer to be a first-class machinist, I am decidedly of the opinion that the engineers' standard of excellence could be improved in no better way than by admitting machinists to the degree of the "eagle-eyed."

And, now, a word of apology. I hope I have given no man umbrage in this article; I had to draw the contrast sharply between engineer and machinist to make points clear. I think the man who has risen from an humble station to a higher one is more entitled to honor than the one who had a better start in life. I have more respect for the "Prince on the dung-heap than the beggar on the throne;" if you will allow me to reverse the proverb, or, perhaps, the old and often-used lines

"Honor and fame from no condition rise,
Act well your part, there all the honor lies"

suit better.

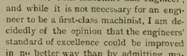
W. H. WESLEY.

*Nashville, Tenn.*

## Tool for Grinding Inside Check-Valves.

*Editors:*

I got up some time ago a very useful and convenient tool for grinding inside check-valves on the boiler, and, thinking it might be interesting, I inclose drawing and description, from which it will be understood:



A is a round, steel rod, one end bent to form a hook, and a crank fastened to the other end, as shown; D is a round handle, turning freely on A, between collars B and C, fastened tight to A by pins, as shown.

In order to grind a valve, the tool is held in the left hand by D; the hook is hooked in the valve, and the valve is turned by the crank E with the right hand.

Any desired pressure can be brought to bear on the valve with the left hand, while with the right a steady rotation to the right or left can be kept up. By the use of this tool a valve can be ground much more quickly and thoroughly than by the use of the old-style hook, worked backward and forward with one hand.

DAVID M. PERINE.

*Baltimore, Md.*

## Keying the Main Rod.

*Editors:*

In your answers to correspondents, No. 18, you say the "lower back or forward upper eighth is the proper place to key the back end of main rod brasses." I beg to differ with you, and will give my reasons. There is comparatively no strain or pressure on main pin on the *center*, hence that is the largest part of the pin and the *proper* place to key the brasses. The reverse is the case with the wrist-pin or front end of main rod. Owing to the up and down motion of back end of main rod the wear on wrist-pin and brasses is in a line with center of cylinder and axle (in a horizontal engine), and pin is smallest there, and would be a bad place to key up on; hence the proper places to key main rod is on center for back end, and quarter for front end. Prove this wrong and I'll apologize. E. J. RAUCH.

*Manhattan Shops, N. Y.*

[It goes without saying that the greatest wear on the main pin will be at the point where it bears the greatest pressure. That this point is the dead center it is not hard to prove. When the piston is at or near the dead center there is some pressure on it due to compression, and this is supplemented by the lead, and steam is admitted at this point nearer to boiler pressure than at any other. All indicator cards show the highest pressure when the piston is leaving the end of the cylinder. From the center to nearly the end of the stroke the pressure diminishes. This is as true of the front end of the rod as of the back end. We believe that all will agree that the brass should not be keyed across the narrowest part of the pin, and this is certainly at or a little past the dead center.]

## A Presentiment.

*Editors:*

It is an old maxim that coming events cast their shadows before. I will relate a circumstance which happened to me, my life being undoubtedly saved by being forewarned of danger. During the spring of 1871, I was running engine 71 on the M. & O. R. R. I was pulling the express train between Jackson, Tenn., and Columbus, Ky. I would go north in the morning and south at night. We left Columbus one evening about 6.30; black clouds appeared in the southwest and the thunder and lightning was terrific. I had only gone two or three stations when the rain came down in torrents; sometimes the wind seemed as though it would blow the engine and train off the track, at other times there would not be much wind but the lightning was terrible. But I ran along on time until I got about two miles south of Dyer station, when I saw the top of a large tree on the track. I called for brakes and reversed, but could not stop until I went through it; but it did no damage except battering up the steam-chest and cylinder casing. We lost a little time in clearing out the limbs from under the cars, and as I came into Trenton a perfect hurricane of wind and storm struck us. I could hardly find the station; I could not see the smokestack, but it was over in a few minutes.

As I was leaving Trenton, about the time I passed over the south switch I pulled out my watch to see the time, and I said to myself "Eight minutes behind time." About that time it seemed as though I was shocked with electricity, and something said to me: "Yes, and a big tree across the track ahead of you."

I was sitting on my seat, and this shock seemed to weaken me so I don't think I could have lifted five pounds, but in a few minutes was all right again. I was fully satisfied in my own mind that I would find a tree across the track before I got to Humbolt. By the flashes of lightning I could see the track as far as though it was daylight. I kept on running at a good rate until the storm got far behind me, and the flashes were very dim in front. By that time I was within two miles of Humbolt. Then I had a field to go through of about three-quarters of a mile; then it was heavy timber to the north switch at Humboldt. Just before I got to the timber, I shut off steam and let her roll along slow. After I got in the timber about a quarter of a mile, I was running not more than seven or eight miles an hour, it was sprinkling rain, just enough to keep my headlight glass wet, so I could not see more than about fifty feet ahead. I was standing up with my head out at the side window and my hand at the reverse lever, when I saw a tree about one foot in diameter lying across the track.

I then immediately reversed and gave her steam. She struck the tree and shoved it about four feet; then she stopped. It mashed the pilot back under the trucks, and turned the trucks crosswise of the track. This tree lay within fifteen or twenty feet of a deep ravine, with a culvert in it, and had I been running at my usual speed along there, the engine would have certainly turned end over end; then my fireman and myself would have had a poor chance of saving ourselves from a sudden death.

Conductor James Bright and Superintendent M. M. Miller, who was on the train, came out to the engine, and Mr. Miller asked me what was the trouble. I told him I ran into a tree and was off the track. He said, "Did anyone flag you?" I told him no. He said, "I don't understand how you happened to be running so slow." I told him I understood it. We went to work and got the engine on the track, and went in a couple of hours late. I did not tell anyone that night about being warned of danger, but the next trip I told Mr. Bright all about it, and he said he could not help but believe me. James Bright is now keeping the Robinson House in Jackson, Tenn.

If anyone has any doubt about this story being true, I will swear to it if they wish me to. ALEX. CUNNINGHAM.

*Pine Bluff, Ark.*

## Releasing of Brake When Valve is "On Lap."

*Editors.*

I ask the question: I reduce ten pounds, place the valve on lap, and the air in drum and train-pipe equates and brakes release. What is the matter with engineer's valve? WM. LANSING.

*Clinton, Iowa.*

[Probably air leaks under the main valve.]

## Storage Electric Car Lighting.

*Editors:*

As a matter of information, I wish to advise that we have been testing for the past two weeks a storage electric light system on two of our cars running between Cincinnati and Washington; one combination passenger and baggage, and the other a coach, the coach having eight 16-candle power lamps, and the combination car five. The coach is equipped with 24 cells of W. L. Silvey's storage battery, the combination 12, which are placed in crates of 6 cells each. These crates are placed in boxes, bolted to the bottom of the car at right angles to the length of the car. The batteries are charged at Cincinnati and will make the round trip between Cincinnati and Washington, giving us between thirty-five and forty hours lighting, full candle power of the lamps. The batteries can be changed in a train of five or six cars, by two men, in less than an hour's time. Enough batteries for fifty cars can be charged in the same length of time as it would take to charge for one car. It will take from eight to ten hours to charge the batteries to their fullest capacity after having been exhausted, all of which can be handled by one dynamo engineer and electrician. The lights are simple and are very easily manipulated. The ordinary trainman can operate them without any difficulty or any liability of damage to the system.

I am of the opinion that this light can be produced at a much less cost than the present system of electric lighting, where electricity is generated by a dynamo in the train. The Silvey storage battery is a

new device and has until recently been unknown. I consider it nearest to perfection of any I have seen. There is no danger with this battery of plates bending or buckling, which has been a great source of annoyance with all other batteries that have been used for this purpose.

I give you this as a matter of information, thinking perhaps you would like to look into the subject more fully. Mr. Silvey or our Mr. Haller, at Covington, Ky., would explain the details of the system.

W. GARSTANG,
Chesapeake & O. R. R.

*Richmond, Va., Feb. 3, 1892.*

## How to Thaw Out an Engine.

*Editors:*

An experience I had some winters since may be of benefit at some time to some reader of LOCOMOTIVE ENGINEERING in the cold, frozen North, and while the topic mentioned above is a seasonable one, a relation of the circumstance will go to show that an engineer can sometimes learn of a division superintendent, provided they get near enough together and are both in a frame of mind to give and receive information.

At the time of which I write I was going West on freight with a little old 16x24-inch "Tweed"—the 69, I believe. There was a heavy fall of snow on the ground, with the "cuts" full and flanges "bad."

This particular engine was a great student of the Signal Service reports, and no sooner was a snow-storm bulletined than she would begin to skip and dance in anticipation of the first "beautiful" she should find on the rail, and when she struck a drift or a frosty rail she did not seem to weigh a pound.

The weather had been favorable all day, but as evening approached the air showed indications of a change, and an hour later we were in a veritable blizzard, slightly broken by a small body of timber. We had arrived within about ten miles of the end of our run and the remainder of the trip lay over an open prairie, where many a better engine and more experienced engineer had "laid quietly down" and waited to be "shoveled out." We had two cars of live stock in the train which it was very desirable to have brought through to the division station, and on our arrival at "The Springs" the train dispatcher asked us if we thought we could get through with the stock and caboose. We were in a valley surrounded with timber, and it was a difficult matter to judge of the force of the storm on the open prairie; besides, there was a good supply of water there, and we had coal enough for several hours of standing on the side track, and there were good boarding accommodations at hand. So, after taking in the whole situation, we "wired the office" that we considered it extremely doubtful. However, we got orders to take the stock and come ahead.

The first mile and a half was up a 50-feet grade, and by the time we were at the top of the hill it was apparent to "Charlie" and I that we had undertaken a big job. The old 69 had been nobody's pet for a good while, and no friendly hand had chinked up the holes and cracks about the cab as is usually done by men on regular engines in that latitude in the winter season. The result was that myself and fireman did not see each other from the time we struck the first drift until we stopped on an open piece of track about four miles from the start. The fuel was about equal parts of snow and coal, and with the engine slipping it was not surprising that the steam pressure was low, as well as the water line in the boiler. We had a short piece of clear track on a down-grade for a start, and, after filling her up with water and getting her "hot," we started to make the final run that was to land us at home or —— elsewhere, and "elsewhere" caught us. We were now less than three miles from home, at about ten o'clock at night, with the wind blowing from the northwest over an unbroken plain, and colder than "Jehu." We had plenty of water and some coal, and there was nothing to do but make ourselves as comfortable as we could and keep the old kettle alive as long as the fuel held out or until a "rescuing" party arrived. Next morning a section gang arrived "overland" and assisted in getting hay and corn for the stock, and from a farm-house near by we got a substantial breakfast. It was still cold and blowing, but not snowing. About noon the supply of coal gave out, and we proceeded to lay the "old girl" out in the regulation style. We took everything down on the left (south) side preparatory to being "towed in," but put off our attack on right side until the weather had modified as much as possible. The engine was almost a solid mass of ice and frozen snow, especially on the north side, and, when late in the afternoon a "snow-bucking" outfit showed up and the disagreeable job of disconnecting that side could no longer be delayed, I applied the regulation invigorator—burning waste saturated with kerosene—to the mass of ice and iron; it made about as much impression as a parlor match would on a cupola charged with scrap-iron. It is needless, perhaps, to say that when the rescuing party arrived the noble 69 was not ready to "tow," and your humble young engineer was not a little embarrassed, the more so as Division Superintendent Fred. Underwood was with the party. Upon his inquiry as to what was the matter, I explained that owing to the "froze up" condition of things I could not get her disconnected on the right side. The superintendent took a brief survey of the situation, and soon noticed a pile of hay that had been left after feeding the stock, and he at once directed the men to bring it and distribute it about the engine. We tucked it in around her links and eccentrics and machinery in a way that reminded me a good deal of the way I used to fix the schoolma'am for a trip to spelling-school not so many years before. The torch was applied to that hay, and the way the ice slid off of that old "scrap pile" was a sight to restore the circulation in the veins of a benumbed engineer. It is surprising how little hay or straw is required to do the work, and the secret of its success is that it burns up quickly, warming all parts at once, and goes out before any of the parts become overheated. We had to use a few shovelfuls of snow to protect the running-boards, and did not put any hay far enough back to affect the cab.

This remedy is not applicable where depots or other inflammable structures are in close proximity, as the afore-mentioned superintendent informed me he used the same means to liberate some engines frozen in alongside of a coal-shed on the S. M. once, and it brought the engines out all right, but they had to "hustle" to save the coal-sheds. This same superintendent was, the last I knew of him, burning Ha—vanas in a better position on the "Soo Line," and I have emigrated to a clime where the snow-balls do not cluster in such luxuriant profusion.

AB. TUCKER.

*Chillicothe, Mo.*

## Road Tests of Air-Brakes.

*Editors:*

Correspondents of the two preceding numbers of this paper have very different ideas about the testing of air-brakes, each stating a certain reduction of train-pipe pressure as necessary to a satisfactory test.

Cars arriving at terminal or lay-over points, shop tracks, etc., should be given a "repair test" by applying the brake from the different indicated points of the brake-valve, and should receive a thorough inspection, and, when necessary, oiling and adjustment.

A "service test" should follow a change of engines or any change in the make-up of a train, as adding cars, cutting train, etc., and is intended to make sure that the pipe line is open continuously throughout the train, and that all brakes will apply and release; it is neither a fitting time nor place for taking down a triple valve, and if sufficient cause exists, cut out the car; but if a triple fails to graduate and goes full on at service application, the type of triple should determine the proper course; if a plain style of valve, non-graduation is better than no brake on that car, but if a quick-acting triple it had best be cut out and reported.

Passenger train stops are short as possible, and when engines only are changed a light application of the brake will show their condition and insure a quick release and quick departure.

When the inspector calls for the brake about ten seconds before leaving time, there are engineers who discharge all of their train-pipe pressure with an emergency application, and if some brakes fail to release, declare that "those new quick-acting triples are no good—always sticking on you."

But another case, where a through train changes engines and is inspected after backing in on two additional cars. After the train has been inspected, the fresh engine is coupled on and the inspector calls for the brake; the auxiliaries of the two rear cars contain no pressure except the small amount drawn from train pipe of the other cars, and there is no time for changing, so the train-pipe pressure must be completely discharged in order to apply the two rear brakes.

Any orders or instructions regarding service tests of brakes must be ignored oftener than obeyed on roads where time and avoidance of delays are of any consequence. Instructions to men handling and inspecting air brakes should be information as to the construction and operation of the brake, allowing them to use their own judgment, and bearing in mind that cases are governed by varying circumstances, some of which are not apparent to one not thoroughly acquainted with the running of trains.

In the January number Mr. Synnestvedt states that cases have come to his notice similar to the one by "Black Hills," and gives as the cause a broken guide-pin of graduator, but it would be interesting to hear an explanation from Mr. S. how such a defect in the graduating valve would delay action of the brake on that car for a half minute after each service application on a three-car train. With an eight-pound reduction of train-pipe pressure, the triple will instantly respond, and with auxiliary pressure sufficient to overcome the resistance of the spring, why the delay?

In answer to G. H., January issue, question second contains the statement that "when the lever of the engineer's brake and equalizing discharge valve is thrown to the emergency stop, both gauges are shut off from their supply of air."

This error must have been intentional and to excite discussion. The red pointer of air gauge is connected direct with main reservoir pressure, and its supply of air can not be shut off by any movement of the brake-valve. Applying the brake at either service or emergency stops will relieve the governor and allow the pump to increase its speed, running up a higher excess pressure in main reservoir, which must be and is registered by the red pointer.

WILL W. WOOD.

*Terre Haute, Ind.*

## A Lubricator Puzzle.

*Editors:*

I have a little conundrum for the boys concerning a lubricator. It puzzled me for a while, and I would like to hear what the lads have to say on the subject.

I made the run of 85 miles; my lubricator worked all right for that distance; when I arrived at the end of the division I unscrewed the feed-valves and cleaned out the glasses, my fireman shut off all the connections and filled the lubricator. When we were called to go out about six hours later, our lubricator was only two-thirds full; my fireboy asked me if I had let any of the oil out of the lubricator while our engine stood in the roundhouse. I told him I had not. We thought that some of the roundhouse men had let it out, but got out of the house and hooked on to our train. From the yard for 7 miles is a heavy up grade; when I got to the top of grade the oil was all gone out of my lubricator. I could not account for the disappearance of the oil, for I knew that it had not gone out of the feed-valves.

I refilled the lubricator and tried it again. Before I had gone 10 miles it was all gone, but this time I watched it and found out what was the matter, and fixed it in ten minutes. Now what was the matter with it? Would say that the lubricator is a Detroit of improved pattern.

D. B. HUTCHINS.

*Cresson, Iowa.*

## Conger's Puzzle.

*Editors.*

In answer to C. B. Conger's puzzle No. 1, in January issue, would say that after the eccentric strap bolt broke it allowed the strap to spring open, and as a consequence the eccentric could not move the bottom rocker arm back a sufficient distance to uncover the front steam port to the exhaust, which resulted in the advancing piston compressing the imprisoned steam up to a pressure sufficient to blow out front cylinder-head.

As to puzzle No. 2, would suppose that top gauge-cock stood full of condensation, and owing to the small opening at boiler end it took some time before it would show steam.

G. P. CASS.

*Monett, Mo.*

*Editors:*

In answer to C. B. Conger's puzzle regarding the broken cylinder-head. When the bolt parted it would leave the front port open, the strap being so loose on the eccentric, the valve would not travel far enough forward to open the exhaust, and the piston going forward on the steam contained in the cylinder caused too much pressure for the weakest part—the head—and blew it out.

E. A. SIDDALL.

*Oxford, N. S.*

*Editors:*

The steam that was between the piston and cylinder-head could not get away. The momentum of the engine forced the piston against the steam, compressing it until there was more strain on the cylinder-head than it could withstand, and it gave way. I have known the same thing to occur, and could not account for it in any other way. Some persons would say that the steam would force the valve off its seat.

W. W. L.

*Hampton Junction, N. J.*

THE ANSWER.

*Editors:*

In regard to the two easy puzzles on page 17, in the January number, there may be a difference of opinion as to the cause of the cylinder head breaking. After the eccentric-bolt broke at top of strap and let the strap open out the valve stopped in back end of steam-chest leaving the forward port open to the live steam and piston traveling against it. This made a great strain on the front head, as it was the weakest place it gave way.

Right here I would like to inquire if it is possible to have valves set so as to give excessive compression after exhaust closure and shear the bolts in forward end of main rod?

The gauge-cock (second question) was stopped up at the end inside the boiler, so there was a very small hole in it; it was then almost full size for 2½ inch and very small at seat of valve. Possibly this passage filled up with water from condensation, so it showed clear water when first tried, and after that was blown out the

steam came through so small a hole in the end it condensed some before getting out. This cock was bored out clean the entire length and gave no more trouble, so it is fair to charge its peculiar action to being stopped up with scale. This case emphasizes the danger of allowing gauge-cocks to become stopped up, as the correct water level will not always be shown.

C. B. CONGLER.

*Grand Rapids, Mich.*

## Square Engines.

*Editors :*

It has cost railroad concerns a lot of money to get and keep their engines exhausting square, keeping them to suit the delicate ear of their engineers. There has been much thought on this subject and much ingenuity displayed to attain this "ideal" of perfection.

The remedies used have been legion and I will name a few.

There are some that have put on square exhaust-nozzles thinking, no doubt, that it must sound square coming out of a square hole. Others, finding that this was not a panacea, thought that it was not the outlet that should be square, but that it was the steam itself that should be made in square chunks, and to do this they use a Belpaire fire-box, which is square in the place where most of the steam is made; and when this failed others used the square fire-box and nozzles both, and are not happy yet.

Now it is right here that I would like to make a few suggestions. When the square fire-box is used and the steam is generated in square chunks, the things have a good start and ought to succeed, and probably would if these square chunks of steam did not get their corners knocked off when going through the steam pipes which are all made round. Why not make them square, also the cylinders the same. You know the ports are all right without any changing. Now if this will not accomplish the desired end, why not?

It seems a pity that this matter should stop short of final success after so much expense. Unless one can get good square steam from a Belpaire fire-box it will never pay to use them, for their first cost is much more than other makes and repairs are much more; for example, out of twelve engines on the New York Division of the P. R.R. which are comparatively new, they have nine or ten patches on them up to this date, and the standard engines which are doing the same service and have been for years are without a patch on them. Why is the Belpaire boiler used?

*Mantua, Pa.* BOSS DODGER.

[Some of this article would have been designated by Artemus Ward as "sarkasm."]

## Air-Brake Points.

*Editors :*

I like the interesting discussions on the knotty air problems in your valuable journal, and if I could get my arguments on paper in a composed or readable shape, they might be of some benefit to some straying ones that have fallen short of a clear understanding of the quick-acting air. But as a writer I fear I am a failure. G. H. makes a very plain statement on air in the February number, but he must not persist in drilling that hole through close to the seat of feed-valve 21, or he will do just what us farmers would call opening a slip gap in a G-rail fence between the goats and the sheep; both become one common herd; besides he would throw a good twenty-pound spring out of a job.

The answers to the question as to what causes the blow from train-pipe exhaust after handle has been thrown back to full release, after a service application of brakes, is plain both in question 1, January, and G. H. in February. Take a engine and tender with no train, exhaust 10 or 15 pounds of air, service stop; when stopped push engineer's handle to full release; air is restored into train-pipe from main drum through large cavity in rotary valve in a single flash, and, of course, comes around under piston 17, raising it off its stem of the seat and holding it off, causing the blow, until air going more slowly down through the two small holes into chamber D, on top of piston 17, and filling the little drum under foot-board, then equalizing pressure, getting the most pressure on top of piston 17, and seating it; this blow will be long or short, in proportion to the air exhausted in service stop.

Some good air manipulators have claimed that this blow was caused by a wave. When the engineer's handle was pushed into full release, air from main drum would go with a rush against angle-cock at rear end of tender, coming back in a wave and unseat piston 17, but this can not be, for no wave can come against main drum pressure.

Here is where a wave comes in, and it will knock off two, three or five brakes next to the engine in a fairly long train. Bring engineer's handle around and give a quick dip into emergency and stop on lap; this starts a rush of air out of train-pipe emergency port, and cutting it off so quick, not letting enough air out to start emergency valve, and stopping the rush out all of a sudden a wave is thrown back by the pressure concentrating at the hole it was escaping at, and throws off the triple-valve, releasing brakes on the cars next to the engine.

Here is another way of throwing a wave back, and some enginemen make the mistake of doing it, mostly in long trains. Take a train of fifteen to thirty cars, all equipped with quick-acting brakes; it requires the weighing or letting out of 6 to 8 lbs. at preliminary port for a service stop for a train of twenty or thirty cars, but as it only required a little over 8 lbs. of train-pipe air to run out at train-pipe exhaust port for one car, it will require for a 30-car train thirty times as long for the air to run out of train-pipe exhaust.

The engineman gets uneasy at this long-continued blow or exhaust of train-pipe air, thinks he is losing his train air and pushes his handle from "on lap" to between running position and lap, with the handle spring on the bridge or lug between running and lap position; this immediately stops the rush of air out at train-pipe exhaust port, and the air being cut off again so suddenly at its exhaust hole it piles up and waves back again, raising the triple pistons and releasing brakes on the cars next to engine.

As this stopping of flow of train-pipe air and kicking off the first brakes at front end of train is not exactly done in the same way, but with the same effects that dipping into emergency air has as explained.

Will some one handling the improved equalizing discharge-valve on long trains see how near he can come to explaining just how and just what stops this air in its mad rush to get out and causes the wave back? It is plain when understood.

LEM. DE LONG,
O. & M. Ry.

*Louisville, Ky., Feb., 1892.*

## Diagrams of Locomotive Starting.

The indicator diagrams here shown, for prints of which we are indebted to Mr. Theo. N. Ely, General Superintendent of of Motive Power of the Pennsylvania Railroad, give an interesting illustration of the defects of the link motion as a valve-gear for locomotives. The engine from which the diagrams were taken was class A of the Pennsylvania Railroad, with cylinders 18x24 inches, the purpose of the experiment having been to determine the difference between valve ports 16 inches long and 17¼ inches long.

When the diagrams shown in Figure 1 were taken the reverse lever was put in a notch, where cut-off at one end took place at 10⅛ inches, and the other end at 8¼ inches. The engine was started with the lever in this position, and the full line diagram marked 1 was taken in starting. Diagram 2 was taken after 10 seconds, with 5 revolutions per minute; diagram 3 was taken after 20 seconds, when the engine was making 14 revolutions per minute; diagram 4 at the end of 30 seconds, with 26 revolutions per minute; diagram 5 at end of 40 seconds, while the engine was making 40 revolutions per minute; diagram 6 at the end of 50 seconds, with 58 revolutions per minute.

One of the leading stereotyped objections raised against the link motion is, that when the link is drawn up to cut-off early the point of release is made so soon that loss of power and loss of steam result from the valve being opened long before the piston reaches the end of the stroke. If an engine was worked at the slow speed made in the first revolution, this objection would hold good. Release takes place at A (Fig. 1), when the piston has more than one-quarter of its stroke to move, and the steam escapes so quickly


*Fig. 1.*

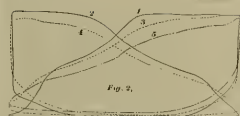



*Fig. 2.*

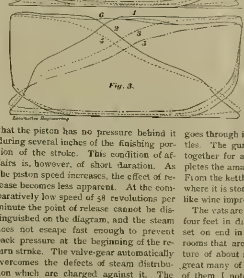



*Fig. 3.*

that the piston has no pressure behind it during several inches of the finishing portion of the stroke. This condition of affairs is, however, of short duration. As the piston speed increases, the effect of release becomes less apparent. At the comparatively low speed of 58 revolutions per minute the point of release cannot be distinguished on the diagram, and the steam does not escape fast enough to prevent back pressure at the beginning of the return stroke. The valve-gear automatically overcomes the defects of steam distribution which are charged against it. The successive diagrams show a highly interesting picture of how perfect steam distribution is brought about.

In Figures 2 and 3 the pencil that formed diagram 1 was applied after the engine had made two revolutions. Figure 2 was taken with the lever in the 12-inch notch. The point of cut-off being more protracted, the period of release comes later than in the other cards, and so the drawbacks of early release are not so pronounced. In the cards shown in Figure 3 the cut-off does not occur till about 15 inches, and the release is then delayed until there is just merely time for the steam to escape from the cylinder before the return stroke commences. Increase of piston speed with this late cut-off soon shows back pressure at beginning of return stroke.

We regard these diagrams as new testimony to the merits of the link motion. They demonstrate that the motion is only defective when worked in a way never followed, and that it automatically improves as speed increases.

## Where They Make Fine Varnishes.

Travelers who keep their eyes open will see, when passing up the Detroit River, a village of buildings to the left about two miles north of the Michigan Central ferry at Detroit, with "Berry Brothers Varnishes" displayed in conspicuous lettering. There are few railroad shops where the product of these works are not known, and it may interest our readers to learn some particulars about the place.

Varnish does not appear to be a complex article, yet a visitor to these works finds out that there are a great many processes connected with its manufacture. The first impression one receives in wandering about the establishment is its great magnitude, then we admire the extraordinary precautions that are taken to guard against fire. All the material handled is of a highly inflammable nature, and it is controlled and treated as if it was ever starting into flame. Here we find fire-proof buildings worked out to perfection, for nothing is left in them that will burn except the material manufactured.

The fine varnish used for passenger car work is made from copal gum, grown in Australia and Africa. The first considerations in the production of a good, durable varnish are first-class gum and the best of linseed oil. That is the combination. If it is worked out by skillful hands the best kind of an article will be produced. Copal is an expensive article, and there are many substitutes employed with varying degrees of badness down to common resin. The inferior varnishes, that are not unknown to railroad business, are made from the cheap material that graduates from copal to resin.

In the Berry Brothers' works a visitor can examine endless packages of copal as they come from the ship, and he can watch the careful manipulation that the article goes through in its way to the boiling kettles. The gum and linseed oil are boiled together for a certain time, which completes the amalgamation of the materials. From the kettles the varnish goes to vats, where it is stored for aging, like wine, and like wine improves with age.

The vats are cylindrical iron tanks about four feet in diameter and eight feet long, set on end in rows in vaulted fire-proof rooms that are maintained at a temperature of about 100 deg. Fah. There are a great many of these storage rooms. One of them I noted had a capacity of 85,000 gallons.

Connected with the works is a finely equipped chemical laboratory, where all material used is tested or analyzed. Samples of all kinds of the varnish made pass through the hands of the chemists, and the quality of all goods sold is on record.

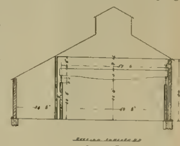
The A. French Spring Co., have introduced a practice of sending out outline prints of their springs with spaces for entering leading dimensions of the springs to be ordered. The blank contains all particulars that must be known, such as length between centers, number of plates, with dimensions, size of hangers, size and form of bands, weight on engine or truck, etc. The blanks are printed in copying ink and all particulars of an order can be easily copied.

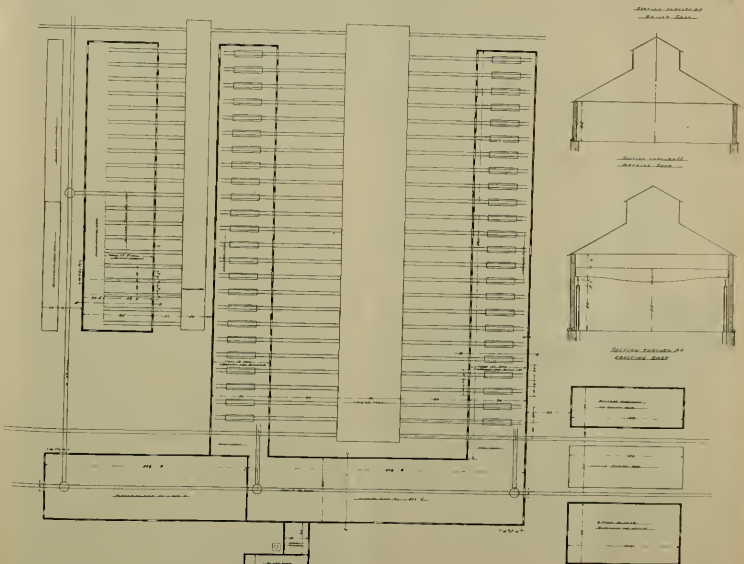
A coroner's jury in the case of the locomotive boiler explosion at St. Clair, Pa., have rendered a verdict fixing the responsibility on the Philadelphia & Reading Railroad Co.


## New York Central New Shops.

The annexed engravings show the ground plan and end elevations of very large shops about to be built near Buffalo by the New York Central for the repair of locomotives. The size of these shops will be readily understood when it is seen that there is erecting shop accommodation for forty-eight locomotives at once, and that facilities will be provided for sending fifty engines through the place every month. This will be the largest and most commodious repair shop for locomotives in the country.

The main plan is two erecting shops set parallel with a transfer table between them. At the end of these shops and at right angles to them is the erecting shop with the blacksmith shop to the left. In a separate building, parallel to the erecting shops, is the boiler shop, which is also served by a transfer table. The transfer tables will be operated by electric motors, and all the shops will be served by overhead traveling cranes. The best tools and other appliances for doing work economically will be supplied to the shops. The shops were designed by Mr William Buchanan, superintendent of motive power.





## Dangers of the Compartment Car.

The railway passenger car used in Europe is an enlargement of the hack or hackney coach so long used in the stage coaching period. When the railway age came it was considered by British engineers the right and natural thing to put a hackney coach on flanged wheels and make it a railway passenger car. The line of development followed was putting a number of these coaches on one frame and calling them compartments. Britain gave the whole of Europe the type of rolling stock, and all that part of the world suffers from the inconveniences of the compartment system.

The English say that the compartment system suits the insular tastes of old country people, since it secures greater privacy than the open car. This privacy is obtained at the expense of dreadful drawbacks. It is impossible to make efficient means of communication between a closed compartment and the trainmen, consequently murders, robberies and outrages are constantly perpetrated in these carriages, and no effectual means can be devised to prevent them. The following incident of travel told in a Manchester paper strikingly illustrates the dangers to a lone lady in a compartment car.

A lady who has been traveling abroad relates an adventure which befell her in Italy in a railway train. Her husband put her into a compartment alone, and went to attend to the baggage. After he had gone a villainous-looking fellow got in, and presently the train started off, the husband not appearing. The lady was naturally a good deal disturbed, and the way in which the stranger looked at her did not tend to diminish her agitation. Suddenly, still with his eyes fixed upon her, the man took from his pocket a large claspknife and opened it. Then he rose, and deliberately cut from the window blinds their cords, and began to knot them together.

The lady was terrified almost to death. She expected to be strangled on the spot, and began appealing to the stranger to spare her. He only laughed brutally, answering her in Italian, of which she did not understand a word. Then he pulled off his coat and waistcoat, and just as the terrified woman was almost prepared to fling herself out of the compartment of the swiftly-moving train, he knotted the cords so as to piece out a broken suspender, put on his coat and waistcoat, and sat quietly down in a corner, where he went quickly to sleep.

## Improved Car Journal Lubricators.

When a man goes along the side of a freight train and examines the oil-boxes of the cars, it strikes him as strange that a better bearing, a better oil-box and a rational means of lubricating the journal are not employed. Truly, the things in use form a crude combination, but somehow they do the business fairly well.

The method of oiling the journal is really the worst and leads to much heating, cutting of journals, and in consequence breakage and wrecking of trains. The remedy seems simple enough. The common practice is to pack the box with cotton waste and saturate it with oil This is all right as long as the waste keeps up to the journal, but the vibration of the car soon packs the waste solid in the bottom of the box, the journal gets dry, and heating ensues. A natural remedy is to put some spring arrangement under the waste that will prevent it from sagging away from the journal. A prettier and theoretically more perfect plan is to put in a roller held to the bottom of the journal by means of springs. As the journal revolves, the roller revolves, and the bottom being down in the oil, the lubricant is constantly supplied to the moving journal.

The improved methods of oiling would be all right if they were properly cared for, but under existing methods they are no good. The galvanizer walks along the side of a car looking for dry oil boxes. He opens one of these fancy packed concerns, and seeing no sign of grease-begrimed waste, he lifts a supply out of his basket,

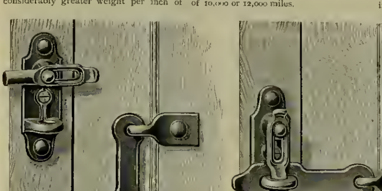
dabs it into the box, stirs the mixture with his packing iron, goes on to the next victim, and the identity of the improved car-journal lubricator is lost. The rough-and-ready methods of American railroading are hard on many improvements, and others besides the lubricator, while theoretically correct, fail to pass the practical ordeal.

With the heavy freight cars coming into general use the defective methods of lubricating is growing a serious matter. Journals of larger size are coming into general use, but the 60,000-pound car is much more liable to have hot boxes than the 40,000-pound car of a past decade, and it was troublesome enough. The heavy car puts considerably greater weight per inch of bearing surface upon the journal, the greater diameter increases the journal speed, and the train speeds, as a rule, are faster than they were ten years ago. Under these circumstances it is not surprising that hot boxes should be causing delay to so many freight trains that the business of some roads is seriously impeded thereby. The problem of preventing hot boxes has generally come up in connection with passenger trains. It has now to be solved in connection with heavy freight cars. The simplest remedy would be to use an elastic material for packing that would not sag easily away from the journal. Hot boxes have been cured on the passenger cars of several roads by this simple improvement. Its application to freight cars might prevent a general demand for an improved form of oil box.

## Long Search for a Car.

Freight cars do not get lost so often now as they used to do when construction companies were in the habit of stealing cars and using them in out-of-the-way places, but a car goes astray yet and gives chasers a long search. A bad case of this kind was lately related to a reporter of the *Globe-Democrat*:

"One of the best jobs in car-tracing that was ever done in this country was completed about three weeks ago by a car-tracer of the New York Central. That road had lost a car and sent out the tracer to look it up. He followed it West to Pittsburgh, then to Cincinnati, then to Chicago, and from there to St. Louis. Here he lost track of it, but after some search found it had been in an accident and had been repainted. By some oversight the number had been changed, but, taking the new number, he chased the car to Kansas City, where he found it had been loaded and sent on to Galveston. To Galveston he went, and there found that, after taking a fresh load, the car had gone to San Francisco. He went after it, but on reaching San Francisco found the car had gone back to Galveston. By this time his blood was up, and he made up his mind to find that car if it took the balance of his natural life, so he went back to Galveston, and, to make a long story short, followed that car to New Orleans, to Mobile, to Atlanta, to half a dozen places in Florida, then back to New Orleans, to Galveston again, and thence to Kansas City, and from there to Chicago. He had now been on the hunt for over three months, but had got so close to the runaway that just as he came into Chicago by one road the car left it over another on its way to Buffalo. Its load was consigned to that point, and when he ascertained the fact he telegraphed on to have the car held and and took the next train for the East. At Buffalo he came up with the car and caught his first sight of it. He had traveled almost constantly for over thirteen weeks, traversing a distance of 10,000 or 12,000 miles.




## A New Car-Door Fastener.

The National Malleable Castings Co., of Cleveland, O., have recently put upon the market a car-door fastener of new design, and possessing some advantages.

This device is illustrated herewith, the cuts showing its application and position, both opened and closed.

The principal improvement is in fastening the pin to the plate, so that they are to all intents and purposes one plate, and there is never the annoyance of a lost pin.

This fastener is complete in three parts, there are no chains, staples nor separate pins to purchase and apply.

## Flexible Metallic Tubing.

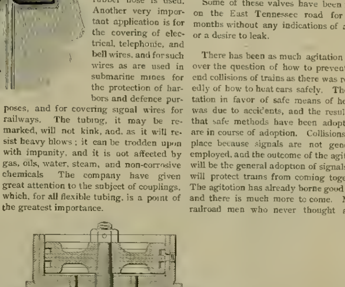
There are numerous purposes about locomotives and cars where a flexible metallic tubing would be of the very greatest service. Rubber is good in its way, but it soon wears out and heat disintegrates it very rapidly. Flexible metallic tubing is badly needed. Several forms of metallic tubing have been offered, but they were dependent upon rubber strips to form a tight seam. That made the article weak in the line where all rubber fails.

The *Practical Engineer* had lately a description of a new form of flexible metallic tubing put on the market in England which seems to fulfill all requirements. The tubes are produced by a machine from strips of metal of the required length, width and thickness. These strips, in passing through the machine, are corrugated longitudinally with a large and a small corrugation side by side, and the tube is formed by the corrugated strip being coiled spirally round a mandrel in such a way that the small corrugation enters and interlocks with the large one, thus forming a flexible joint. This kind of flexible tubing was previously made steam and water tight by means of a strip of india rubber inserted in the interlocking corrugations, and although this answered well for many purposes, yet it was found in some cases that the substance passed through caused the india-rubber to deteriorate. In the new form the absence of india rubber does away with this difficulty, and thus solves the problem of manufacturing a cheap, effective flexible metallic tube, which is unaffected by the passage of ordinary liquids or gases.

These tubes at all times sustain great internal pressure. For instance, under a hydraulic strain of 1,000 lbs. to the square inch, $\frac{3}{16}$-inch tubing retained its flexibility and tightness. Tubing 1 inch in thickness stood the same pressure, finally giving way on a trial of over 1,600 lbs. to the square inch. The tubing is also tight at low pressures.

The uses to which such tubing can be applied are almost legion. One of the railway companies has recently adopted it for carrying petroleum gas used in lighting their carriages. This gas is conveyed from a reservoir to the carriages at a pressure of about 150 lbs. on the inch.

For steam the tubing has been used at varying pressures up to 200 lbs. on the square inch. It has also been employed for pumping petroleum from barges, for cooling rifle barrels, and it might, in fact, be added for nearly all purposes for which rubber hose is used. Another very important application is for the covering of electrical, telephonic, and bell wires, and for such wires as are used in submarine mines for the protection of harbors and defence purposes, and for covering signal wires for railways. The tubing, it may be remarked, will not kink, and, as it will resist heavy blows; it can be trodden upon with impunity, and it is not affected by gas, oils, water, steam, and non-corrosive chemicals. The company have given great attention to the subject of couplings, which, for all flexible tubing, is a point of the greatest importance.



## Independent Double Disk Throttle-Valve.

Men who have had trouble to keep throttle-valves ground tight and know the nicety of work necessary to have both seats of a common balanced throttle-valve ground to a fit, will appreciate any improvement that promises to abate the annoyance.

The valve shown herewith was invented and patented by Master Mechanic J. B. Michael, of the E. T. V. & G., at Knoxville, Tenn. Mr. Michael had so much grief with leaky throttles after the advent of high steam pressure, that relief was necessary.

As will be seen, the top valve carries on its upper side a box into which a piston is packed, the stem of the piston extending loosely through the valve, and being fastened to the lower disk, which seats, as usual, from the inside. The lower valve and the piston above the larger one can be lifted half an inch before the upper valve is moved. The interior of the box or case on top of the upper valve is lined with brass, and two packing rings are carefully fitted, with lap joints, to the piston. Holes are drilled through the upper valve to the cavity under the piston, so that when the lower valve is lifted pressure enters below the piston and helps to balance it and aids in keeping the upper valve to its seat, these also prevent leaks from throwing the valve out of balance. This valve can never "fly open," and can be easily handled, its principal advantage, however, lays in the independence of the two valves of each other. Each can be ground to its seat and can always get there regardless of what the other one does, or how much the case expands or contracts.

The lower valve, when opened to the point that the steam commences to move the upper valve, gives an opening of 42 per cent. of the area of the dry pipe, which is enough to run the engine under ordinary circumstances, and prevents wear of the upper disk by not using it except where very heavy throttling is necessary.

Some of these valves have been in use on the East Tennessee road for some months without any indications of a leak or a desire to leak.

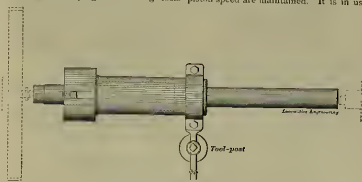
There has been as much agitation lately over the question of how to prevent rear end collisions of trains as there was repeatedly of how to heat cars safely. The agitation in favor of safe means of heating was due to accidents, and the result was that safe methods have been adopted or are in course of adoption. Collisions take place because signals are not generally employed, and the outcome of the agitation will be the general adoption of signals that will protect trains from coming together. The agitotion has already borne good fruit, and there is much more to come. Many railroad men who never thought about signals are now getting educated to the necessity for this means of increasing the safety of train operating.

There was a good meeting of the New York Railroad Club last month. Arrangements have now been made for this club to meet regularly at the rooms of the Society of Mechanical Engineers. This is a popular arrangement. At last meeting a variety of subjects were discussed, the members taking a much more active part than they have done for a long time. President R. C. Blackall makes an excellent presiding officer, and he is working outside the meetings to make the club a success.

## A New Boring Bar for Lathes.

The engraving accompanying this article is a plan view of a very neat and efficient boring bar recently designed and patented by Jackson Richards, M M. of the P. & R. shops at Philadelphia.

The head carrying the cutting tools slides on a ground arbor or bar, and is moved out and in by the connecting lug that is fast in the tool-post of the lathe, thus using the regular carriage feed. Anything that can be clamped to and revolved by the face plate can be bored out. Several sizes of this tool in a repair shop would be very efficient for boring out air-pump cylinders, driving-boxes, etc.



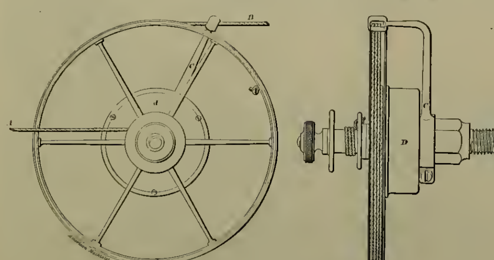

Boring Bar for Lathes.

## Motion Reducer.

The introduction of compound locomotives and the growth of intelligence are making the application of the steam-engine indicator to locomotives so common, that any improvement which aids the engineer in the operation of taking indicator diagrams is worthy of attention. For this reason we bring to the notice of our readers the reducing wheel for engine indicators shown in the annexed engravings. The ordinary methods of reducing the travel of the cross-head to that adapted for the drum of the indicator are nearly all crude, and cause inaccuracy due to the swing of the moving parts. This wheel appears to be free from the objectionable features of other motion reducing devices. The rim of the wheel is aluminum and is made to combine lightness with strength.

The wheel can be mounted on the back cylinder head in such a position that a cord connected with a small rod secured to the cross-head and extending to the wheel will move parallel with the guide-bars. The arrangement makes a very short cord connection between the wheel and the indicator, and the motions being in straight lines the diagrams taken are certain to be correct.

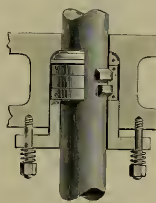
The apparatus is made by Webster & Parks Tool Co., Springfield, O.




Motion Reducer for Indicators.

## The "Silver Bronze" Metallic Packing.

The illustration herewith shows the arrangement of rings in a form of metallic packing that has become quite popular where excessively high steam pressure and piston speed are maintained. It is in use on the fast double-screw boat "Monmouth" of the Sandy Hook line. This boat is driven by a pair of triple expansion engines running with a piston speed of 800 feet per minute with steam at 160 pounds—the boat making from 20 to 23 knots per hour.



"Silver Bronze" Packing.

The packing is used on the "John G. McCullough" and other boats in this harbor.

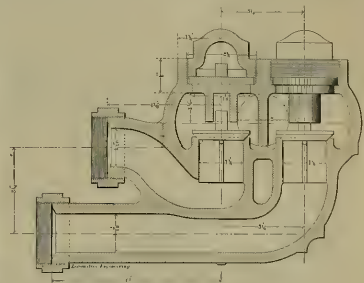
The advantage is that it can be applied to an old stuffing-box, using the old gland and without disconnecting the rod. The two inside rings, the ones in contact with the piston rod and taking the wear, are made of "silver bronze," and by renewing these the packing is entirely renewed. There are no springs inside the box, but two small ones are located on the studs outside of the gland.

This packing is being made and sold by the Forrest Silver Bronze Packing Co., of 115 Liberty street, this city.

## Both Injectors on One Side.

The Louisville & Nashville people are putting both injectors of their locomotives on the right-hand side and passing the water from both into the boiler by means of a single check-valve designed by Mr. P. Leeds, Superintendent of Motive Power.

There are several reasons why this change is made as explained by Mr. Leeds. In the first place, the engineer has the whole of the feeding apparatus under his hand. Then he can use the injectors alternately, which keeps them both in good order, a condition that does not always prevail when one injector is on the left-hand side, and the right-hand injector is sufficient to feed the boiler at all times. Another advantage is, that only one check-valve is used with one opening into the boiler. This takes away half the danger from having check-valves knocked off.



L. & N. Double Check.

When we had listened to all these reasons in favor of the two injectors being on one side, we cordially admitted that Mr. Leeds had made out his case.

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The superintendent of motive power of an important railroad is reported to have said at a public meeting that he did not use iron brake-beams because he was afraid they would give trouble breaking. This man might obtain useful information from the experience of the New York Central with brake-beams When they were using the wooden beams on passenger trains the breakage was about one hundred beams a month, the quick-action brake nearly always breaking a beam when applied. This was too expensive for the company and they adopted iron beams.

## COMBUSTION.

### Plain Explanation of a Cloudy Subject.

By M. E. WELLS.

I have been interested in the efforts of a prominent Western road, in educating their engineers and firemen on the subject of combustion. A little study of the chemistry of combustion proves interesting, and is not so difficult to understand as might be imagined at first sight. I am sure the little effort it takes will more than repay you, besides being a great help toward economical and good firing. The earth is composed of about sixty-eight simple elements which exist, in their free state, in the smallest divisible quantities of matter called atoms.

These atoms of matter are represented by their chemical symbol, as carbon (C), oxygen (O), hydrogen (H). They also have what are called chemical affinities or powers to unite with other atoms in certain fixed proportions.

Hydrogen (H), has a chemical affinity of one, oxygen (O) has a chemical affinity of two. To make it simpler, an atom of hydrogen has one hand or grasping power, while oxygen has two It is perfectly plain then that oxygen with its two hands can unite with two atoms of one handed hydrogen, thus; $\begin{matrix}H\\H\end{matrix}{>}O$ or $H_2O$ which is the chemical formula for water. We see from this that the union of two gases (oxygen and hydrogen) forms water, and farther on we will discover that a little light and a great amount of heat are produced by the union.

An important point to be realized as we go on is that the power of a locomotive is derived *entirely* from heat, and that this heat is obtained by the combustion of fuel (principally coal nowadays). The chief elements entering into the chemistry of combustion are carbon (C), hydrogen (H) and oxygen (O)—carbon and hydrogen being found in the coal, and the oxygen coming from the air. It might be well to state here that one-fifth of the air is oxygen, while the remaining four-fifths is nitrogen; these two gases being only mechanically mixed to form the air They are not chemically united Ordinary soft coal contains from 50 to 65 per cent. carbon, from 25 to 40 per cent. hydro-carbons (which are the gases given off) and 10 per cent. moisture ($H_2O$) and non-combustible matter called ash. When fresh coal is thrown upon the fire the intense heat drives off the gases. These gases (hydro-carbons), as the name indicates, are composed of hydrogen and carbon, and as they are the first to burn we will first consider their combustion.

The oxygen coming through the grate, when heated to the igniting point, has so much stronger an attraction for the hydro-

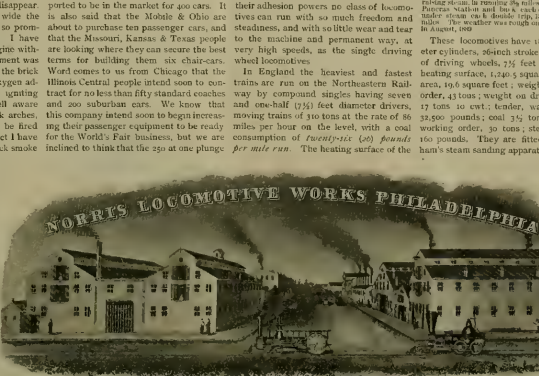
gen than for the carbon of the hydro-carbons that they are separated—the atoms of hydrogen clashing with the atoms of oxygen producing great heat, and water ($H_2O$) by their union—thus $2H+O=H_2O$ as shown above. When you take away the hydrogen from the hydro-carbons of course you have free carbon left. It is this carbon that makes the black smoke so often seen coming from our locomotives. If there is sufficient oxygen admitted through the grate and above the fire this carbon will be consumed; but, as you all know, a large per cent. of it is usually wasted. It is this carbon that collects as soot in our stove pipes In order to burn this black smoke (carbon) successfully, a brick arch is very necessary, and also some means of admitting a limited amount of air (oxygen) above the fire. Too much air above the fire will destroy the combining effects of what comes through the grate, because it cools down below the igniting point and combustion ceases, followed by a great waste of fuel.

I used to perform an experiment for the entertainment of any visitor we might have riding on the engine that proved the truth of the above. I was firing a common everyday locomotive on a common everyday freight train. She had a brick arch in fire-box and no means of admitting air above the fire except a few small holes in fire-door and an occasional hollow stay-bolt that had not filled with ashes or otherwise stopped up.

I would put one or two scoops of coal on a bright fire and close the door; the black smoke would commence to roll; I would then watch the stack and open the fire door just a little; the black smoke would disappear. By closing the door again the black smoke would show; open a little again the black smoke would disappear. And then by opening the door wide the black smoke would show, but not so prominently as with the door shut. I have often tried this with the same engine without the brick arch, but the experiment was not so successful. This is because the brick arch heats the gases and the oxygen admitted above the fire up to the igniting point, and they burn. I am well aware that all engines do not have brick arches, and also that all engines cannot be fired without lots of black smoke—in fact I have seen firemen who thought the black smoke very necessary to steam-making. If you have not got a brick arch you can make a great saving in your fuel account by light feeding on a light fire. There is a certain amount of oxygen passing through your fire all the time, and if you feed your fire by light installments smaller amounts of hydro-carbons are given off each fire. This gives the oxygen some chance to burn the hydro-carbons as they pass off, whereas, with heavy firing, the work for the oxygen is not well distributed, and large portions of the hydro-carbons pass through the stack unconsumed.

The chemistry of the combustion of carbon I will give in a subsequent article.

*Deadwood, S. D.*

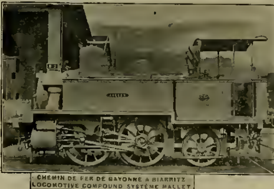



NORRIS LOCOMOTIVE WORKS IN 1853—NOW PART OF THE BALDWIN WORKS

No more subscriptions can commence with January; the entire edition of 30,000 is exhausted. We can commence some 1,500 subscriptions with February. We hardly expected 13,500 paid subscriptions to come in before March, but such has been the fact. The progressive men are with us.

## The Ancestor of Compound Locomotives.

The small locomotive shown in the annexed engraving is interesting, because it was the first of the race from which the compound locomotive has sprung The engraving was made from a photograph sent us by the well-known French engineer, Mr. Anatole Mallet, and represents the first locomotive which he designed. It was one of three built by Schneider & Co., of Creusot, for the Bayonne & Biarritz Railroad, in France, and to its successful working was due the movement in Europe which resulted in so many compound locomotives being built.



CHEMIN DE FER DE BAYONNE A BIARRITZ LOCOMOTIVE COMPOUND SYSTÈME MALLET

The locomotive was a very small machine, the cylinders having been only 9½ and 15¾-in., with 17¾-in. stroke. The ratio of high pressure and low pressure cylinders is high, being as 1:2.79 The engine had the cylinders placed outside the frames, and like all Mallet's compounds, were so designed that they could be worked simple any time when the engineer so desired.

These engines gave so much satisfaction that the entire road where they were introduced on is now worked by compound locomotives.

## Comfort for Manufacturers.

The New York & New England are reported to be in the market for 400 cars. It is also said that the Mobile & Ohio are about to purchase ten passenger cars, and that the Missouri, Kansas & Texas people are looking where they can secure the best terms for building them six chair-cars. Word comes to us from Chicago that the Illinois Central people intend soon to contract for no less than fifty standard coaches and 200 suburban cars. We know that this company intend soon to begin increasing their passenger equipment to be ready for the World's Fair business, but we are inclined to think that the 250 at one plunge is beyond the courage of the finance department There is a good reason for believing that the Savannah, Florida & Western will soon award a contract for building fifteen coaches. The New York, Ontario & Western we have reason to believe will soon order five locomotives and 500 cars.

## Locomotives for Hauling Fast Trains.

By WM. BARNET LE VAN

The tendency at the present time is to build locomotives to move passenger trains at the rate of a mile a minute continuously for a distance of 150 miles. To accomplish this high speed with safety and economy, a single pair of driving wheels must be resorted to. It is impossible to couple a pair of driving wheels by parallel rods that will remain alike The lateral disturbing forces at high speeds produce unequal wear which adds additional friction. It is well known, and has been shown by the experiments made by M. Regray, the superintendent of the Eastern Railway of France, that the frictional losses in locomotives amounts to over *twenty-five per cent.* of the total indicated horse-power when "coupled" by parallel rods.

Single locomotives with large driving wheels make better time and consume less coal per train mile than coupled ones. Heretofore the objections urged against single drivers was the want of sufficient adhesion in starting the train and the climbing of inclines, but this is now overcome by the introduction of steel rails and followed by the "steam sanding" apparatus now in general use on the majority of the best and fastest English trains, it has been demonstrated that a single pair of driving wheels can carry as much as twenty (20) tons where formerly fourteen (14) tons was the maximum load. The above improvements have brought the single locomotive into favor and enabled heavy loads to be put on their driving wheels as witness the Caledonian Railway. Mr. Drummond's seven feet diameter single locomotives during the great railway race between London and Edinburgh, in 1888, averaged between Carlisle and Edinburgh 59.9 miles per hour for one hundred (100) miles, climbing two inclines of 10.15 and 870 feet, on the former grade, averaging 42.7 *miles for ten miles up a 133 per cent. grade.*

It is undeniable that for trains within their adhesion powers no class of locomotives can run with so much freedom and steadiness, and with so little wear and tear to the machine and permanent way, at very high speeds, as the single driving wheel locomotives

In England the heaviest and fastest trains are run on the Northeastern Railway by compound singles having seven and one-half (7½) feet diameter drivers, moving trains of 310 tons at the rate of 86 miles per hour on the level, with a coal consumption of *twenty-six (26) pounds per mile run.* The heating surface of the boiler being only 1,130 square feet and the fire surface twenty (20) square feet, cylinders 20 and 24 in. by 28 in. stroke This performance has never been paralleled on any railroad.

The low coal consumption per train mile is extraordinary as compared to the coal burned in this country. Take the fuel consumption per train mile of either the Pennsylvania Railroad or the Bound Brook branch of the Reading Railroad on their fast trains between Philadelphia and Jersey City and the coal consumed per train mile never falls below fifty (50) pounds except in the case of the Webb compound on the former road

When the statement is made of the fast time and small coal consumption, you are met with the cry that their trains are lighter than those in America, but the facts are to the contrary, as will be seen by the following, from their printed statements The Midland Railway Company, England, for the month of August 1889, Samuel W. Johnson, Locomotive Superintendent.

COAL CONSUMPTION AND WORK DONE BY LOCOMOTIVES OF THE 1853 CLASS FOR THE YEAR ENDING SEPTEMBER 5, 1889:

| Locomotives, No of | Miles | Coal consumed Lbs | Coal consumed Lbs. per mile | Aver No of Carriages |
|---|---|---|---|---|
| 25, 28 30, 31, 32 and 34 | 168,027 | 3,483,840 | 20.7 | 9½ |

WORKING OF LOCOMOTIVES NO. 28 AND 34, RUNNING THE SCOTCH EXPRESS AUGUST, 1889, BETWEEN LONDON AND LEICESTER AND RETURN.

*Double Trips.*

| ITEMS | Aug. 5 to 9, 1889, 8 25 p m London to Leicester and 6 18 a. m. Leicester to London Average double trips 4½ | Aug 19 to 17, 1889, 8 25 p m London to Leicester and 6 18 a. m Leicester to London Average double trips 5 |
|---|---|---|
| Total miles run ..... | 839 | 992 |
| Coal consumed per mile in pounds .... .... . | 25.7 | 25.9 |
| Pounds of water evaporated per pound of coal. | 8.9 | 9.1 |
| Number of coaches . ... | 16 | 15.7 |
| Weight of coaches in pounds .... .......... | 347,312 | 304,112 |
| Weight of Locomotive and trains in pounds .. | 537,040 (239 tons) | 546,896 (244 tons) |
| Actual speed run in miles per hour . ... .... ... | 50.7 | 48.3 |

NOTE —The fuel in the above includes all used in raising steam, in running 3½ miles from shed to St Pancras Station and back each day Total time under steam each double trip, 13¾ hours for 198 miles The weather was rough on the dates given in August, 1889

These locomotives have 18½-inch diameter cylinders, 26-inch stroke, a single pair of driving wheels, 7½ feet in diameter; heating surface, 1,240.5 square feet; grate area, 19.6 square feet; weight in working order, 43 tons; weight on driving wheels, 17 tons 10 cwt.; tender, water capacity, 32,500 pounds; coal 3½ tons, weight in working order, 30 tons; steam pressure, 160 pounds. They are fitted with Gresham's steam sanding apparatus

On London, Nottingham, and Leeds branch they are timed at 53½ miles per hour, with loads of from nine to thirteen coaches, and have been for the last four years performing this work, with an average consumption of from twenty to twenty-three pounds of coal per mile, and have frequently taken trains equivalent to

from thirteen to sixteen coaches without loss of time.

In this country, up to within a short period, the fastest running was between Philadelphia and Jersey City, a distance of 90 miles, and the actual speed run in miles per hour is 48, the coal consumption per mile run being 52 pounds, average weight of train 210 tons; the difference in fuel consumption being 50 per cent. in favor of the single locomotives of the Midland.

The amount of adhesion required to turn to account the whole power which a locomotive is capable of developing varies, inversely, as the speed at which the locomotive is run—*the higher the speed the less being the adhesion required.*

Again, there is another important factor in the utilization of the gases evolved by the fuel—*that is the allowance of sufficient time.* A large diameter driving wheel, combined with a long stroke of cylinder, reduces the number of revolutions per mile, thereby allowing the products of combustion time, thus prolonging the passage through the flues, resulting in the giving up the greater portion of the heat evolved, thus effecting a higher evaporation per pound of coal burnt, which is shown by the performances of the Midland's locomotives.

By compounding and increasing the stroke we reduce the back-pressure on the pistons, the occurrence of which is one of the great drawbacks to high speeds.

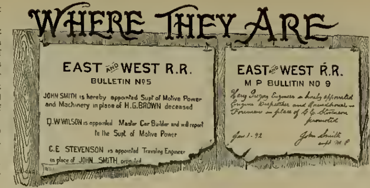
### Central Vermont Shops.

Any person traveling over the Central Vermont Railroad at this time will be impressed with the good condition of both the motive power and equipment generally, and the writer distinctly notes the improvement over a year ago. The superintendent of motive power has succeeded in centralizing his shops by bringing all the repairs to St. Albans. A recent addition of 250 feet, giving a machine shop 500x50 feet, helps very materially in keeping up with the repairs to cars. A number of new tools have been added, such as a heavy planer for car-sills, and a molding machine for car ceilings and roofing, a Rogers end tenoning machine, a three-spindle car-boring machine, and a gaining and cutting-off tool, and a hollow chisel and mortising machine. The company further contemplates adding to the machine shop and putting in a transfer table, greatly facilitating the handling of work through the different shops.

Mr. Robertson has 180 engines to look after, which are doing severe and trying service. The freight engines make 400 miles per 24 hours, and passenger engines 250 miles per 10 hours, which reflects very creditably upon the thoroughness in the mechanical department. That engines turned out by them some time since (light 16x24 8-wheelers) make 250 miles per day, or a run of 125 miles, in 4 hours and 15 minutes each way, with 28 stops, with six heavy cars, including a Wagner parlor car, and does that twice a day, and continuously during five winter months, without missing a trip, is surely excellent work. The road is crooked, about one-half of it being composed of grades, and where it crosses the Green Mountains the grades run as high as 48 feet to the mile.

The burning of the barrel factory of the Standard Oil Company at Bergen Point, N. J., made it necessary to get thousands of barrels from the Western factories. Superintendent C. A. Smith met the transportation question very promptly by dismounting the tanks on some hundreds of cars and putting on racks that carried safely 280 barrels.

One of the new Baldwin compounds had to be taken out of service last month owing to a badly laminated sheet in the fire-box. Some of the steel now offered for locomotive boilers is as unreliable as iron came to be. Inspection and tests of this material cannot be too rigid.




Mr. John Wells has been appointed purchasing agent of the Ohio & Mississippi.

Mr. E. L. Moser has been appointed mechanical engineer of the Philadelphia & Reading.

Mr. D. C. Horn, a conductor on the Northern Pacific, has been promoted to the position of assistant superintendent.

Mr. John Henry has been appointed master car builder of the L., N. A. & C., with charge of the car-shops at Monon, Ind.

Mr C. Palmer has been promoted to the position of general foreman of the Chicago and Northwestern Railway shops at Janesville, Wis.

Mr. F. P. Boatman has been appointed master mechanic of the Queen & Crescent, with charge under Mr. Meehan of the shops at Ludlow, Ky.

Mr. Fred Winkles has been appointed master mechanic of the Louisville, New Albany and Chicago, with charge of the shops at Monon, Ind.

Mr. Joel H. Hills, general agent for the Granular Metal Company, has removed his office to 55 Oliver street, Boston, where he wishes to see his many friends.

Mr. F. H. Stark, general car foreman of the Wheeling & Lake Erie, has been promoted to be master car builder, with charge of the shops at Ironton, O.

The Central Railroad Club and the Western Railway Club have both passed resolutions of sympathy with the family of the late William F. Turreff on the death of the husband and father.

Col. William G. Rice, President of the Consolidated Car-Heating Company, was married at Albany, N. Y., last month. His wedding was one of the most fashionable affairs ever held in Albany.

Mr. Frank Bruce has been appointed master mechanic of the Great Northern, at Barnesville, Minn. Mr. Bruce was formerly on the Santa Fé, and subsequently on the Chicago and Eastern Illinois.

The employees of the Grand Trunk shops at London, Ont., and numerous friends, presented Mr. J. D. McIlwain, lately superintendent there, with a gold watch and other testimonials of regard.

Mr. Jas. S. Mather, formerly of Danville, Ill., has been promoted to the office of General Foreman of the Chicago & East Illinois Railroad Co., and is now located at Thirty-third street roundhouse, Chicago, Ill.

Mr. Ross Kells, superintendent of motive power of the Erie, is said to be rapidly recovering from the illness which has prostrated him for several months. It is expected that he will return to duty about the beginning of April.

Mr. James T. Furber, general manager of the Boston & Maine, died on January 27, after a short illness. Mr. Furber was an able railroad man of the rough, swearing type. A scandalous roughness of manner covered a warm and generous heart.

Mr. J. C. Clarke, one of the most active friends of LOCOMOTIVE ENGINEERING on the Santa Fé system, has been made roundhouse foreman at Woodward, Indian Territory. Mr. Clarke has been running out of Newton, Kan., for some years.

Since the death of Mr. Furber, Mr. John W. Sanborn has been acting general manager of the Boston & Maine. Mr. Sanborn is 70 years old and is not likely to be made permanent general manager. His strength lies on the financial side of railroad business.

Mr. Joseph Shrimpton has been appointed general car foreman of the Chicago and Eastern Illinois. He left the position of joint inspector at Toledo, O., to accept the appointment named. Before going to Toledo he was joint inspector at Niagara Falls.

There is a great deal of talk in New England to the effect that Mr. Payson Tucker, general manager of the Maine Central, will be appointed general manager of the Boston & Maine. Mr. Tucker is considered one of the ablest railroad men in New England.

Mr. Samuel F. Prince, Jr., has been appointed mechanical engineer of the Long Island Railroad. He has been for several years chief draughtsman of the Philadelphia & Reading. He is a graduate of the Pennsylvania Railroad, and is recognized as one of the rising men of the day.

Engineer George King, of the Wabash road, claims to have made the largest mileage with his engine, in one month, ever made in the country—6,627 miles. Other engines have made larger mileage, but no other engineer has ever made such a mileage in the same time with a single engine. —*Ex.*

Mr. Lucius Tuttle, for the last two years General Manager of the New York, New Haven & Hartford, has been elected Vice-President in place of Mr. Reed, deceased. Mr. Tuttle is one of the broad-gauge class of railroad managers whose upward progress brings pleasure to all classes of railroad men.

Mr. L. B. Butler, Master Mechanic of the New York, Providence & Boston, has been taking a much-needed rest. He did not take to his room voluntarily, although an unusually busy season had given him a good excuse. La grippe took a hold of his limbs and intimated that a brief period of repose was imperative.

Mr. John Heath, for some time foreman of the Chicago & Northwestern shops at Janesville, Wis., has been promoted to the position of master mechanic of the Wisconsin division. We are glad to see Superintendent of Motive Power Smith finding men on his own road to promote when vacancies occur in higher positions.

Mr. John McCurdy is one of the oldest engineers on the Michigan Central. He has run an engine between Jackson and Michigan City for forty-four years, and it is figured that he has traveled 2,400,000 miles, being a distance of over ninety-six times around the globe. He has never been hurt, and every limb of his body is as sound as ever.

Mr. William Garstang, Superintendent of Motive Power of the Chesapeake & Ohio and one of the vice-presidents of the Railway Master Mechanics' Association, was offered the position of Assistant Superintendent of Motive Power of the Erie but declined it. The Chesapeake & Ohio management gave him material inducement to remain where he is.

Mr Samuel A. Beardsley, of Utica, N. Y., has been appointed Railroad Commissioner of New York in place of Mr. W. E. Rogers. Mr. Beardsley is an able politician, and will be entirely at home in the New York Board of Railroad Commissioners. Mr. Rogers was considered the ablest man of the Board; but his ability was manifested almost exclusively in talk.

Mr. Daniel W. Sanborn, since 1884 superintendent of the Eastern Division of the Boston & Maine, has been made general superintendent of the system, a new position. He has been in railroad service 33 years and rose through train service, having been brakeman and conductor. He has the reputation of being an excellent practical railroad man and may be made general manager.

Charles L. Sullivan, who for the past three years has been Superintendent of the Boyden Brake Company's shops, at Baltimore, has resigned that position to accept the Superintendency of the Northwestern Equipment Co. of Chicago, who manufacture brake-beams and other supplies. Mr. Sullivan is a B. & O. boy, having come up through all the stages, finally leaving the service while occupying the position of Engineer of Tests. He is one of the educated mechanics who has gone through the mill, and got his theory and practice to mix and equalize.

We have received from the Lukens Iron and Steel Co. a notice of the appointment of Coolbaugh & Pomeroy to be general agents. These gentlemen scarcely need an introduction to our readers. Mr. F. W. Coolbaugh is an old train dispatcher from the D., L. & W., and Mr. L. R. Pomeroy was secretary of the New York Rapid Transit road. Both of them are the kind of men railroad officers like to meet, for they can always be depended upon to tell something of interest about their own business, lightening it with yeast consisting of all the latest news of railroad circles.

Mr. William Gibson, who has been for some time secretary to the General Manager of the Cleveland, Cincinnati, Chicago & St. Louis, has been made superintendent of a division of the road. Mr. Gibson began railway work on the North British Railway in Scotland. He came to this country with Mr. John Scott, who was for some years General Manager of the Queen & Crescent. When Mr. Scott left that road, Mr. Gibson went to be chief clerk for General Superintendent Rockwell, of the Columbus & Hocking Valley, which he left to go to the Big Four.

Last month, in announcing the death of the master mechanic at Mandan, N. D., on the N. P. road, we got the name J. W. Goodman, when it should have been Gardner. J. E. Goodman is alive and still filling the position of road foreman of engines. Mr. Gardner was at one time shop foreman of the C. St. P. M. & O., and afterward general foreman of the St. P. & K. C., at So. St. Paul, from this position he went to Missoula on the N. P. as general foreman of the Rocky Mountain division, and from there was promoted to be master mechanic at Glendive, Mont., being transferred last August to Mandan. He was a very popular shop manager, and his death is deplored by those under him.

# Cast Steel Works of FRIED. KRUPP, ESSEN, Germany.

**Represented by THOMAS PROSSER & SON, 15 GOLD ST., NEW YORK.**

These works cover an area of 1,200 acres, employ about 18,000 men, have the most improved plant, and stand unique, from the fact that they have their own Ore and Coal Mines, Blast Furnaces, etc., and that *every* stage of manufacture is under their own supervision, and are not (like others) dependent on the open market for a miscellaneous assortment of crude material; which, in connection with 75 years' experience, enables them to turn out a product of a very superior quality, second to none, and at the same time the different grades of Steel are always of the *same uniform* quality.

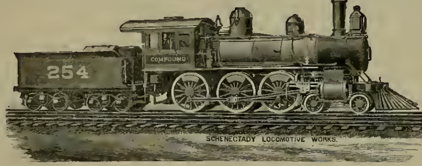
Locomotive Tires, Crank Pins, Piston Rods, Spring Steel, Steel-Tired Wheels, Etc.

After a test of over 25 years the "KRUPP TIRE" has proved itself the best in the market. If a reliable article is wanted, which will give satisfaction, get KRUPP'S.

# SCHENECTADY + LOCOMOTIVE + WORKS,

**SCHENECTADY, N. Y.**

LOCOMOTIVES OF STANDARD DESIGN FOR ALL CLASSES OF SERVICE,




OR FROM DESIGNS FURNISHED BY RAILROAD COMPANIES.

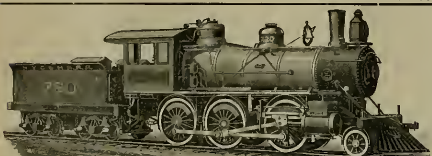
## COMPOUND LOCOMOTIVES,

**Showing an Economy of 15 to 30 Per Cent. in Fuel and Water.**

**ANNUAL CAPACITY 400.**

EDWARD ELLIS, President.
WALTER McQUEEN, V.-Pres.

WM. D. ELLIS, Treasurer.
ALBERT J. PITKIN, Supt.



# BROOKS LOCOMOTIVE WORKS,

**DUNKIRK, N. Y.,**

DESIGNERS AND BUILDERS OF STRICTLY HIGH CLASS

# LOCOMOTIVE ENGINES,

from our own designs, or in accordance with the views of purchasers. All of our locomotives are built to standard gauges and templets, and we guarantee the perfect interchangeability of like parts of same class and pattern.

EDWARD NICHOLS - - *President.* | D RUSSELL, - - *Superintendent*
M L HINMAN, - *Vice-Pres and Treas* | H. TANDY, - *Ass't Superintendent*
T. M HEQUEMBOURG, - *Secretary.* | R J. GROSS, - - - - *Agent*

## THE PRATT & WHITNEY CO.,

HARTFORD, CONN., U. S. A.,

MANUFACTURE

STANDARD CYLINDRICAL SIZE and U. S. STANDARD THREAD GAUGES.

Special Gauges for every variety of interchangeable production.

**REAMERS, TAPS AND DIES,**

In all usual styles for Machinists, Pipe Fitters and Boiler Makers.

**Renshaw Ratchet Drills, Combination Lathe Chucks, Die Stocks, Bolt Cutters, Lathes, Planers, Drilling, Milling, Profiling, Cutter Grinding, Die Sinking, and Drop Forging Machines, Forging and Trimming Dies.**

MONITOR MACHINES FITTED WITH TOOLS

For finishing to Sample Screws, Studs, Locomotive Fittings, Plumbers' and Gas Fitters' Brass Goods.

*CATALOGUE L SENT ON APPLICATION.*

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**Keeps all Dust Out of Front of Boxes. Keeps Oil in the Boxes. Made of Pressed Steel or Malleable Iron. Cannot Jump Up or Down while Car is in Motion. If Left Open it will Close Itself.**

Another veteran railroad man, who climbed from the scoop and worked upward to a high altitude, has passed away. Last month, Edward M. Reed, Vice-President of the New York, New Haven & Hartford, died at New Haven, Conn. Mr. Reed was born in Pennsylvania in 1821. When quite a lad he went to work in the repair shops connected with a coal-pit, and he continued for several years to follow this kind of work. In 1843 he went firing on the Baltimore & Ohio, and after a few weeks was made engineer. Mechanics were then very scarce, and the mechanical training Reed had received recommended him for rapid promotion. After two years on the road, he was offered the position of master mechanic of the Philadelphia & Reading, and accepted. A couple of years afterward he received a tempting offer to go to Cuba and take charge as superintendent of a railroad under construction out of Havana. This he accepted, and remained in Cuba for two years. On returning to the States he accepted the position of master mechanic of the Hartford & New Haven road. There he rose to be superintendent and eventually vice-president of the line forming the principal artery of travel between New York and New England. To the last Mr. Reed took an active interest in the mechanical affairs of the road.

Mr. Amos R. Barrett has been promoted from the position of Division Master Mechanic to that of Superintendent of Motive Power of the Boston & Maine. Mr. Barrett is a native of East Boston, and he learned the machinist trade in the Eastern Railroad shops, now part of the Boston & Maine system. After learning the trade he went firing for a short time, and then was duly promoted to the right-hand side. From this he was made assistant master mechanic and held the position nearly 20 years, with a break of 9 months when he held the place of master mechanic on the Sandusky & Dayton Railroad. Ten years ago he received and accepted an offer as division master mechanic on the Atlantic & Pacific and was there for three years, having been stationed successively at Williams, Peach Springs and The Needles. Returning to New England seven years ago, he was appointed master mechanic of the Worcester division of the Boston & Maine, from which he has now been elevated to the head of the mechanical department.

The rapidly increasing business of the Consolidated Car-Heating Company has made it necessary for them to enlarge their plant. Heretofore the factory which they have occupied they have leased, but recently they purchased a tract of land at the north end of the city of Albany, and have already let contracts for the erection of a new factory and warehouse. The first floor of the new building will be used exclusively for a shipping-room and wareroom for all finished material. A portion of the second floor will be used for offices and the remainder for lathes. The third floor will be used for drills, brass lathes and hand work in putting up their various apparatus. The fourth floor will be used exclusively for tests and experimental work. This floor will especially be equipped so that all apparatus furnished by the Consolidated Car-Heating Company will be thoroughly tested before leaving their factory, so that defects in all material supplied by them will be reduced to a minimum. Their factory will be equipped with the latest improved and best machinery for doing their work, the greater part of which is special. Aside from this will be the engine-house and auxiliary buildings. The contractors for the building are already at work, and the buildings will be rapidly pushed to completion. The Consolidated Car-Heating Company will probably occupy their new building on or about June 1.

## WHAT'S GOING ON.

The Pennsylvania Railroad Company have contracted for twenty-five new day coaches.

The Atchison, Topeka & Santa Fé have placed orders for fifty coaches with Barney & Smith.

The Long Island Railroad are about to make a large increase to their freight car equipment.

There were more orders for cars placed during the month of February than in any month for years past.

The Pennsylvania Railroad people have just ordered a ten-wheel compound locomotive from Baldwin's.

In our recent review of "Grimshaw's Engine Runner's Catechism," we quoted the price as $1 50, it should have been $2.00.

The Chesapeake & Ohio has ordered fifteen 10-wheel engines and ten consolidations from the Richmond Locomotive Works.

The Peninsular Car Works are building 100 platform cars for the Burlington, Cedar Rapids & Northern. They will have Williams' couplers.

The Missouri Pacific people are about to contract for fifty locomotives. Mr. George Gould is attending personally to what will go on these engines.

The Rock Island people have placed orders with Pullmans for thirty coaches, and Barney & Smith are building twenty passenger cars for this road.

The Central of New Jersey have placed orders for 1,000 gondola cars of 50,000 lbs. capacity, and for 250 box cars. All the cars will be equipped with Westinghouse air-brakes and Janney couplers.

The Rock Island has lately received six 10-wheelers from Brooks, and are about to give out contracts for the building of twelve more. The latter will weigh 131,000 pounds and will have cylinders 19x24 inches.

The Louisville & Nashville have just given contracts for new cars as follows: The Ensign Manufacturing Co., 250 fruit cars, the Mt. Vernon Car Mfg. Co., 500 box cars, the Elliott Car Co., 500 box cars and 250 gondolas.

The New York, Susquehanna & Western have ordered 250 box cars. They will be equipped with the Smillie coupler, and will have Lee composite roofs. The company contemplate placing another order for cars soon.

The Schenectady Locomotive Works have within the month received orders for sixteen engines for the Duluth & Iron Range, and sixteen for the Chicago & Alton. At present writing the latter road has ten more engines to give out.

The Mowry Car Wheel Works, Cincinnati, have been very busy since the New Year. Among the roads they have been making wheels for are the Pennsylvania, the Cincinnati Southern, the Ashland Coal & Iron Co., and a variety of other southern roads.

The Bridgeport Machine & Tool Works are building an addition of 80x100 feet to their machine shop, the increasing business making an enlargement imperative. The Sturtevant system of heating and ventilating has been introduced for the whole of the works.

The contract awarded by the Chicago & Northwestern to the Hall Signal Co., to equip nearly 90 miles of road with block signals, interlocking switches and crossing alarm signals, is said to have been the largest contract ever awarded to a signal company at one time.

Mr. Marvin Hughitt, president of the Chicago & Northwestern, is reported to have said that his company has saved more than enough to pay for the air-brakes and close-couplers put on the freight cars by the prevention of wrecks alone. The saving of life and the acceleration of trains is regarded as clear profit.

It is reported that the Panhandle car shops at Columbus, O., are about to begin work on a large number of passenger cars for the Southwestern system of the Pennsylvania. These shops are as well equipped for doing work of this character as any railroad shops on the continent, but it is doubtful if they can compete successfully with contract shops.

The Nashville, Chattanooga & St. Louis are getting eleven fine passenger cars built at Jeffersonville. The Chicago & Grand Trunk have ordered ten suburban cars, the Louisville, New Albany & Chicago eight day cars, the New Orleans & Southern four passenger cars, and the Cincinnati, New Orleans & Texas Pacific five postal cars from the Ohio Falls Works.

The New York Central have contracted for the 2,000 freight cars which we mentioned last month as being in the market. There are 1,000 gondolas and the same number of box cars. All the cars will have vertical plane couplers and air-brakes. The builders bidding on these cars asked about $50 a car extra if required to put in the Fox steel truck. They did not get it.

The passenger trainmen on the Pittsburg Division of the Pittsburg, Cincinnati, Chicago & St. Louis have been directed to state, in announcing the name of a station, on which side of the train the platform is located.—*Ex.* How much better and safer it would be to adopt platform gates and only open them on the station side.

The Mount Vernon Car Works are building 500 box cars for the Louisville & Nashville, and some 60-foot flat cars for a St. Louis company. The latter cars will be painted white and made very attractive. The Mount Vernon company report that they are making a great many cast-iron wheels for railroad companies, and are receiving gratifying records from those in service.

The Pennsylvania Railroad people at Altoona have lately put five sets of Fox pressed steel trucks, similar to those illustrated in our January number, under the tenders of fast passenger engines. It is rightly concluded that the trucks will receive a more thorough test for strength and durability in this service than in any other. If the truck gives satisfaction it will be largely adopted for freight cars.

We learn that the Canadian Pacific are very busy in their car shops at Montreal. The repair work is unusually heavy, and they are building a good many new cars. Among these are some emigrant sleeping cars, in which several changes from the usual standard have been made, and it is said that all the colonists' sleeping cars hereafter built will be similar to the new type. The cars will be vestibuled, and there will be fixtures between the berths, to divide them more effectually. Stout leather covered seats will be provided in place of the old wooden seats.

The Chicago & Northwestern have adopted the Hall Electric Signal as standard, and have ordered enough to entirely block all the lines for some thirty miles out of Chicago — eighty-seven and one-half miles of track altogether. This requires 201 block signals, 52 road-crossing signals, and 157 switch connections. This is one of the largest orders ever given for block signals at one time. Green will be the safety color, and the system is what is known as the automatic electric block signal, using a wire circuit. The Northwestern evidently intends to get into shape to do a heavy and safe business during the World's Fair, and their example can be followed with profit by all the other lines without exception. Block signals are the true safeguard, and all large roads must adopt them. All honor to those that lead!

## Engine on the Brain—A Driver's Wild Ride.

"I was loafing around the streets last night," said Jim Nelson, one of the oldest locomotive engineers running into New Orleans, "and as I had nothing to do I dropped into a concert, and heard a slick-looking Frenchman play a piano in a way that made me feel all over in spots. As soon as he sat down on the stool, I knew that by the way he handled himself that he understood the machine he was running. He tapped the keys away up one end, just as if they were gauges and he wanted to see if he had water enough. Then he looked up, as if he wanted to know how much steam he was carrying, and the next moment he pulled open the throttle and sailed out on the main line as if he were half an hour late.

"You could hear her thunder over culverts and bridges, getting faster and faster, until the fellow rocked about in his seat like a cradle. Somehow I thought it was old '36' pulling a passenger train and getting out of the way of a 'special.' The fellow worked the keys on the middle division like lightning, and then he flew along the north end of the line until the the drivers went around like a buzz saw, and I got excited. About the time I was fixing to tell him to cut her off a little, he kicked the dampers under the machine wide open, pulled the throttle away back in the tender, and—Jerusalem jumpers! how he did run! I couldn't stand it any longer, and yelled to him that she was pounding on the left side, and if he wasn't careful he'd drop his ash-pan.

"But he didn't hear. No one heard me. Everything was flying and whizzing. Telegraph poles on the side of the track looked like a row of cornstalks, the trees appeared to be a mud bank, and all the time the exhaust of the old machine sounded like the hum of a bumblebee. I tried to yell out but my tongue wouldn't move. He went around curves like a bullet, slipped an eccentric, blew out his soft plug, went down grade fifty feet to the mile, and not a confounded brake set. She went by the meeting point at a mile and a half a minute, and calling for more steam. My hair stood up like a cat's tail because I knew the game was up.

"Sure enough, dead ahead of us was the head-light of the 'special.' In a daze I heard the crash as they struck, and I saw cars shivered into atoms, people mashed and mangled and bleeding and gasping for water. I heard another crash as the French professor struck the deep keys away down on the lower end of the southern division, and then I came to my senses. There he was at a dead stand-still, with the door of the fire-box of the machine open, wiping the perspiration off his face and bowing at the people before him. If I live to be a thousand years old I'll never forget the ride that Frenchman gave me on a piano."—*N. O. Times-Democrat.*

Some years ago a rich planter of Cuba ordered a lot of cars from the Ramapo Works, and came to see Mr. Snow about them himself. He wanted things fixed up just right to insure the best results in his country. He made no inquiry about the wheels, axles or other ironwork, didn't care whose coupler was used or what paint, but demanded a sworn statement from the cutter that all the timber was felled "in the decline of the moon."


(22) A. G. C., Trotwood, O., asks

How do you find the number of revolutions per minute a locomotive will make? *A.*—By counting.

(23) W., Selma, Ala., writes

Please give me the rule in regard to putting water-gauge cocks into locomotive boilers. Distances from crown sheet. *A.*—There is no rule, the practice is to put the lower gauge from six to eight inches above the highest point of crown sheet.

(24) G. H., Detroit, asks:

1. What is the spring on tumbling shaft for and what advantage is there in its use? *A.*—To make the lever handle easier by counter-balancing the weight of the links and rods. 2. Is eight feet too high for center of boiler for safety at high speeds? *A.*—There are many locomotives this high running with entire safety.

(25) G. L. T., Detroit, asks:

1. To what extent has steam reversing gear been applied to locomotives in this country and England? *A.*—In this country very little, the P. R. R. and Reading have some in use, the former road threw away some of the rig when balanced valves became a success. 2. What is the approximate ratio of volumes of boiler and cylinder in new 8-wheel passenger engines. *A.*—Varies according to engine; take general dimensions given from time to time and figure it out yourself—it will be time wasted, however. 3. Why is cylinder center higher than driving-wheel center. *A.*—To get cylinders up out of way of truck, out of snow, etc. 4. Is it practical to compound a 3x4 cylinder engine? *A.*—It can be done.

(26) C. S. W., Madison, Wis., writes

Will you please state in your paper the proper position for deflecting plate and petticoat-pipe in extension front of a soft coal burning locomotive, and also what effect the raising and lowering of them would have on the fire, and also what part of the fire by so doing would be effected the most? *A.*—This depends so much on the arrangement of the front that it is impossible to answer. 2. What size stack (a straight one), petticoat-pipe and nozzles should a 15-inch cylinder have, other things being all right. *A.*—About 14 inches.

(27) J. A. S., Selma, Ala., asks: 1. Why is the pin in the link-block not in the center of the link? *A.*—It is thrown out to equalize the cut-off distorted by the angularity of the main rod. 2. What is meant by exhaust clearance. *A.*—When the exhaust cavity of the valve is wider than the exhaust port and both bridges. 3. What is meant by the angular advance of an eccentric? *A.*—The amount that the throw of the eccentric is advanced from a point at right angle to the pin toward the pin—if the pin is on the center, the amount that the eccentric is placed ahead of the quarter is the angular advance.

(28) W. C. H., Moncton, N. B., writes: 1. Has there been a standard height of freight car draw-bar adopted by the M. C. B. Association If so, what is it? *A.*—The standard height of draw-bars for freight cars is 33 inches, measured from top of rail to center of drawbar when car is empty. 2. Has there been a standard strength of spring adopted for freight cars, or anything to regulate the depression of the springs per some unit of weight? *A.*—No standard relating to this has been adopted.

(29) A Fireman, Buffalo, N. Y., writes.

Our road, the D. L. & W., has adopted the extension front end, and are having considerable trouble in making them a success. We used the single nozzle, and in making alterations to get the engine to steam the M. M. ordered a double 3-inch nozzle. My engineer claims that with the double nozzle the engine will carry her water better, and I fail to see what difference it makes. *A.*—The kind of nozzle used has about as much influence on the water level as a horseshoe hung under the headlight, or the fact that the windmill that pumped the water saw the new moon over its left shoulder.

(30) C. F., Winona, Minn., asks.

1. Suppose you place a piston in the center of its cylinder so that a line drawn through the exact center between the two cylinder heads would evenly divide the thickness of both the spider and follower plate, where will it place the crank-pin? *A.* The pin will be a little ahead of the quarter, this is on account of the angularity of the main rod; if it were disconnected from the pin and dropped to the axle it would bring the center of its bearing to the center of the axle, the greater the length of stroke the more the effect of angularity is manifest. 2. Which end of a cylinder uses steam the furthest, front or back? *A.*—Practically the same. 3. Does the lead of valves wear away? I am firing an engine, 17x24. When she came out of the shop she had a 32d lead in her valves; when she was out a year we found she was getting logy, and could not make the time. They run her valves over and found she lost a 64th lead. *A.*—The wear on the valve motion caused it to open the port a little slower—this needs no explanation. Think. 4. Is the pressure in the top and bottom of the boiler alike or not? *A.*—The pressure at the bottom of the boiler is greatest on account of the weight of water, the steam pressure is elastic and the water transmits it to the bottom of the boiler, but adds its own weight.

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Those who have endured the misery of riding in a European railway carriage in winter or during cold weather will understand why some of the Parisian papers are expressing joy that the Northern Railroad Company, of France, have determined to warm their carriages. They seemed never to have dreamed of attempting to make the boiler of the locomotives supply heat for the cars. The warmth is to be provided by means of acetate of soda placed in boxes. The chemical is put in a solid state into the boxes, and these are then plunged into hot water of about 100 degrees. The effect is that the soda becomes liquid. On being taken out of the water the boxes are wiped dry and put into carriages. By degrees the soda solidifies, and as long as that operation lasts—that is, for about five or six hours—it gradually gives off the heat it has absorbed in the melting process.

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We have received from the Otley Mfg. Co., Chicago, a small pamphlet lately published, setting forth the merits of the Eureka steam packing cement made by the company. This cement is used for joints of all kinds, and we know from experience that it is an excellent material for the purpose, being much better than lead or rubber. Nothing has ever been tried for smoke-boxes and other parts where great heat is present that has approached this cement in making a tight joint. The use of the material is reported to be increasing greatly. It is a case where merit is winning success.

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Another boiler exploded on a Reading locomotive on January 28th. The engine was slowly pushing a long train, eighty-six empty coal cars, up a grade near St. Clair, Pa., when the explosion occurred. The entire crew were instantly killed—five men. The boiler that exploded was one of the 72-inch straight ones, with narrow fire-boxes, only four years old, and was the fourth out of five of this class to explode. It is maintained by the men that these boilers were seldom if ever inspected, that broken stays are the rule not the exception, and that 180 pounds of steam was carried on them where 150 was originally intended, the fifth engine has been shopped for a new boiler. The back, or fire-box end of a locomotive boiler is of something the same shape as a Burdon gauge spring tube. Every time it is subjected to great varying pressure, there is more or less of a movement that has a tendency to bend and finally to break stay-bolts. In the use of such pressures as 180 pounds per square inch, eternal vigilance is the price of safety. Inspect!

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The postal authorities of Germany sent some men to this country some time ago to study our railway mail service, and especially our mail cars. They reported that the cars used by the C., M. & St. P were in their estimation the best in the world. The result of this was that the German government asked the C., M. & St. P. road to build them two models of their cars. These models are now finished and on their way to Germany. They are complete cars, built just one-sixth the full size, and are complete in every particular, and the interiors contain all the racks, mail-throwing devices and mail catchers, as well as a full complement of sacks. These models are 12 feet long and were exhibited in Milwaukee before being sent away. They were built at the West Milwaukee shops.

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In a paper read by Mr. D. L. Barnes to the Western Railway Club on "Recent Progress in Car Construction," he said The freight car in use twenty years ago was in appearance not unlike those we now use; but the difference in construction is considerable. The most important change has been, of course, in the increase of capacity. The old cars were adapted to carry 24,000 pounds, and weighed 20,000 pounds, or 8-10 pounds of dead weight per pound of rated useful load. The present car weighs about 30,000 pounds, and has a capacity of 60,000 pounds or 5-10 pound of dead weight per pound of rated useful load. The car of twenty years ago had a capacity of 1,000 cubic feet, or about 20 pounds of dead weight per cubic foot, or a rated capacity of 24 pounds per cubic foot. The recent cars have a capacity of nearly 2,000 cubic feet, or 15 pounds of dead weight per cubic foot, and a rated capacity of about 30 pounds per cubic foot. From this it is seen that there has been 37 per cent. decrease in dead weight of box freight cars per ton of full rated load; 25 per cent. decrease in dead weight per cubic foot of capacity, and 25 per cent. increase in the full rated load per cubic foot of capacity.

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The wisdom of legislators was well illustrated when a public demand arose many years ago to pass laws that would help to secure the safety of steam boilers. The Government inspectors reported in favor of the use of charcoal-iron being exclusively employed for making boilers. A law to this effect was passed and makers of charcoal-iron were advised to put the stamp C on the plates. All makers of iron plates then began using the C stamp, and as no penalties were imposed on those who used this stamp upon other than charcoal-iron, it took years to amend the law to make it useful.

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In a discussion on air-brake matters before the New York Railroad Club, when questions relating to the oiling of brakes were receiving attention, an inspector of air brakes mentioned that brakes were sometimes oiled by pouring a liberal supply of black oil into the hose. Others corroborated this, and the impression was given that the practice was common. At this rate, it is not surprising that sticking and slow-acting triple valves are common. The general conclusion was that, as a rule, too much oil is used, even when applied in the proper way

## The Station-Master and the Goat.

One of the most imposing personages to be seen when traveling in Belgium is the station-master. He appears to combine the dignity of a field-marshal with the importance of the village bailiff, so graphically portrayed by Dickens. He wears an ostentatious military uniform, and he is distinguished from all lesser railway lights by a blazing red cap. All train movements at a station seem regulated by the wave of the station-master's arm, and all and sundry regard him with awe mingled with fear. The altitude of this official must be understood in order to appreciate an event which happened lately at Charleroi.

In the seclusion of private life the station-master is not always performing an heroic part. It appears that the station-master at Charleroi is owner of a goat, and that this wife of Aries provided a supply of milk for the family. This particular goat had all the evil propensities of its kind, and was noted for kicking and butting those with whom it was not on amicable terms. The relations between the goat and the station-master were not cordial.

It happened that Mrs. Station-Master went from home one day, and during her absence the problem of securing the supply of milk from the goat came up for solution. The juvenile members of the family were in distress for want of milk, and the supply must be drawn from the goat. The station-master tried his most winning and seductive arts as a milker, but the goat would have none of him. Being a man of fertile resources, as becometh an old railroader, he conceived the idea of personating his wife, and making the goat believe that the regular milker was operating upon it. He donned his wife's attire, and was just preparing to deceive the goat, when, to his consternation, the whistle of a passenger train was heard. There was no time to change his attire, and for a passenger train to stop at the platform without the station-master being there to receive it was without precedent.

Again he acted promptly. His wife's bonnet was thrown aside, and hastily putting on his red cap that none might mistake who was there, the station-master strode out to his acustomed place, skirts, waist, bustle and other parts of the female outfit making an incongruous combination with the bearded face, red cap and military bearing. In vain the station-master gave his signals with unusual austerity and dignity. Some of the passengers laughed, but the prevailing impression was that the station-master had suddenly gone crazy. He was promptly marched off to prison. The case is undergoing investigation.

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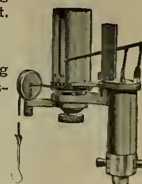
The Tabor Indicator has the lightest reciprocating parts, and is the only accurate instrument at excessively high speeds. It has no equal.



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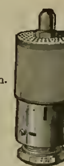

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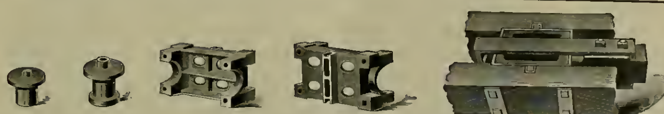

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This Company guarantees its device for One Year from application against breakages. If the Yoke or Strap Style is used, we guarantee against Spring breakages and Pulling out of Drawheads or Couplers.

*No other device offers as many good features as the Butler.*

**IT HAS THE FEWEST NUMBER OF PARTS.**

**IT HOLDS THE DRAFT TIMBERS TOGETHER.**

**Simplicity and Strength are thoroughly combined in this attachment.**

These Elements reduce breakage to the lowest point and make repairing easy.

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Is being applied to more CARS than any other device on the market.

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LOCOMOTIVE ENGINEERING.

A Practical Journal of Railway Motive Power and Rolling Stock.

VOL. V, No. 4. NEW YORK, APRIL, 1892. PRICE, 20 Cts. Monthly. $2 00 per Year.



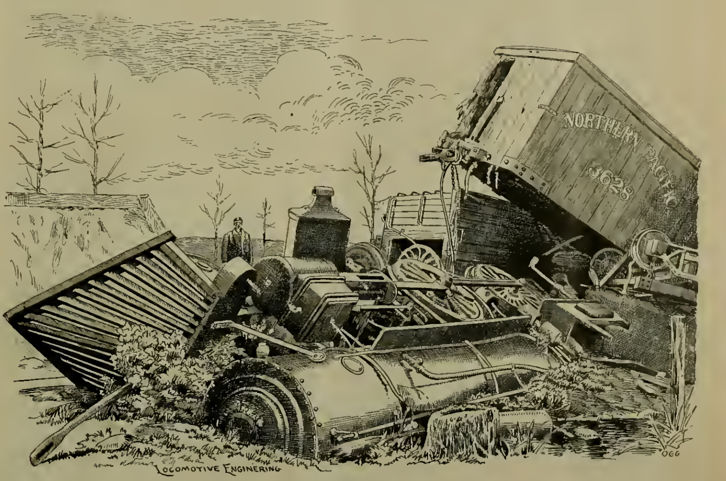
## Under the Wreck.

The occurrence illustrated in the accompanying engraving is one of those sad incidents of railroad operating that render the life of a railroad trainman so much like that of a soldier in active service. This is the line of industrial warfare that claims many victims. In this case three men went down to the Valley of the Shadow of Death.

About midnight a train of north-bound fast merchandise was speeding along on a railroad in the Northwest. No train was ever run under circumstances more promising for reaching the terminus on time. There were twenty loaded cars, most of them being equipped with air-brakes, and a first-class engine that handled the train as if it were merely load enough to steady the power. They were speeding along at about thirty miles an hour when, without the least warning, the engine's wheels dropped from the rails. They were entering upon an embankment and a small bridge was in front, which the engine passed over on the ties. Then she turned over, the cars broke down the bridge, and engine, cars and bridge were mixed in a confused wreck with three precious human beings beneath. The Northern Pacific car that stands up so prominently in the picture was away from home.

The engineer was pinned under the tank alive, and it took five hours' work to get him relieved. He died three hours after being taken out. On the train stopping the conductor ran ahead, and on the way met the fireman stark naked on his way back to the caboose. He had been badly scalded, and tore off all his clothes in his agony. The head brakeman was found standing knee-deep in water, which was so hot that they had to put down a plank to reach him. He and the fireman both died from scalding.

The rumor was circulated that the wreck was caused by obstructions laid on the track, and the railroad company offered a reward of $1,000 for the arrest and conviction of the train-wreckers. New ties had been distributed for some time to be put in the track where the accident happened. The coroner's jury investigated the case, and returned a verdict to the effect that the accident happened through the spreading of the rails, due to the presence of rotten ties. This was the common-sense view of the cause of the derailment. The road where the accident happened is well managed, but there was a weak link somewhere that permitted worn-out ties to remain in place.




UNDER THE WRECK.

## Simple Test of Coal.

Railroad men do not need to be told that there is great diversity in the quality of coal bought for steam making. It is no uncommon thing for the fuel from one set of coal mines to have ten per cent. or more carbon than the coal from another source of supply. As the carbon is the vital element in the coal, care ought to be taken to choose the best quality of coal. As the price is generally about the same, a little care might result in important saving of fuel.

There is a very simple form of test for coal that ought to be known to everybody interested in fuel. It is based on the quantity of pure lead that will be released from its oxide by a given weight of carbon. Litharge is oxide of lead, and contains 34.5 units of lead to one of oxygen. When finely powdered coal mixed with oxide of lead is heated to the combining temperature, the oxygen of the compound unites with the carbon and leaves the metallic lead. The quantity of lead precipitated gives the means of determining how much carbon there was in the coal used.

Let a sample of coal be heated with forty times its weight in pure litharge. The weight of the lead formed will give a basis for ascertaining the purity of the coal. The weight of lead will vary from twenty to thirty times the weight of the coal. If the weight of lead is twenty-five times the weight of the coal employed, the per centage of carbon in the coal will be about $\frac{85}{100}$. This is not absolutely correct, but it is near enough for all practical purposes.

A plan of making this test, devised by Prof Monroe, is to fit up a piece of 2-inch iron tube, about 2 feet long, with a threaded cap on one end and a reducer at the other, to which is fastened a piece of ¼-inch gas pipe about 3 feet long and open at the ends. One ounce of finely powdered coal, mixed with about forty times its weight of pure litharge, is placed in the tube. This is placed in a hot fire, with the gas-pipe slanting outward. The mixture will boil quickly, giving off a stream of gas which can be felt by the finger. As soon as the gas stops escaping, the tube should be removed from the fire. A sharp rap will send the lead to the bottom of the tube. The weight of the lead button found will, by the calculation given, show the per centage of pure carbon in the coal.

## Florida Central & Peninsular.

The Florida Central & Peninsular Co. operates 650 miles of road, the main portion running east and west across the northern part of the State of Florida. They have but forty-five locomotives, these, however, being double-crewed and chain ganged.

The main shops are located at Fernandina, on the eastern coast, but they have a moderate-sized shop at Tallahassee.

The old shops at Fernandina burned down some three or four years ago and were never rebuilt. A few boards were stuck up over one lathe and an old engine, fast to the side of a dead boiler, drove it and a fan for the blacksmith shop and a small foundry. The pits were under a shed, and the work done under many disadvantages.

New shops are already up, and will soon be equipped with tools and ready for business. With the facilities enjoyed, it is a wonder to me that the motive power has been kept running at all.

Mr E Burton, who has but recently become master of machinery, has been for some time past general foreman of the shops at Tallahassee, and is now hard at work trying to bring order out of chaos. Mr Burton is one of the large class of railroad motive-power men who graduated from the B & O.

The fuel used on the road is pitch pine, and engines carry those homely balloon stacks. Most of the power is comparatively new and of modern size and style.

Colored firemen are sprinkled in with the white ones, and seem to make very good men. They are without the incentive to work for promotion, and therefore evince little interest in learning other than their firemen duties. The engineers prefer them to the white fireman, who is credited, in this part of the country, with getting a bad dose of "throttle fever" after having been exposed for about three months on the left side.

J. A. H.

The practice of taking links and pins from cars standing on side tracks is almost universally followed, and is frequently a source of delay and annoyance. General Superintendent Brown, of the Fall Brook Railroad, is opposed to this practice and vigorously enforces rules against it. The standing penalty is prompt and permanent dismissal. Yet dismissal is a rare penalty for offences on that road. But they will not stand link and pin-stealing.

## Samuel L. Moore—the Career of an Old-Time Engineer.

By HARRIS TABOR.

The modern traveler has become so accustomed to the luxuries of the "vestabuled Pullman" that he does not realize what railroading meant to the pioneers of a generation ago. He may touch the electric button at his side to order a lunch or a

cocktail, with never a thought of the men on the foot-board or their predecessors of a few years ago. He may sit listlessly under the barber's razor, with no fear of losing a portion of his face, or he may lie in the bath-tub until, if gauged by cleanliness, he is fit for the highest Heaven. If he happens to be a literary man, or one with the nightmare of unanswered letters on his mind, he may summon a stenographer and talk to his heart's content, with a certainty that his garrulity will come back to him on a neatly printed sheet ready for his signature. He may enjoy his after-dinner cigar, and take a turn with some favorite author in apartments that will satisfy the most fastidious dude in the "Four Hundred." If it be his good fortune to travel with his wife, a lady's maid is at his beck to relieve his clumsy fingers of the little details of her toilet, and to pass the final judgment, which would otherwise fall to him, with a certainty that it will be better done. Everything, in fact, that comfort can suggest is at his command while traveling at a speed that would have been considered impossible a dozen years ago, and at a cost that is reasonable when compared with the better hotels. He is literally living in a hotel on wheels, wherein he may enjoy himself as he likes. This is modern railroading, with which all who travel are familiar. It is an evolution that has been brought about by untiring industry, pluck, ingenuity and skill, coupled with a perserverance in danger and difficulties that would make heroes of men in time of war. Indeed, many men have had knighthood and medals thrust upon them for less exhibitions of courage than pass unnoticed every day on American railroads. This is not strange. Frequent occurrence destroys sentiment, and makes all things commonplace. The every-day hero is soon buried beneath the multitude of brave deeds.

In the early days of American railroads, when the whole number of locomotives in in the country would come well within the dozen, it meant something to be an engineer, he was brakeman, as well, and to his other accomplishments must be added the skill of the machinist, with a capacity to spike down "snakeheads" as they raised and threatened the train. In those days there were none of the wrecking appliances now in use, no double tracks, and few sidings to fall into play in case of a wreck, and when one did occur it must have taxed to the utmost the few resources of the road.

There are but a few of these "old-timers" left, and their number is fast growing less. It has been suggested by the Editor that his readers have an interest in anything pertaining to these veterans of the rail, hence this letter.

It has been the good fortune of the writer to meet, almost daily for the last two years, one of the oldest, if not the oldest, railway master mechanic in America, Mr Samuel L. Moore, president of the Crescent Iron Works and Shipyard, Elizabeth, N. J. Mr. Moore is a hale and hearty old gentleman, eighty-nine years of age. His age is a long time for a man to live and retain his mental activity; it covers three generations, and a period of time which represents the industrial progress of the world. Mr. Moore was born in Crosswick, N. J., one year after the Cornish miner, Trevithick, patented his high-pressure locomotive with fly-wheel on the crank-shaft, and nine years before John Stevens, of Hoboken, memorialized the Legislature of New York, urging the budding of railways, and showing their advantage. He was twenty-six years old when Stephenson built the "Rocket," which was the beginning of the world's system of steam railways. When he began his railway career there were only 1,000 miles of railroad in the United States, and of this probably not 200 miles used locomotives.

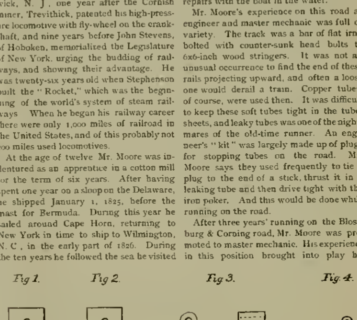
At the age of twelve Mr. Moore was indentured as an apprentice in a cotton mill for the term of six years. After having spent one year on a sloop on the Delaware, he shipped January 1, 1825, before the mast for Bermuda. During this year he sailed around Cape Horn, returning to New York in time to ship to Wilmington, N. C., in the early part of 1826. During the ten years he followed the sea he visited the west coast of Africa and Napoleon's grave at St. Helena, and was shipwrecked twice. He arrived in New York January, 1836, from the west coast of Africa. One month later he became fireman on the Trenton & Philadelphia R.R., where he remained until the following October, when he accepted a similar position on the New Jersey R.R. & Transportation Co. Here he remained as fireman, running between Jersey City and New Brunswick, until some time in 1837, when he became engineer on the same road. He ran on the N. J. R.R. & Transportation Co. road as fireman and engineer about five years, and then, in May, 1841, accepted a position as engineer on the Corning & Blossburg road, with instructions to take the new locomotive "Tuscarora," built by Rogers, of Paterson, to Corning via canal boat. The "Tuscarora" was the third locomotive built by Rogers. She had four 4-ft. drivers and 12x16 in cylinders. Rogers was to put the "Tuscarora" on the boat in Jersey City. When he saw the boat, a double-ender—commonly known as chunkers—he did not consider her safe, and would guarantee nothing beyond the loading. The locomotive was put in one end of the boat, the tender in the other, with Mr. Moore's household goods between. Mr. Moore, with his family, took passage on one of the then famous canal "packets," which bore about the same relation to the ordinary canal boat that a Mississippi steamer now does to a Fall River liner. The trip was up the Hudson to Albany, thence via Erie Canal to Geneva, Seneca Lake to Jefferson, now Watkins, and from there to Corning by stage. Mr. Moore has many pleasant recollections of this trip. At Corning Mr. Moore could get no tidings from the "Tuscarora." He returned to meet her, finding the boat at Schenectady. The delay was caused by staving a hole in the boat which compelled unloading for repairs. Mr. Moore then took charge and remained with the "Tuscarora" until her arrival at Corning. At Geneva another snag was encountered, and another hole resulted. Mr Moore made the repairs with the boat in the water.

Mr. Moore's experience on this road as engineer and master mechanic was full of variety. The track was a bar of flat iron bolted with counter-sunk head bolts to 6x6-inch wood stringers. It was not an unusual occurrence to find the end of these rails projecting upward, and often a loose one would derail a train. Copper tubes, of course, were used then. It was difficult to keep these soft tubes tight in the tube-sheets, and leaky tubes was one of the nightmares of the old-time runner. An engineer's "kit" was largely made up of plugs for stopping tubes on the road. Mr. Moore says they used frequently to tie a plug to the end of a stick, thrust it in a leaking tube and then drive tight with the iron poker. And this would be done while running on the road.

After three years' running on the Blossburg & Corning road, Mr. Moore was promoted to master mechanic. His experience in this position brought into play his capacity to do in cases of emergency. In our days a copper tube is a very simple, long hole, which is within the reach of any man who can pay for it. Then it was different. None were carried in stock nearer than New York or Philadelphia, and during the winter season wagon freights were enormous from these points. The soft, sulphurous coal used on that road would destroy a set of tubes in two or three years, making replacing necessary. In some cases, when tubes were not obtainable, Mr. Moore has made them, doing his own brazing and drawing into shape afterward, for entire boilers. When he was master mechanic of this road the locomotive "Chemung" was bought from a New Castle, Del., concern. She had one pair of drivers, with the weight pretty evenly distributed over them. Her first attempt at pulling a train developed a disposition to lift in front and leave the track. Mr. Moore put pony trucks under her rear before she became serviceable. One cranky locomotive on a road to-day would mean nothing, but if twenty-five per cent. of the motive power was on its bad behavior there might be trouble. The "Chemung" comprised just one quarter of the motive equipment of the Blossburg road.

In May, 1847, Mr. Moore engaged as superintendent of a machine shop building wood planers, in Albany. He remained here only a few months. In November,

*Fig 1.* *Fig 2.* *Fig 3.* *Fig. 4.*




EVOLUTION OF THE IRON BRAKE-SHOE.

1847, he accepted the position of M. M. of the Elizabeth & Somerville road (now part of Central of N. J.), and moved his family to Somerville. The following year he moved to Elizabethport, where he has since lived. When Mr. Moore came on this road its car equipment comprised, all told, about fifteen cars. The motive power consisted of four locomotives with 10x16 inch cylinders, single pair of drivers, all built by the Baldwin Locomotive Works. The length of track was 26 miles. When Mr. Moore took charge of the mechanical branch, he says that the only tools in the shop that had a rotative motion were a grindstone and a blacksmith's crank drill. He soon secured a lathe for turning driver tires, and one smaller, but had nothing to give them motion. A steam-engine for driving these tools was then out of the question. He had lathes, but unless they could be made to revolve they were useless. He was equal to the occasion. He put a set of rollers in the track so that the driving wheels would revolve them; from these rollers he took his motion to his lathes. When an engine came in from her run to Somerville she was put to the treadmill duty of turning off the tires of some sister engines, much the same as the farmer uses his dog for a churn motor. This was his shop power until the "Speedwell" became useless on the road and was "jacked up" in the shop for permanent power.

Mr. Moore has been an important factor in the evolution of the present cast-iron brake-shoe. I believe he was its inventor. At any rate, when he adopted it it was new to him and his road. When he came on the Somerville road the common braking appliance was a piece of wood suspended to the car, like sketch No. 1. This was found too short-lived, and an effort was made to add staying qualities by the addition of old leather next to the wheel. Old harness traces were found to be better than anything in the leather line on account of their firmness. This was unsatisfactory, and bar iron was substituted with but little better results. It was found that the wrought-iron became so hot that the wooden beam would burn. Sketch No. 2 shows the application of wrought-iron. In the fall of 1850 Mr. Moore designed the form shown in sketch No. 3, which he found very satisfactory. Later on No. 4 was substituted on account of its cheaper form. The comments made on the introduction of the cast-iron shoe by the trainmen were numerous and generally adverse. It would wear the wheel badly, and in cold weather its braking capacity would be limited by frost.

Castings for the road were difficult to get. There were no foundries nearer than Jersey City and Newark. At one time a foundry in New Brunswick made the castings. The constant annoyance from being so far from the foundry led Mr. Moore, in company with his brother and Isaac Field, to start a small foundry in 1854. That small beginning was the nucleus of the immense shops and ship-yard of which he is now president.

In the car equipment, when Mr. Moore came on this road, there were no two cars alike No two axles would interchange.

The foundry business grew to such an extent that in 1858 Mr. Moore resigned his position as master mechanic and took charge of his own shops, adding a machine shop. In 1869 the interests of the other partners were purchased and his son Douglass G. became associated with him, under the firm name of S. L. Moore & Son. In 1886 the present company of S. L. Moore & Sons Co. was incorporated and the works moved to the present site in new shops. The officers were. President, Samuel L. Moore; Vice-President, Douglass G. Moore; Secretary and Treasurer, Miller F. Moore.

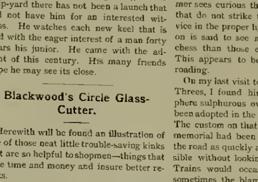
It is a noteworthy fact during the time Mr. Moore was a locomotive runner his trains had no brakes.

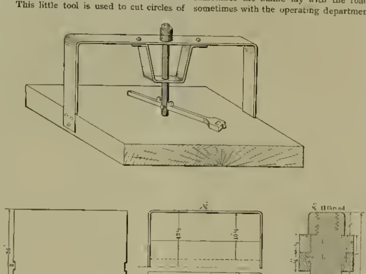
It has fallen to the lot of few men to look back on so long a life well spent. Integrity, pluck and perseverance have been well rewarded. Mechanical and social distinction, as well as political preferment, have centered around him. He was a member of the City Council ten years, and for two terms represented his district in the State Legislature at Trenton. After a busy life, reaching almost to a century, he is still active, and visits the shops daily. Since the beginning of the ship-yard there has not been a launch that did not have him for an interested witness. He watches each new keel that is laid with the eager interest of a man forty years his junior. He came with the advent of this century. His many friends hope he may see its close.

## Blackwood's Circle Glass-Cutter.

Herewith will be found an illustration of one of those neat little trouble-saving kinks that are so helpful to shopmen—things that save time and money and insure better results.

This little tool is used to cut circles of glass for head-lights, signal-lamps, etc., always insuring a round job and preventing cracks from running out of cutter. The tool is one devised by General Foreman Blackwood, of the South Carolina shops, at Charleston, S. C.





BLACKWOOD'S CIRCLE GLASS-CUTTER

The general view shows the tool complete, except the diamond-holder, which is held in the slot at end of bar.

On the bed or platen they draw circles of all the standard sizes of round glass used, and in cutting it is only necessary to see that the glass covers the circle used and the tool placed over it. On the tool used by Mr. Blackwood he has a common wooden one-foot rule set into the base from the center out so that the tool can be set to cut any given size without measuring.

In some earlier forms of the cutter made by Mr. Blackwood trouble was experienced from the cutter chattering, but this is entirely avoided by the form of bearing at top of spindle, plainly shown in the detailed drawings; on which sizes are given enabling those interested to make the machine.

On a recent visit to the Charleston shop the writer saw a large glass cut into rings about an inch wide; these had been put together again without breaking through, so accurate is its work done.

## What a Railroad Drummer Sees and Hears.

KICKING AGAINST THE PRICKS—A SENSELESS SUPERINTENDENT.

BY SAM SHORT.

It appears to me that a railroad drummer sees curious things about railroading that do not strike the men in active service in the proper light. The man looking on is said to see more of the contest in chess than those engaged in the game. This appears to be the case also in railroading.

On my last visit to Gratsam, of the Twin Threes, I found him making the atmosphere sulphurous over new rules that had been adopted in the operating department. The custom on that system from time immemorial had been to get the trains over the road as quickly and comfortably as possible without looking closely into delays. Trains would occasionally be late, and sometimes the blame lay with the road, sometimes with the operating department and at other times with the machinery department. There had been no systematic reports of delays made, and it was not clearly understood what department was most at fault, but each agreed that the other was the greatest sinner. There was not much blaming or hard feeling about the matter, for they were all practical railroad men and understood that delays would occur in the best regulated department. No kettle was much inclined to call black bottom to the pan.

But a change has come o'er the spirit of the dream. A new general superintendent has appeared on the scene, and his ideas are rattling the dry bones out of their sockets. This new superintendent declares that guess-work is not good railroading, and he demands reports of all irregularities. When I went into his office, Gratsam was praying in his peculiar way over an assortment of slips calling for explanations about delays due to defects of engines and cars. My friend was moved all over with wrath, not at the shortcomings that had caused the delays, but at the new order of things that pointed them out. He was exasperated because nothing had been said about numerous delays he was familiar with by bad train-dispatching, blocking of the tracks in the yards, and the slow handling of baggage. "Everything is heaped upon the mechanical department," he declared, "railroading is going to the dogs with all these theoretical dudes pretending to manage things."

What I gathered from the conversation that ensued was, that Wilt. Gratsam had made up his mind to throw every obstacle in his power in the way of the new general superintendent. Wilt. thinks the road cannot run without himself looking after the department that has grown from almost nothing under his charge. It will be a terrible blow to the old man if the management turn him out, but I am afraid that is what will happen.

One meets with a great many cases similar to this, where men in charge of motive power are inclined to resent the introduction of what are really business methods. Opposition of this kind generally proves bad for the kicker.

In Gratsam's case the general superintendent is in the right and the master mechanic in the wrong; but in my travels, I frequently find things the other way. While in Cincinnati last week, I heard a story talked about that reflects very badly upon the general superintendent of an Eastern railroad.

It seems that a rumor had been going around that the master mechanic of the Eastern road was about to quit, and a Cincinnati railroad man wrote to the general superintendent recommending one of his friends for the position. The G. S. answered that he was anxious to get rid of the master mechanic and had tried to get him to quit without success; that he believed the man would cling to the position till he was driven out with a club.

I know both parties intimately, and feel certain that the master mechanic is by far the most capable and efficient of the two.

## Work at Schenectady.

The Schenectady Locomotive Works are not shouting very loud about the number of compound locomotives they are building, but they seem to be hauling in sufficient orders to satisfy the advocates of the newer type of locomotive. After a satisfactory trial of a number of compound locomotives in different kinds of service, the Southern Pacific Company have lately ordered twenty-seven new compounds from Schenectady. As far as we know, this is the largest number of compound locomotives ever called for in one order. Seven of the engines are intended for passenger service, and have cylinders 20 x 29 x 26 inches. They are ten-wheelers. The remaining twenty engines are twelve-wheelers of the form illustrated in LOCOMOTIVE ENGINEERING for January.

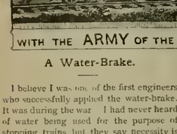
These works have two mogul compounds for the Adirondack & St. Lawrence about ready for delivery. They have just received from the New York Central an order for one hundred locomotives.

## Alabama Midland Railroad.

One of the new and struggling roads of the South which is rapidly lifting herself up out of the mud, where it was left by the construction company and turned over to the Plant system as a gilt-edged property, is the Alabama Midland, running from Montgomery to Brauntree, through perhaps the most valuable timber and farming land in Alabama and Florida. What has been accomplished in this direction has been done through the perseverance and indomitable will of Col. Bradford Dunham. As a manager of Southern railroad properties where economical methods are essential for dividends, Col. Dunham has few equals. His success is based on a comprehensive system of management and direct supervision of details. Elaborate system in transportation, mechanical and roadway departments cannot be successfully saddled upon roads south of the Ohio In the South success depends to a great extent upon the personal attention and vigilance of the manager.


### A Water-Brake.

I believe I was one of the first engineers who successfully applied the water-brake. It was during the war I had never heard of water being used for the purpose of stopping trains, but they say necessity is the mother of invention. It was so in my case. I arrived at Cowan, on the N. & C. R R , with thirteen cars, Engine 17, L. & N., Robert McKallipp, conductor , Robert Warnock, fireman. The pusher assisted us up the hill. In the tunnel I felt the slack run out, thus knowing we were to get



Work of Sherman's Destroyers.

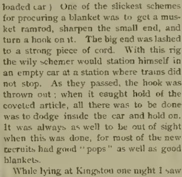
down the mountain alone. We went down in a hurry Before we were fairly out of the tunnel I could feel the train bumping the engine and called for brakes, but felt none About this time McKallipp came over the train bareheaded, shouting to me to hold her as they had only three brakes and had broken two of them I had been trying to slack them by reversing previous to this, but had let up on them two or three times for fear of blowing steam-chest covers off. Not knowing what might be at Tantalon, I was at a loss what to do Then my good angel came to my aid. We were flying I turned on the left-hand pump. Warnock set it to work by opening the pet-cock With both pumps working it did not take long to get a full boiler When she showed water in the whistle I reversed and opened the throttle, with a fervent prayer that the steam-chest covers and cylinder-heads would stand the pressure of the water. They did, but we passed Tantalon a little faster than I want to ride under such circumstances

The railroad company abandoned Tantalon as a meeting station after the war, as there were several disastrous wrecks there by reason of trains running away on the mountain.

### How Trainmen got Home-made Blankets.

When President Lincoln called out the one hundred days men many of them were furnished with fine double all-wool blankets by their friends in the North Now, the aforesaid blankets looked very tempting to the Government trainmen. As it was getting along toward winter when these men were sent South, many schemes were devised by them to secure one or more of the much-coveted coverings for their bunks. As the soldiers had to ride on the top of the cars they were compelled to use their bedding to keep warm (No soldier was allowed to ride inside of a loaded car ) One of the slickest schemes for procuring a blanket was to get a musket ramrod, sharpen the small end, and turn a hook on it. The big end was lashed to a strong piece of cord. With this rig the wily schemer would station himself in an empty car at a station where trains did not stop. As they passed, the hook was thrown out ; when it caught hold of the coveted article, all there was to be done was to dodge inside the car and hold on. It was always as well to be out of sight when this was done, for most of the new recruits had good "pops" as well as good blankets.

While lying at Kingston one night I saw the tables turned. One of our conductors had a Mexican blanket "serape." He had been showing it to some soldier friends of his who were in his caboose, where they spent the evening. About ten o'clock the conductor made up his bed, spreading his serape over him. I was on the station platform, close to his car, when I saw a soldier sitting between the trucks immediately under the car-door. As there was nothing unusual about this I did not pay any attention to the man until a passing train came by, when he got up and made ready to board the train, which he easily did. About the time he dodged between the cars I saw an object flutter out of the caboose, and start up the track after the train. It was Steven-



Badly Kinked.

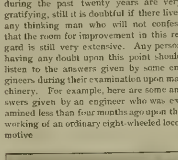
son's "serape" at the end of a cord , he fired one or two shots after the train. said a few cuss words, and crawled under an old Government gray.

James H. Hevey

The writer recently measured the depth of sand on a break-beam on the tender of an L. & N. engine, running between Pensacola and River Junction, Fla. The engine had run the 162 miles, and was covered with sand, that on the beam being an inch and an eighth deep This division lays through white sand wastes , at night it looks like a slight fall of snow. Not very good for machinery, and awful bad for tires. The only thing that could be said in its favor is that it causes the brakes to take hold in business earnest.

### More Education for Engineers.

What means can be employed to more fully impress upon the minds of machinists and locomotive engineers and firemen the great importance of education in their business? While it must be acknowledged that the results of effort in this direction during the past twenty years are very gratifying, still it is doubtful if there lives any thinking man who will not confess that the room for improvement in this regard is still very extensive. Any person having any doubt upon this point should listen to the answers given by some engineers during their examination upon machinery. For example, here are some answers given by an engineer who was examined less than four months ago upon the working of an ordinary eight-wheeled locomotive



Burning and Raiding.

Question—How long have you been employed as locomotive engineer?

Answer—Thirty years.

Q.—Where does the steam go after it has completed its work of driving the piston to the opposite end of the cylinder?

A.—It goes to the cylinder on the opposite side of the engine.

Q.—Where does it then go?

A.—Back to the other cylinder.

Q.—Does any of it get out of the stack?

A.—Yes, a portion of it.

Q.—What becomes of the balance?

A.—It keeps going from one cylinder to the other.

Q.—Did you ever read any upon the subject of steam and the steam-engine?

A —Naw I don't go much on readin' books. Experience is good enough for me.

And this man ran a locomotive for thirty years. Think of it If he had pulled the regulation trains for thirty years with the steam acting in this manner, what a fuel record-maker he must be. Can any one believe that had this engineer read Locomotive Engineering regularly and carefully he would have made the above answers? No. And should he begin now to read and study upon matters connected with his business he would wish to be re-examined quickly.

Examples of such ignorance as the above answers indicate are becoming more rare each year, and this desirable result is brought about by the men taking more time to read and study such literature as Locomotive Engineering, "Sinclair and Forney on the Locomotive," etc. An engineer should never be examined upon the subject of machinery without an effort being made to impress upon his mind the fact that he cannot afford to neglect the study of such works as these

Oh, engineers and firemen! what would become of us should the physicians of this country give no more study to their business than did the engineer, a part of whose examination you have just read. And what will become of the machinists, engineers and firemen who do not study and endeavor to keep thoroughly posted upon subjects pertaining to their business?

Not many years ago, if a special was to be run over a road, the general manager or superintendent would inquire, "What conductor can you give us" Now the question oftener is, "Who is engineer?" And if he is a sober, careful, intelligent man all is satisfactory, and the official retires with the feeling that all will go well with the special. We must not lose sight of the fact that brains count more in railroading now than formerly. Good, sober, energetic men of brains are those whom the general managers are looking for to fill positions of trust. Experience is a good thing and should not be underestimated, but experience, coupled with careful thought and study, is a better thing.

The days of the ignorant engineer and fireman are numbered. They would not now be chosen to fill important positions ; and the day is not far distant when they will no longer be allowed to stumble blindly along, gaining all their knowledge by experience alone, but they will be dropped out as being utterly useless.

L. C. Hitchcock

### Lining Guides.

BY A. HOLBEER.

In your February number we notice an article by Mr. L. C. Hitchcock upon method of hanging guides We have no fault to find with the method, except that as Mr Chas. Graham once expressed to me, after he had examined our method of squaring an engine, and we had asked him if it was not correct, "Yes, it is correct enough, but is all-fired awkward." So with Mr. Hitchcock's elaborate method. It is all right but in this age of get there it is decidedly slow.

Our method is :

1st. Have your guides straight.

2d. Have your piston turned and fitted to crosshead, keyed firmly to place. Then put your piston and crosshead on planer ; clamp the piston-rod in "V" block, which are, of course, fitted to slots of planer. This insures that any cut taken on the crosshead is in line with piston-rod ; then plane up the crosshead. Have gland ready to slip on the piston ; this gland should fit the stuffing-box at back cylinder-head. Now everything is ready for guide hanging.

Next put your piston in the cylinder; push it back until it is in the center of cylinder ; slip the gland to its place. Then if your spider does not fit the cylinder accurately line to center of cylinder by strips of tin or thin wedges ; next key on the crosshead and level it , then clamp your guides to the crosshead, using a liner of heavy paper between the wearing parts of guide and the crosshead. A bit of thought will show you that your guides are now in their proper place, and the process of fastening them to this place is next. We believe it best to have guide-blocks that are considerably thinner than crosshead. Put them in place, and put liners on top and bottom of guide-blocks to fill up whatever space may be left. Now clamp both ends of the guides firmly to these blocks, ream out for bolts, and put bolts in place. Then loosen up all bolts and take out the paper liners used between crosshead and guides, and tighten up bolts When this is done, unless your liners have been very accurate, your guides will be sprung up or down ; relieve this by paper until the crosshead and piston move freely.

This is all there is to it Do not fool with a line, or take measurements where you can avoid it.

In Mr. Hitchcock's method a line is used to represent the piston, and if guides are not central with cylinders (as most of them are not) a complicated calculation is needed. By this method you put the piston and cross-head in place, and fit the guides to it. We know from practical experience that when you tighten up your guide-bolts in this method you are liable to spring the guide So you will by the method as explained by Mr. H ; but you can depend upon this, that your guides are reamed right, and any relief you may have to make by liners is not going to affect the alignment.

In this connection, allow me to say that it is folly to attempt to hang guides too closely. When a young man I worked in a shop with a friend who, I think, was the most careful and painstaking man I ever met, and he used to hang guides on one side of an engine and I on the other. When we were through I used to feel cheap, as my guides did not look like his; but after the engine had been in service a few days mine looked the best, for there was usually trouble with his guides cutting. Why, because they were not in line? No, but because they were hung too close, and would not admit of proper lubrication.

*Rochester, N. Y.*

## The Golden Rule—of Brass.

It's a strange thing that a man can have two consciences; can do right in one walk of life and wrong in another; can be honest with Smith and dishonest with Jones—a Dr. Jekyl on Thursday and a Mr. Hyde Thursday night.

There are a whole lot of people who would cut their right hand off rather than do any man a wrong in private business, but who, as railroad officers, will enter into disreputable schemes to work injury to other roads or other people and think that they are doing their duty and "managing" for the company.

The writer recently sat in the office of the master mechanic of a Southern road when a "drummer" appeared; he had a thing that he called a car brass, it had an iron stiffening piece in it which was surrounded by a little brass and lead lined; it looked fairly well.

He only asked ten cents per pound for it and the M. M. at once said that a reliable brass could not be made for that money. Then he explained the iron center. M. M. said he didn't want them; would wear down to iron and cut the journal; then an ordinary brass was worth something for scrap, this bastard nothing.

Then the drummer opened his clinching argument. People don't buy them for their own use, but to put into foreign cars; they get off your road all right, and it makes 30 per cent. difference for renewal of brasses on foreign cars.

The M. M. said he always had and always would put the same kind of brasses into foreign cars that he had in his own—treated his neighbor as he hoped to be treated—and that he didn't want any snide brasses or any cast-iron coupler knuckles, or any culled car wheels to put on cars to annoy, rob or kill other people; said it wasn't right and he wasn't sure but that it was criminal.

Several days later the writer ran across the drummer in another city, and he said he was doing a good business. No railroad officer can do this kind of work and remain an honest man.

## Compound for Cleaning Paint.

Firemen who are anxious to keep neat looking engines will be interested in anything that will tend to lighten their labors, and cleaning paint-work is labor.

The following mixture is used on the South Carolina road for cleaning all varnished paint, and neater looking tanks, cabs, etc., are hard to find:

To four gallons of water add one pound of borax and one quart of lard oil. This is rubbed on the paint and then wiped dry with clean waste. It does not dim the luster of varnish by repeated use, and comes off easily, but it should not be left on very long; rub half a dome or sand-box with it and then wipe off before it is partly dried.

A coat of this once or twice a week will keep a tank shining. It does not darken gold-leaf letters, costs almost nothing, and is effective. Try it.

## The First Agreement between Locomotive Engineers and a Railroad.

As is, perhaps, well known, the South Carolina Railroad was one of the first in America, having been chartered in 1827 and built in 1832, it had the first hundred miles of continuous track in the world, and was, up to 1838, the longest road in the world—its main line is no longer now.

This road put into service the "Best Friend," the first locomotive built in America, and in 1835 had *eight* locomotives in daily service.

During a recent Southern trip I had the pleasure of looking over many old drawings and records from "ye olde, olde, very olde rode,' and had I but time and space could give you something of interest from all of them.

In the front of the time-book for engineers and firemen for 1835 was found what I believe to be the earliest "contract" or "agreement" between engineers and a road, and it is here reproduced from the original, full size and exact.

Pay of Engineers

While in Charleston $2.00 pr. day

passengers laying over at the place on Sunday — 2.00 do.

With Freight. $9 for trip of 3 days

" Passengers. 5.50 for do 2 days.

If detained at Aiken for repairs $2 pr day

If the Engineer returns without completing the trip nothing will be allowed for the time absent unless the trip be lost in consequence of Breakage of the road and exchange of trains or from other cause than the failure of the Engine - When thus detained on the road $2 per day for the time exceeding the proper time of the trip. Engineers running for wood or timber will be allowed $2. pr. day.

The most interesting clause is the one providing that when the engine broke down, and had to return without finishing her trip, the engineer got no pay. That was the day of the "machinist runner," when he did all the repairs and often helped to build his engine.

Verily, "over-time," "delayed time," "lay-over pay," "pay by the trip" and "agreements" are not modern inventions.

J. A. H.

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Our neighbor the *Railway Review* shows up an old picture of one of the Camden & Amboy eight-footers, and moralizes a little on the probable details, wondering if drawings still exist, etc. In THE LOCOMOTIVE ENGINEER for February, 1889, the detail drawing of the first of this class of engines, the "John Stevens," was shown from plates taken from the original drawings, giving dimensions, etc. The engines were designed by Isaac Dripps, and the original drawings were made by a son of Richard Norris, who is still alive. The big wheel was a correct principle for fast speed but there was not sufficient power behind it.

## Courage of Trainmen.

Some of the courageous scribblers who sit in their secure dens and reel off words for the daily papers at $5 a column are very courageous on the subject of train robbers, and abuse trainmen for quailing before a loaded pistol or shot gun. The *Railway Conductor*, edited by a man who has been compelled to interview robbers and ruffians in actual service, has this to say respecting a paragraph in a New York paper reflecting on the courage of trainmen:

"We would like to see a fair test made of the courage of the writer of such a paragraph. He is either thoughtless, ignorant or a braggadocio. We do not believe there is a train running in America that has not one or more in the crew who, with anything like an even chance, would not fight in defense of the property in his care. Railway employés are not deficient in courage as they demonstrate every day; the most of them do have a little common sense though, and they do not consider that they use good judgment in throwing their lives away in defense of the express company's or even the passengers' cash. The train crew are the ones first looked after by the robbers, as a rule, and they know that they are marked, and that a move means death."

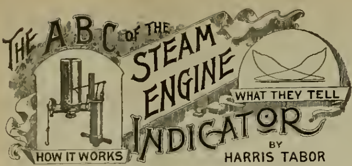
## A Thing-Man.

On a recent trip in the South, the writer stumbled upon one of those characters who make you disgusted with being human, and causes you to half wish you were a girl baby or a baboon. This specimen claimed to be a lawyer from Chicago, and was particular to mention that he was a neighbor of George M. Pullman. He had a letter asking Pullman employés to show him every courtesy. He rode in the sleeper a short distance, simply paying a seat fare, the berth being sold to other parties. When it became late enough for people to go to bed, the conductor asked him to sit in the smoking-room, so that the berth could be made up—he had been in there a long time before. To this he made no objection at the time, but when most of the people were in bed he commenced to abuse the conductor for moving him. He was funny, sarcastic and insinuating, but the conductor kept his temper, and even asked the "thing's" pardon, but he was madder the longer he talked, and finally said he should make a complaint and have the conductor discharged. "I want your job for this, that's the way I'll fix you," were his words. To this threat the conductor replied that he could no doubt accomplish that end if he tried, but that it was a mean spirit for a man to exhibit. The conductor told the writer afterward that he had been in the employ of the company for thirteen years. The Pullman Co. ought to require conductors, in a case of this kind, to take off their uniforms and punch the head of the animal needlessly insulting them and threatening to deprive them of their means of livelihood. There are stock cars for such things, a sleeper is too good for them. We do not know the name of the "man who lives neighbor to Pullman," but the conductor's name is W. B. Ellison, and he runs between Jacksonville and New Orleans. If the Pullman Co. discharge him for this complaint, it will punish the wrong man. He was a gentleman—the other was not.

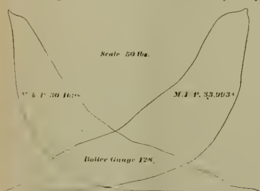
## Divisibility of Gold.

It is said that a Southern Pacific officer has induced the Pullman Car Company to make a reduction on the quantity of gold leaf used on the exterior decoration of the cars, and that it has resulted in a saving of $80 per car. We suppose that the report is correct, but it seems a big saving for one car, for gold leaf is very thin, and an ounce goes over a big surface.

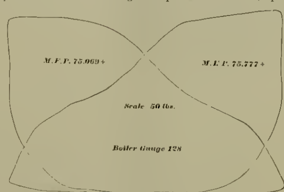
Few people realize how thin gold can be spread. In the manufacture of gilt wire used for embroidery the amount of gold employed to cover a foot of wire does not exceed the 720,000th part of an ounce. Those fond of figuring know that if the 720,000th part of an ounce is used in covering 1 foot of wire that in an inch there is only the 8,640,000th part of an ounce. We may divide this into 100 parts and yet see the gold quite distinctly with the naked eye, and find that the 864,000,000th part of an ounce of gold is visible, and the exceedingly minute particle possesses all the characteristics of a large piece.



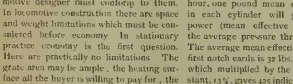

The locomotive is a machine that is largely influenced by extremes. These extremes often work in opposite directions, or in antagonism to each other, seriously affecting the economy of the locomotive as a steam motor. This point may be illustrated by referring to the series of diagrams published in the preceding number of this journal. We know that the cards taken when the reverse lever was in the first and second notch are much more economical in the use of steam than that taken with the lever in the seventh notch. We also know that the boiler will steam much better under the latter condition, for the reason that this condition is favorable to a larger coal consumption. A more economical result might be obtained from coal if the draft conditions would warrant slower combustion, but they do not, and the locomotive designer must conform to them. In locomotive construction there are space and weight limitations which must be considered before economy. In stationary practice economy is the first question. Here are practically no limitations. The grate area may be ample, the heating surface all the buyer is willing to pay for, the natural draft may be made to suit any requirements that appear. As a result of this freedom in design a pound of coal burned under a stationary boiler will produce more power than we can ever hope for from a like amount burned in the fire-box of a locomotive.




14.75 Miles per hour.
Reverse lever in 1st. notch.
Throttle open
Grade 30 ft. per Mile.




7.37 Miles per hour.
Reverse lever in 3rd. notch.
Throttle ½ open
Track level.




34.31 Miles per hour
Reverse lever in 2nd notch.
Throttle open.
Grade 30 ft. per Mile.

The running conditions which must always govern the locomotive is another factor against the highest coal economy. There will always be grades which mean extremes in loads, and frequent stops. Anything like a uniform load, which is one of the conditions of good economy, will always be out of the question. With the stationary engine the load rarely varies beyond the limits of economy.

Enthusiasts who would revolutionize the present locomotive practice do not give sufficient thought to the limitations that must be met. If we analyze the card taken with reverse lever in the first notch, and its effect upon the boiler, we meet one of the obstacles in the way of high economy when compared with the more favored stationary engine. This card, considered independently from the boiler, shows excellent results. Its steam consumption is low, and the drain upon the coal pile necessary to supply the steam would be very satisfactory. With 62-inch drivers, running at a speed of forty miles per hour, one pound mean effective pressure in each cylinder will give 13¼ horse-power (mean effective pressure means the average pressure through the stroke). The average mean effective pressure of the first notch cards is 32 lbs. per square inch, which multiplied by the horse-power constant, 13¼, gives 425 indicated horse-power. The heating surface in this boiler will not exceed 1,400 sq. feet, or 3.3 feet to the horse-power. In stationary practice the builder of a single-valve automatic engine which would make an indicator card similar to this would not think of recommending less than 10 sq. feet of heating surface per horse-power, and he might call for 12 feet. Under natural draft conditions favorable to the highest steam economy, our first notch card, from a stationary engine, would call for from 4,000 to 5,000 sq. feet of heating surface in the boilers to do the same amount of work that is done on the road with 1,400 sq. feet.

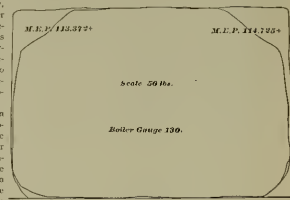
The indicated power shown by the second notch cards, at a speed of forty miles per hour, is 586, which brings the heating surface per horse-power down to 2.38. The stationary engine, with practically the same valve gear, would require 6,000 feet of heating surface to develop the same power. The slower combustion under the stationary boiler compels a much larger grate area.

The mean effective pressure of third notch cards show, at forty miles per hour, 1,000 horse-power, which cuts the heating surface per horse-power down to 1.4 feet. This result is often obtained.

The great drain made on locomotive boilers by the engines calls for very rapid combustion in the fire-box, and an unusually large amount of coal to be burned on each square foot of grate surface. This means a strong draft, which must come from the exhaust of the engines; hence, the card which shows the greatest terminal pressure (pressure at the end of the stroke) and exerts its influence through the greatest portion of the stroke, represents the conditions which give the boiler its greatest steaming capacity. On the other hand, it may be said that the card which gives the greatest mean effective pressure with the lowest terminal indicates the conditions of best economy in the engines. Here we find one of the conflicting extremes which will bear analyzing.

If we refer to the first notch cards, we see that the terminal pressure, on account of expansion and early release, runs down to the atmosphere. There is no impulse to the draft from the pressure of steam. We have a vapor of the pressure of air, which is forced through the exhaust by the piston, to produce draft. An examination of these cards reveals the fact that we do not get this current through the entire stroke; the exhaust is closed before the piston has reached the middle of the stroke, thereby shutting off all communication between the exhaust side of the piston and nozzle, and stopping the forced draft during the latter half of the stroke. We see at a glance why the boiler will not respond to the call of the engines under first notch conditions, notwithstanding they are making a light demand. The second notch cards show the same conditions, but in a less degree. These are very economical cards. Their terminal pressure is somewhat greater, and the increased speed has raised the "back pressure" or exhaust to 4 lbs., the exhaust closure takes place later in the stroke, thus giving a longer communication with the nozzle. The steaming conditions here are much better than shown by the first notch cards, but it is doubtful if the draft would be sufficient for a long run. These cards represent conditions showing extremes in engine economy and limited steaming capacity in boiler. As the terminal pressure is higher and exhaust closure delayed, the coal combustion will be increased.

The other extreme may be accounted for by the lines on seventh notch card. In this case the valve is at its greatest travel and the ports are fully uncovered. The terminal pressure is 94 lbs. The effect of this pressure, admitted through full port to the exhaust nozzle, on the fire can be appreciated only by studying the firebox. The flow continues until the return stroke is nearly completed, when exhaust closure takes place. We have here—first, a greater terminal pressure; second, a larger port opening for its escape to the nozzle; third, an uninterrupted flow through the nozzle during a greater portion of the stroke. Every change in the conditions tends to a greater coal consumption. These cards represent the maximum steaming capacity of the boiler. They also represent the greatest cost, per horse-power, in pounds of coal. The compound locomotive corrects, in part, these extremes or antagonisms. A comparison of compound and simple cards will be made later in this series.




9.22 Miles per hour.
Reverse lever in 7th. notch.
Throttle ⅓ open
Grade 47⅓ ft. per Mile.

Harris Tabor

## Bessemer-Steel Axles.

We have several times had occasion to speak disrespectfully about Bessemer steel as a material for axles. We do not think that the roads which accept Bessemer-steel axles care for anything beyond getting a bar that will fasten the wheels together to start them rolling. When Bessemer-steel axles are subjected to the M. C. B. test before being accepted, and the test conscientiously made, the rejection of axles is something appalling. That is, it is appalling in the light of our knowledge that many roads are using just such axles, and have let them pass into use without examination. We would like to see the men who specify Bessemer-steel axles, and accept them without tests, compelled to ride on the cars carried on such unreliable material.

Those who think of trying Bessemer-steel axles should find out the experience of the B. & O. people with some 1,500 such axles furnished by Carnegie, Phipps & Co.

The Rhode Island Locomotive Works are comfortaby busy, but not rushed. They are working on an order of twenty-seven locomotives for the Boston & Albany, twenty of them being the standard eight-wheel engine, four consolidation engines and three switchers. They are also working on a large order for the Wabash, embracing ten-wheel, eight-wheel and switching engines. There is in the erecting shop a very fine heavy Forney engine for the Wheeling Bridge Terminal Co. The engine will be well adapted either for switching or surburban train service. The New York, New Haven & Hartford have ordered fifteen engines from the Rhode Island Works, and the Union Pacific has placed a large order. Besides these, there are several smaller orders on hand. During the slack time ten of the company's standard moguls have been built, and they are still on hand, but the probability is that a customer will soon be found.

## The Bursting Pressure of Cylindrical Boilers.

Several correspondents have recently asked for an explanation of the rule for finding the bursting pressure of boiler shells. The following article, says *The Locomotive*, is offered as a general answer to all of these inquiries:

Fig. 1 shows an end view of such a shell, with the thickness purposely exaggerated. Let us assume that when the shell bursts it will separate along the line $AB$, so as to come apart in the manner indicated in Fig. 2. Now, although the steam pressure acts perpendicularly to the curved shell at every point, as indicated by the arrows, yet, so far as blowing the two halves of the boiler apart is concerned, the effect is the same as though the steam pressure acted vertically against a flat plate equal to the boiler in length, and equal in width to the diameter of the boiler. To make this plain let us consider Fig. 3, which shows each half of the boiler with a flat plate welded to it along its open side. Now, it is a matter of common experience that a structure like one of these halves will not move upwards or downwards when steam is admitted to its interior. That is, if it were put on a pair of scales the pressure of the steam against its inner surfaces would not make it weigh

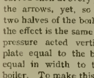



Fig. 1.

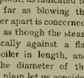


Fig. 2.

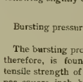


Fig. 3.

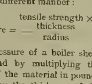



Fig. 4.

less or more than before. It follows, therefore, that the total upward pressure of the steam against the shell is precisely equal to the total downward pressure against the flat plate; the greater area of the curved shell being exactly compensated by the obliquity of the pressure against it.

Let us now consider Fig. 4. The total upward pressure of the steam against the upper half of the shell is equal, as we have seen, to the pressure against a flat plate, such as that shown in the cut, extending across the middle of the boiler. That is, it is equal to

Pressure per sq. in. × area of flat plate.

But the area of the flat plate is equal to the length of the boiler multiplied by its diameter, so that the total upward pressure, tending to blow off the upper half of the boiler, is equal to

Pressure per sq. in. × diameter × length.

This upward force is assisted by the strain on the boiler shell, as indicated by the arrows at $A$ and $B$. The total strain on the shell is equal to the strain on 1 square inch of sectional area multiplied by the number of square inches of sectional area that would be broken across if the boiler should burst. The area of the fracture along each side of the boiler would be

Thickness of boiler × length of boiler,

and since there is one such strip on each side of the boiler, the total area broken across would be

2 × thickness × length,

and, therefore, the total strain at $A$ and $B$, tending to hold the boiler together, is

2 × strain per sq. in. of section × thickness × length.

So long as the boiler does not burst, the force tending to blow it apart must be exactly equal to the force tending to hold it together; so that

Pressure per sq. in. × diameter × length = 2 × strain per sq. in. × thickness × length.

This is equivalent to saying that

Pressure per sq. in. × diameter = 2 × strain per sq. in. × thickness.

And this, again, is equivalent to saying that

Pressure per sq. in. × radius × 2 = 2 × strain per sq. in. × thickness.

That is,

Pressure per sq. in. × radius = strain per sq. in. × thickness.

Now, when a boiler bursts, it does so because the strain on the shell has become equal to the tensile strength of the material; so that in this case our last formula becomes

Bursting pressure × radius = tensile strength × thickness.

This is the ordinary rule for finding the bursting pressure of a cylindrical boiler, except that it is usually expressed in the following slightly different manner:

$$\text{Bursting pressure} = \frac{\text{tensile strength} \times \text{thickness}}{\text{radius}}$$

The bursting pressure of a boiler shell, therefore, is found by multiplying the tensile strength of the material in pounds per square inch, by the thickness of the shell in inches, and dividing by the radius in inches.

In this demonstration we have assumed the shell to be a solid sheet of metal, without joints. In practice the strength of a boiler is reduced exactly in proportion to the strength of its longitudinal joints, so that we must multiply the result obtained by the foregoing rule by the decimal representing the efficiency of the joint. The foregoing formula therefore becomes

$$\text{Bursting pressure} = \frac{\text{tensile strength} \times \text{thickness} \times \text{efficiency of joint}}{\text{radius}}$$

which means that in actual boilers we find the bursting pressure by multiplying the tensile strength of the material by the thickness of the plate *and by the efficiency of the joint*, and then dividing by the radius.

In conclusion we shall give a few numerical examples of the use of the foregoing formula and rule:

EXAMPLE 1. What is the bursting pressure of a steel boiler (tensile strength 55,000 lbs.), 48 inches in diameter and $\frac{5}{16}$ inch thick, with single-riveted longitudinal joints whose efficiency is 56 per cent? ANS.—The radius of this boiler is 24 inches, so that the rule gives

Bursting pressure $= 55{,}000 \times \frac{5}{16} \times 56 \div 24 = 401$ lbs. per sq. in.

EXAMPLE 2. What is the bursting pressure of a steel boiler (tensile strength 55,000 lbs.), 60 inches in diameter and $\frac{3}{8}$ inch thick, with double-riveted longitudinal joints whose efficiency is 70 per cent? ANS.—The radius is 30 inches, and the rule gives

Bursting pressure $= 55{,}000 \times \frac{3}{8} \times 70 \div 30 = 481$ lbs. per sq. in.

EXAMPLE 3. What is the bursting pressure of a steel boiler (55,000 lbs. tensile strength), 66 inches in diameter $\frac{3}{8}$ inch thick, with triple-riveted longitudinal joints whose efficiency is 75 per cent? ANS.—The radius of this boiler is 33 inches, and the rule gives

Bursting pressure $= 55{,}000 \times \frac{3}{8} \times .75 \div 33 = 469$ lbs. per sq. in.

EXAMPLE 4. What is the bursting pressure of a steel boiler (tensile strength 55,000 lbs.), 72 inches in diameter and $\frac{3}{8}$ inch thick, with double-welt butt longitudinal joints whose efficiency is 87.5 per cent? ANS.—The radius is 36 inches, and the rule gives

Bursting pressure $= 55{,}000 \times \frac{3}{8} \times .875 \div 36 = 501$ lbs. per sq. in.

After we have found the bursting pressure, the safe-working pressure may be found by dividing the bursting pressure by a suitable factor of safety. We consider 5 to be the best factor of safety when all things are considered, though we sometimes allow $4\frac{1}{2}$ when the workmanship is known to be first class, and the materials of which the boiler is made have been carefully selected and tested. With a factor of safety of 5, the safe-working pressures in the foregoing examples are as follows: Example 1, $401 \div 5 = 80$ lbs; in Example 2, $481 \div 5 = 96$ lbs.; Example 3, $469 \div 5 = 94$ lbs.; and in Example 4, $501 \div 5 = 100$ lbs.

## Air-Brake Matters.

Mr. W. C. Parsons, of San Antonio, Texas, finds fault with the answer we gave to a correspondent to the effect that no pump gets up 130 pounds pressure in service. He says: "In my experience as fireman, I have often seen the air-gauge register 130 pounds in main reservoir in cases of train parting or hose bursting." In such a case, the first thing an engineer does is to place his brake-valve on lap, in which position the pump-governor is cut out, and the main reservoir pressure will go up very nearly to boiler pressure if the pump is good and the connections tight.

This extra pressure is necessary to fully recharge train-pipe and auxiliary reservoirs so as to be able to go as soon as the train is coupled up. This extra pressure must be admitted into the train-pipe gradually, so as to avoid bursting hose next to engine, for we must bear in mind that the air has to pass into the auxiliary reservoirs through a very small opening, and it takes some little time to recharge them.

The necessity for time to permit the auxiliary reservoir to recharge is well illustrated in cases where brakes are released too quickly in making a stop at a water-tank. The attempt to apply them at once after release often results in running past the water-tank, and the blame is laid on the equalizing discharge-valve, when it should be laid to the fact that sufficient time was not given for the auxiliary reservoir to be recharged with air.

In answer to another question, you say by having air in train-pipe of the rear car, the train would be stopped before damage could be done in case the rear car broke off. Would not brakes have been applied just as quickly if the cock had been turned on rear car behind hose-coupling, leaving cock next to it open so as to have air in hose, but not in train-pipe of rear ear? Of course, in this case the conductor's valve would be useless.

[It is not good practice to let the air go up to 130 pounds pressure. It is not desirable to have a car at the end of a train with the conductor's valve useless.—ED.]

## Western Railroad of Alabama.

Marked improvement in the roadbed and equipment, as well as a corresponding improvement in speed of trains throughout the South is noticeable on every hand. They have shown a disposition to "tread closely upon the heels" of Northern roads in adopting the most advanced appliances, and in some cases they lead our Northern roads. On no road is this tendency "to be abreast of the times" shown in a more marked degree than on the Western Railroad of Alabama, or what is more generally known as the Atlanta & West Point Railway. Under the management of Captain E. L. Tyler this road has acquired an enviable reputation throughout the entire South for excellent track, gravel and stone ballasted throughout, safety switches, switch lamps, 48-inch double angle bars, 68-pound steel rails and semaphore signals. On this substantial and well-maintained structure there is run first-class locomotives and cars that would be a credit to any railroad.

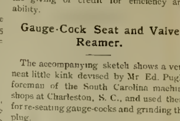
The extended experience of Captain Tyler in different departments of railroads fits him particularly well for the general manager of a Southern road. His experience embraces that of machinist, locomotive engineer, master mechanic and superintendent. One source of his success might profitably be imitated by other railroad officers. It consists in displaying keen appreciation of valuable service and the giving of credit for efficiency and ability.

## Gauge-Cock Seat and Valve Reamer.

The accompanying sketch shows a very neat little kink devised by Mr Ed. Pugh, foreman of the South Carolina machine shops at Charleston, S. C., and used there for re-seating gauge-cocks and grinding the plug.

As will be seen, it is intended to be used with cocks having a straight stem, with thread in outer nut.

The cutting tool is a round piece of steel of the same diameter as the stems to be ground; one end is made in the shape of a



rose-bit, as seen on the right of sketch. This is used to true up the seat. The other end has cutting edges, as shown at the left, made the same angle as the cutter on the opposite end. This end of the tool is held in a sleeve by a pin, as shown, the sleeve serving as a guide, into which the plug of the valve is inserted and rotated to form a new bearing. This is a simple little hand tool that can be carried in the pocket. It is not necessary to remove gauge-cocks from the boiler in order to renew the seat, and the whole set can be put in good shape in a few minutes without any "grinding in."

## The Boring Bar is Old.

We are every day receiving new illustrations of the truth of the saying that "there is nothing new under the sun." Our latest information bearing on this is from Mr. T. B. Purves, Jr., assistant master mechanic of the Boston & Albany, who writes us:

In your March issue, page 97, you illustrated "A New Boring Bar for Lathes." I fail to understand why it is called new. The Schoharie Valley car shops used a bar of this description over twenty years ago for boring car wheels, and there are quite a number of jobbing shops in Albany and vicinity that have had them in use for almost as long a period.

In the Boston & Albany shops we have been using a bar about ten years that we consider an improvement over the "new" one. Instead of holding the bar on its true centers in lathe, we throw them out one-half inch, and with suitable rig attached to tail stock we get one inch movement of the sleeve to which the tool is attached, making it unnecessary to move the tool in sleeve throughout the whole operation; at the same time doing it with as much speed and accuracy as if the tool was held in post. We also have a bar that will bore an oval hole of any diameter that lathe will swing.

When the car cleaners and repairers look over a S. P. car at New Orleans or Houston, they paint the hook of the Miller coupler and the buffing irons with a heavy grease that prevents wear and noise. This practice has obvious advantages over the dry system of letting them cut, file and squeak.

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## Special Notice.

We can commence no more subscriptions with January or February papers, and only a few hundred with March.

When the present owners enlarged the paper and doubled the price they naturally expected some falling off in subscriptions—estimated at 25 per cent.

They printed 30,000 copies in January, using many for specimens, and the regular edition of 16,800 for February.

The subscriptions did fall off in a few localities, but others took their places, and many clubs increased. This called for an increase of edition in March. The subscriptions continued to flow in, and to-day, March 25th, the paid list is larger by some hundreds than it ever was. Our agent in Australia has almost doubled his order, the News Company have increased their order twice since February, and so the April number goes to press to-day with 20,000 copies, and the May number will be increased to forty pages.

Provision will be made to supply back numbers hereafter, so in sending names please have them commence with March or April.

For this prosperous condition we acknowledge indebtedness to the support of the railroad men of the country and to the business houses who have patronized our columns.

We believe the interest taken has been, in a measure, deserved; we have tried to make a good paper; we are now in better condition to make an interesting paper than ever, and no trouble or expense will be spared to keep LOCOMOTIVE ENGINEERING "the most interesting railroad paper printed"—that is the reputation we are striving for.

ANGUS SINCLAIR,
JOHN A. HILL.

## Electric Motors against Locomotives.

The electrical press with one accord has been predicting with intense persistence for several years back that the steam locomotive must give place to the electric motor, and not a few electricians of more or less eminence have expressed themselves to the same effect. If a doctrine is preached persistently enough it is certain to secure converts, and it is not surprising that the prophecies about the coming triumphs of electricity should meet with believers among railroad men. Some railroad men of high degree even have been so much carried away with contemplation of the coming greatness of electricity that they have themselves turned prophets and foretold that the steam locomotive is about to disappear from the railroad scene.

It is not surprising that electricians and those who depend on electrical business for a livelihood should come to entertain extravagant expectations as to the future of electricity, but it is strange to see railroad men beguiling themselves with beliefs that have so little solid foundation. A long-headed prophet studies the facts before he makes predictions. When this is done he is liable to tell correctly how the thing will come out. When a man prophecies in accordance with unreasoned predilections he is likely to miss his mark; when he says that a thing will happen the way he wishes a thing to come out there is a very good chance that he is mistaken. The last two classes of prophets are the men who have been informing the world regarding the future of electricity as railroad motive power. Their inspiration is one-sided.

The moving of ordinary railroad trains by electricity is merely a question of expense, and on this basis alone will the question be settled. There have been so many improvements effected on electrical motors in the last few years that it is probable sufficient power could be transmitted to move high-speed trains; but it is certain that the work could not be done at twice the expense now incurred with steam locomotives. Cost is the real obstacle in the way. Should the day come round that trains can be moved cheaper by electric motors than by locomotives, the latter will soon pass away.

A particularly able electrical expert talking on this subject to the writer lately said, that the prospect of moving ordinary trains by electricity is about as good now as the prospects of lighting cities by electricity were before the discovery that electricity could be generated by a dynamo-electric machine. Previous to the introduction of the dynamo, it was well known that electric lights could be made with powerful batteries, but the zinc and copper that constituted the fuel of a battery were too expensive to make electric lighting anything more than a curiosity. The dynamo effected a revolution by cheapening electricity. If another improvement equally radical should be made over the present methods of generating electricity, it would open the way for operating railroad trains more cheaply by electricity than by locomotives. The radical improvement looked for is the direct generation of electricity from the energy of coal. So long as coal has to be burned in a furnace to make steam for an engine to drive dynamos for the generation of the electricity used, there is no probability of electric transmission being cheaper than hauling by locomotives.

The success of electric street cars is often pointed to as a precursor of what is going to happen on surface railroads. The cases are not parallel. The electric motor competing against horses is very different from the same motor competing against a steam locomotive. With all the boasting of what will be done next year to transport passengers at unheard-of speed by electrically operated railroads to the World's Fair, there was not an electric company in the country that would enter into a guarantee to operate the elevated railroads of Chicago as cheaply with electric motors as it can be done by steam locomotives. Electricity for railroad motive power and oil for locomotive fuel stand on the same basis. They are both practicable, and in some respects both are desirable, but it will not pay to use either, except in special cases where other considerations overbalance expense of operating.

## Need of Better Trucks.

There is no important member of railroad rolling stock that so much evil could truthfully be said about as the diamond truck that is almost universally used under freight cars and tenders, yet no part of car and tender mechanism has met with more general adoption. It is curious how this kind of a truck ever came to meet with the favor that led to its general introduction. It has only one merit, and that is that it can be made cheaply. A second merit might be found in the fact that the cheapest kind of labor can be employed in repairing it.

The general introduction of such a defective carriage as the diamond truck was due to the peculiarities of railroad management that neglects one department and pampers others. Cars are the articles that earn money, the engineering department is given entirely to devising means of expending earnings. As a natural consequence, with managers not noted for much foresight the car department is popular and the engineering department the reverse. The diamond truck was an article that car builders liked because it was cheap and easily put together.

The engineering department might protest that the diamond truck was like a huge sledge hammer battering over the track and their remonstrances went unheeded. Eminent engineers, who were responsible for maintaining the track in good order, have repeatedly exposed the vicious tendencies of the diamond truck; but their information was distasteful, and the authors were treated as theoretical cranks. The diamond truck is itself heavier than the cars were that first brought to light the necessity for freight cars being carried on springs, and the greater part of its weight is below the springs. With this heavy truck pounding over the track at the speed now becoming common, it is no wonder that rails are hammered out of shape with small mileage. It is a common thing to hear railroad managers complain that the steel rails supplied now-a-days are greatly inferior to those supplied when Bessemer steel first was put on the market, and that they do not stand near the same tonnage. We believe that the rails supplied to-day are better than they ever were, and that the cause of their not enduring the same tonnage before wearing out is due to the uncushioned blows from the vicious form of truck carrying the heavy car loads at increased speed.

Had the engineering departments enjoyed their proper influence in the councils of railroad managers, we believe that some more mechanical device would have taken the place now held by the diamond truck, and that it would have been greatly to the profit of railroad stockholders. The cheapest and worst, however, was chosen, and railroad companies are paying for the short-sighted policy followed.

The diamond truck may have been chosen because it was the best to be had at a time when there was little else to select from. It looks now, however, as if railroad men would soon have improved forms of trucks to select from, and the indications are that there will be a general movement in favor of a truck that would carry its load without undue injury to the track. At two railroad club meetings last month the subject of car trucks was discussed, and decided favor was manifested for the Fox pressed steel truck. This is a very simple form of truck, and puts all the load above the springs, as may be noted by an engraving of the truck published in our January number. Railroad companies are exhibiting a decided inclination in favor of the Fox truck, and a great many are already in use under tenders and heavy cars. If it proves durable, the diamond truck will pass away as rapidly as the link and pin coupler. If the Fox truck fails to meet the requirements, some other improved truck will be forthcoming, for the writing on the wall reads that the diamond truck is found wanting, and, like the rascals, must be turned out.

## One-Sided Judgment.

There are very few engineers who will not do something to get rid of a fireman who is obnoxious to him. He may be ever so good a fireman, the oldest on the road; but if the engineer doesn't get along peaceably with him, and the companionship is not congenial, he goes to the proper official and asks to have him "changed off."

This is almost always done, for officials know that the good of the service depends in a measure on the men getting along together. Let the officer refuse to change off a fireman whom his engineer dislikes, and the engineer will soon seek evidence to secure his dismissal from the service. We believe that the official does wrong where he does not make the change upon request. The company needs the energy used in fighting each other in its own service.

We believe that engineers and firemen should seek divorce where the union is unsatisfactory to either side.

But the old saying, "What is sauce for the goose is sauce for the gander" should be true in this case.

An engineer goes to the master mechanic and asks for the removal of his fireman, and thinks he gives ample excuse for the change—which he does—when he says, "I am in charge of that engine and can't do the work well or satisfactorily with a poor, insubordinate or drunken fireman. If I am responsible, I want another man."

This very same engineer will breed a riot if the same measure is applied to him.

If the master mechanic says, "I am in charge of these engines, and I can't make a show with poor engineers; those who are insubordinate or who drink whisky. I can't seem to get along well with you, and you must go on another division or on another road."

War is declared then and there.

The engineer who will stand up and refuse to argue the point when he is accused of being a poor engineer, let alone the poorest, has not been found yet.

Is it just right, when we are so free to pass judgment on those below us, that we demand the right to reverse the decision of every court above? Do we not, as engineers, owe to the officers next above us the same kind of loyalty and interest in *results* that the fireman owes to the engineer? Can we consistently be arbitrary and swear we are right when we are on either side of the fence? Has a chronically insubordinate, incompetent engineer any right to kick for the removal of a chronically insubordinate and incompetent fireman who is under him?

If he has that right, has he the right to kick against the removal of himself by a master mechanic or superintendent who is over him?

Can we not afford to be just? Can we afford to be unjust?

## Steel for Boilers.

The manufacture of the mild steel best adapted for standing the intense heat and strains that result from the rapidly varying temperature of a locomotive firebox has been so well developed during the last fifteen years that makers have no difficulty in producing a satisfactory article. That is, there is no difficulty if the proper skill and care are employed on suitable material. We regret to say, however, that within the last two months our attention has been drawn to failures of firebox steel, which leads us to believe that some of the concerns supplying railroad companies with boiler steel are offering an article that is not well suited for high-pressure boilers.

We mentioned last month the case of a firebox having failed in a new engine, and we have since learned of several other cases on New England roads.

Many railroad companies order steel that will come up to certain specifications, but rarely make the test to determine whether or not the article furnished is of the quality paid for. Owing to this practice, makers are not kept up to tension, and they become careless, with the result that inferior articles are furnished for a purpose where the best is never good enough. A year or two ago the Massachusetts Institute of Technology had an experience with firebox steel that ought to have roused railroad men to new vigilance in the examination of the steel purchased. The Institute ordered firebox steel having a tensile strength of not less than 55,000 pounds, and not more than 60,000 pounds per square inch. The elongation was to be not less than 20 per cent. in a gauged length of 8 inches, and the limit of elasticity to be not less than 30,000 pounds per square inch. The steel had to bend double cold, red hot and at a flanging heat without cracking. No lamination was to exist in any specimen of the plates. From each sheet four test pieces had to be furnished, two cut lengthwise and two cut across. Every specimen of the steel furnished failed, principally on account of lamination when bent cold.

The defect which caused the rejection of the sheets under the careful tests made by the Institute are the kind most fatal to the life of a firebox, and they are the defects that led to the failures we have recently heard about. We are persuaded that if every master mechanic who reads this article would make careful tests of the sheet steel he has on hand, he would find out some things that would surprise him. There is active competition in the sheet-steel business these days, and some of the cheap stuff put upon the market deserves the most vigilant inspection. This necessity for great care does not exist concerning firebox steel only. The shells of boilers have to stand such enormous pressure nowadays that the margin of safety is none too high, even with the best material. When a firebox sheet fails it cracks or laminates, putting the engine out of service for a time. If inferior material should lead to failure in a sheet belonging to the shell, the notice of defect is likely to be of a more violent character. Every sheet that goes into a boiler ought to be up to the ordinary specifications, which are established to secure the requisite strength and durability. The man in charge who fails to find out how near steel purchased agrees with the specifications, is neglecting an important duty. In no department of railroad engineering does the saying eternal vigilance is the price of safety apply more truly or directly than in the inspection of material that goes into boilers.

## Another Reading Boiler Explosion.

It is difficult keeping count of the boiler explosions that happen to locomotives belonging to the Philadelphia & Reading Railroad. A month has seldom passed during the last year without some explosion on this road that resulted in the killing of some one. The State of Pennsylvania holds the lives of its citizens at painfully low account, or there would be some one suffering before this time for the homicides committed by rotten boilers going to pieces. A boiler explosion is the result of criminal carelessness. When the boilers belonging to one company kill nearly twenty persons within a year in one State and nobody is prosecuted for the crimes committed, it is high time that the law officers of the State were indicted for neglect of duty.

The latest Reading boiler explosion happened near Shamokin, Pa., on March 15. The boiler of an engine pulling a freight train blew up, killing the engineer and fireman. A rustic jury will no doubt sit on the case, and decide that the explosion was due to some unknown cause and that nobody is to blame. If a rotten plank of a scaffold gives way, or worn-out ropes break, letting men fall to the street, coroners' juries sometimes find out that the accident was not of a mysterious nature, and the guilty parties find themselves in an awkward position. It is about time that the average juryman was plainly informed that sheets and stay-bolts of a boiler are liable to the deteriorating influences that make the fastening of scaffolds unsafe. There is no more mystery about the average boiler explosion than there is about the falling down of scaffolds. Boilers fail because the material has worn out, and in too many cases no effort is made to find out how the progress of weakness go on.

## NEW BOOKS.

HOW TO RUN ENGINES AND BOILERS. By Egbert Pomeroy Watson, editor and proprietor of *The Engineer*, New York. Price $1.50.

This is a very unpretentious little book, written by a man who is thoroughly familiar with the first principles and traditions of the business of a working engineer. The author is careful to mention that no man can be made an engineer by reading books, practical experience is the capital that makes an engineer valuable, but there are certain facts about the business which can be learned most readily from those who have gone through the mill, and he proceeds to tell some of the things he learned. They are the kind of points that a well-posted engineer would bring out if he was given a list of subjects and told to sit down and write what he knew about them. There is a good deal said about boilers and their attachments. This embraces the keeping of boilers clean and keeping them in safe condition as far as stays, braces, etc., are concerned. The notes about boiler attachments take in mud-drums, feed-pipes, grate-bars, tubes, bridge-walls, and all the principal fittings. Considerable space is profitably devoted to bearings and how to keep them running smoothly. Eccentrics, cranks and the slide-valve occupy a great portion of the book. The young reader will find this a highly interesting part. The book is full of the information essential for a good engineer in charge of an important steam plant. It is full of valuable facts and is notable for the absence of things that are not so.

THE MECHANICAL ENGINEER'S POCKET-BOOK. By D. Kinnear Clark. D. Van Nostrand Co., New York. Price $3.00.

Engineers who require to use books of reference are nearly all ready to admit that Clark's "Manual of Rules, Tables, etc.," is one of the most useful and comprehensive books to be found, but it is a large volume fit only for the library. "The Mechanical Engineer's Pocket-book" is designed to furnish the great variety of information needed by engineers in a shape convenient for the pocket. The high reputation of the author insures the reliability of the work. It is difficult giving an idea of the contents of such a book as this, for it deals with everything that a mechanical engineer is likely to need information about, and that embraces a vast field. It contains a great many tables and rules furnishing information about electrical engineering which we have not seen in any other pocket-book. A strong point about this book is the index. The table of contents is also unusually comprehensive. These are of great importance to a man looking for information.

## Tipping Dining Car Waiters.

An officer of the Santa Fé is reported to have made the statement that the no-tip system for waiters of dining cars which that road has inaugurated works successfully. "Of course," said the officer, "there are those who do not take any note of such trifles, but the majority of travelers are not of that class. When we adopted the no-tip system we found that we had to discharge our colored help, for they refused to work without opportunity to gather in the futures. We employ white waiters, and by not employing so many to each car we pay them good wages, and they give the best of satisfaction. We find that two waiters, as a rule, are sufficient to each dining car, and where they get no tips and know they cannot accept any, we find that they attend to the wants of our patrons well. If there happens to be a crush now and then on the diner, the conductor of the same takes a hand and helps out on the rush."

We consider that the management of the Santa Fé system deserve the gratitude of travelers for the stand they have taken on this question. Instead of aiding to discourage the extortion on travelers by the tip system in dining cars, the majority of roads do all they can to aid the practice of drawing gratuities that are not earned. The duty of a conductor of a dining car used to include the collecting of the payment for meals, but the general practice now is to require the waiter to collect the money. This is done to enable the waiter to impose upon the traveler by making a mute appeal for a tip. During a recent trip over the Lake Shore we had made up our mind to stop tipping, but the waiters were so distressing in their appeals for help that we had not strength of character to refuse.

## Larger Driving Wheels.

We understand that two of the ten-wheel locomotives under construction at the Schenectady Locomotive Works, for the Chicago & Northwestern Railway, will have 60-inch wheel centers, and all the others 57 inches. This is, we think, a change that has been made since the engines were ordered, as the first purpose was to have them all 57 inches. The cylinders are 19 x 24 inches. From what we have seen of large driving-wheels on other roads lately, we would venture the prediction that the engines with the larger wheels will give the greater satisfaction, especially on passenger trains. The road where they are going is fairly level, and the work done is nearly uniform. The 3 inches extra diameter of wheel will give the engines a decided advantage at high speed, and the repairs will be made lighter. Several roads are now running engines with driving-wheels 6 feet in diameter and over. Where such engines come in competition with those having smaller wheels, it is found that the ability to make time, economy in fuel, and wear and tear to engine and track are all in favor of the big wheels. Our railroad men are only beginning to understand the advantage of large driving-wheels.

On March 3, William E. Lockwood, described as managing director of the Shaw Locomotive Company, of Philadelphia, made an argument before the Committee on Railroads of the House of Representatives, at Washington, in favor of a bill to appropriate $25,000 to enable the Franklin Institute, of Philadelphia, to test the force of the reported hammer blow of locomotive driving-wheels. The press report of this proceeding asserts that the bill has been recommended by the American Railway Master Mechanics' Association. This will be interesting news to the members of the association. If there is any one thing that the Railway Master Mechanics' Association has been particularly careful about, it is that of refusing to permits its name or influence to be used in promoting private interests. There is not the smallest foundation in fact for the claim made that the association favors a raid on the national treasury for any purpose whatever, more especially for the testing of a style of locomotive that most of the members hold in contempt. The hammer blow has been tested sufficiently to give a good idea of its magnitude. Those who are most strongly impressed with the subject have no intention of resorting to the Shaw form of locomotive as a remedy. If the national treasury should be drained of $25,000 to make new demonstrations of the force of this hammer blow, the money would be wasted, for it would lead to no change in locomotive construction.

The publishers of *Cassier's Magazine* have got up a particularly convenient envelope for filing advertising contracts. It has the names of all the leading technical papers on the outside, with columns to note the space taken, the time of beginning and the amount to be paid. We would recommend firms doing advertising to send for these contract envelopes.

In our correspondence pages there is a letter on standard bolt-heads by Professor Sweet, which will be read with interest by every one who has paid any attention to standard sizes. When the movement was in progress which led to the establishment of the United States standards of screw-threads and the sizes of nuts and bolt-heads, Professor Sweet proposed that wrenches and not nuts and bolt-heads should be made standard. He favored making the wrenches ¼-inch, ¾-inch, 1-inch, etc., regardless of the nut, which, of course, would have been made to suit the wrenches. Had this plan been adopted, its practical effect would have been to reduce considerably the number of wrenches necessary to keep on hand. This would have been a great convenience, and, although it is now too late to change, we consider it a pity that Professor Sweet's proposal was not adopted.

One of the meanest, most selfish and most unreasonable things we have heard of lately is an agreement that the engineers of a certain road have asked the management to sign, providing that no firemen shall be promoted and all engineers hired. This is not right and won't work. It won't work because it isn't right. It is the hope of promotion that stimulates men worth something to be good firemen, without hope of promotion dead men only will fire. Why don't these men start a society for the strangling of all women, so that no children can be reared to take their places. Engineers asking this are like the old Know-Nothings—only more so. We believe in hiring some engineers and promoting some—no hard and fast rule to the advantage or disadvantage of any man or class of men. Honest men do not want advantage, they want justice.

Under the caption "A Thing-Man" we publish elsewhere particulars of a case of abuse of a Pullman conductor that is representative of many that are daily occurring. There is a belief abroad that the Pullman Palace Car Company deal very severely with employés against whom complaints are made, and this encourages a mean, cowardly class of traveling hogs, disguised in decent apparel, to treat Pullman employés with contumely without any cause. The sleeping-car conductor and porter are frequently made to bear wicked treatment of people who have no right to mix with any class higher in the social scale than hogs, but the ill-usage has to be meekly borne. Every discomfort of traveling and every delay of trains brings down upon Pullman conductors and porters the wrath of unreasoning occupants of cars, who find relief in abusing the helpless men who dare not reply with a little wholesome truth. The Pullman Co. ought to make some effort to relieve decent travelers from the annoyance of listening to the domineering talk of the brutes who try to make all within their reach miserable.

## Wouldn't Ship Under False Colors.

The Central Railroad of Georgia use a line flag on their ships and the same device on certain fast freight cars as well as on their stationery—a trade mark.

The flag has a white ground with cross-bars of blue running from corner to corner with the initials of the line and a star or two in red.

One of their traveling freight hustlers dropped into a Chicago house not long since to solicit business for the line and sent in his card, which bore the trade-mark flag.

The "old man" of the house was one of those fire-eaters of the North who had never been south of Peoria, and believed that the war was only over temporarily. He came right out. "Young man," said he, glaring savagely at the freighter, "you've got the damndest secession gall about you to come into my office and ask me to ship my freight over a treason-infested dam road that does business under the dodrotted rebel flag! Not by a damsite, not by a damsite, young fellow, my uncle Abner was in the war! Go back to Savannah and Jeff Davis with your rebel rag line, and try and set up slavery again. If there is a man in Chicago that ships as much as a can of lard under that Libby Prison rag I'll have him fired out of the Board of Trade, damfi don't."

## An Improvement in Springs.

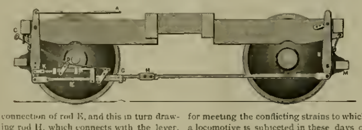
The Charles Scott Spring Co., Philadelphia, have introduced an improvement in locomotive springs that promises to be highly popular with railroad men. The usual practice in spring making is to weld a pad on the ends of the upper leaf to make bearings for the hangers. Those having to deal with locomotives are aware that breakage of the spring very often takes place at the weld of the pad. Recognizing this fact, Mr Ellis, of the Chicago, St Paul, Minneapolis & Omaha, introduced the practice of forming the pad by pressing the upper spring plate to the required form. The practice increased the durability of the springs so much that it was made standard on the road. The Charles Scott Spring Co have now adopted the improvement for all their locomotive springs and have special dies and presses for forming the hanger seat.

Within the month we have received from the inventors of two distinct new car couplers the offer of heavy proprietary interests in the inventions if we would devote our efforts to putting them on the market. As this thing is getting a little monotonous, we wish to intimate to all whom it may concern that we are engaged in getting up readable matter for a railroad journal, and that we intend to depend on that for a livelihood or starve. When we see starvation as certain in our chosen vocation we will be ready to consider an offer to sell car couplers.

## Brake Slack Adjuster.

At the present time there is expressed by all railroad men who have anything to do with the air-brake system, the want of a slack adjuster for the brake-rods. Mr. E. G. Desoe, the air-brake inspector of the Boston & Albany R. R., has designed a slack adjuster which has been found practicable. Following is the description.

The rod A connects directly from the cylinder with the lever B, pulling with it the brake-beam C and through the lever




connection of rod E, and this in turn drawing rod H, which connects with the lever, and sets beam M through the dead lever N. When there is any wear on the shoe, the auxiliary rod K is pulled forward with the motion of the lever B, thereby catching up as many teeth of the ratchet D as are necessary to compensate the wear on the brake-shoe. When the brake is released, the auxiliary rod K holds the two beams together, all that has been taken up by wear and the lower rod E is then shortened by ratchet G. The ratchet D simply takes up the wear and holds it, so that when the brake is released the rod E will shorten.

Further particulars of this arrangement can be obtained of the Mason Regulator Co., Boston, Mass.

We hear it reported that there is a movement on foot to form clubs of railroad employés in several Southern States for the purpose of opposing legislation and political action prejudical to railroad interests. Clubs of this kind have exerted a wholesome influence in some of the granger States. When legislators force down rates till the earnings are not sufficient to cover operating expenses, as has been done for some railroads in Texas and elsewhere, it is time that railroad men generally should stand up and demand that they be counted. The railroad man continues to be a citizen whose interests are entitled to respect.

A school of Marine Engineering has been established in connection with Cornell University. Everything relating to marine engineering and architectural construction will be taught in the new college, which is the first of the kind in America. Railroad interests are much greater in this country than those connected with the sea. The establishing of a school of Locomotive Engineering would appear to be next in order. It offers a great opportunity for the munificent individuals who have built monuments of wealth out of railroads. Our railroad magnates are much more given to acquiring than to distributing wealth.

We have never examined specimens of boiler making for locomotive work that appeared so strong and mechanically sound as the Belpaire boilers that they are now building at Altoona for Pennsylvania Railroad locomotives. The design appears to be ideal for meeting the conflicting strains to which a locomotive is subjected in these days of high pressure. The flat surfaces are stayed to flat surfaces so that all movements and stresses are met by direct binding. Stays and braces are put in wherever there is a surface that requires support. As we finish examining the newly-finished boiler and fail to find a weak point, we naturally conclude that this is a perfect boiler for a locomotive. Yet we find that nearly all the boilers of this type in service have been patched; some of them after a very few months of work. The weak point is the junction sheet between firebox and shell.

Mr. E. J Whittington, who resigned the position of master mechanic of the Chicago & Alton a month ago, died at Denver on March 20th.

Mr. M L. Butler, superintendent of motive power of the New York, Providence & Boston, has been nominated for State Senator by the Democrats of Providence, R I.

We have not recently seen more truth in small compass than what we found lately in the letter of a high railroad official whom we were urging to apply for the management of a road badly in need of the labors of a live, energetic railroad man. "It is a better and more independent course to let the place search for the man. When I look around, and see the large number of blokes, shams, frauds and humbugs that are holding positions on leading railroads of this country, men who merely get in and ride without attempting to lead, it makes me weary."

## Success of the Rotary Snow Shovels.

During the month of March there was a heavy fall of snow in the Mohawk Valley and the northern portions of New York State, and the high winds that prevailed drifted the snow badly, causing great obstruction to some of the railroads. The New York Central made good use of the rotary snow shovel which they have. With this machine they opened a division in a few hours that would have been closed for several days had the old methods of snow handling been the only ones relied upon. The rotary was used to good purpose in opening up the Rome, Watertown & Ogdensburg division of the New York Central which was badly snowed under. During the single storm the rotary easily earned its cost a thousandfold and the Central people consider themselves very fortunate that they had the machine on hand. It had waited six years in the engine house without being used; but like a wrecking outfit, it is one of those things that earn most when lying idle.

The S. P. switchers around the wharfs of New Orleans have a flat car behind each sloping tank. These cars are painted and striped like the engine, have steps around each end and on sides, and carry a headlight, tool box, the frogs and replacers, switch ropes, etc. They can be seen over, and often act as a long light arm to reach down upon some boat and take a car without having the engine leave solid ground.

## FARMING IN THE SOUTH.

It is not astonishing that hundreds of Northern farmers have settled in the South at points on, or adjacent to, the southern division of the Illinois Central Railroad within the past five years, nor is it remarkable that instead of confining themselves to the cultivation of cotton exclusively, they are diversifying their crops with gratifying results. One of the important questions in the mind of any Northern farmer who contemplates locating in the South is: "What crops can be profitably grown in that latitude?" The passenger department of the Illinois Central Railroad will, on application to Mr. J. F. Merry, Assistant General Passenger Agent, Manchester, Iowa, mail free the following pamphlets: "Southern Home Seekers' Guide," "How to get Rich in the South," "Truck Farming," and "Farmers' and Fruit Growers' Guide to McComb City, Miss." These publications contain valuable information and should be read by every farmer looking for a Southern home.


### Standard Bolt Heads.

*Editors :*

I see by LOCOMOTIVE ENGINEERING that the Master Car Builders have up the question of bolt heads and nuts. I should like to get before them the argument we use to justify ourselves for adopting certain proportions, and in order to give my position some weight will say that for two years previous to the time the Committee of the Franklin Institute had the question under consideration, I had been connected with a large bolt and nut works in England as draughtsman, designing machinery, etc. The question of sizes had been under discussion, and the conclusion reached that the thing to do was to make the *wrenches* the standard and not the *bolt heads and nuts.*

This at first sight will appear like a distinction without a difference, but I will try to show that the difference is a matter of prime importance.

I hoped to get the result of our conclusions before the Franklin Institute at the time, but doubt if it was presented with the force it deserved ; and to give it more force now let me recount the reasons that led up to the question.

Whitworth had succeeded in introducing his pitches of threads to a considerable extent, by putting on the market the best "screw tackle," that is screw plates, taps, and dies, then to be had in England, and had promulgated a set of sizes for nuts and bolt heads, the worst that man could well have devised, and that was to make the size of a hexagon nut across the corners just twice the diameter of the bolt. One of the easiest things in the world for the draughtsman to deal with, and an impossible thing for the machinist to measure across the flats. Square nuts and bolt heads were on some other formula, and the number of wrenches required for an ordinary machine twice or more than necessary.

The Franklin Institute system is better as to measurements, but bad in this that it calls for one set of wrenches for rough nuts and another for finished. The United States Engineers accepted the Sellers threads, the Franklin Institute pitches, but not the separate sizes for finished nuts, making the size of finished nuts and rough nuts the same. This, it will be seen, reduced the number of wrenches in the engine-room by one-half. Another point comes up. The size of the standard nut—one and a half the size of the bolt plus one-eight inch—is large enough to look well, and if as thick as the diameter of the bolt, is doubly strong, but a bolt head of the same size is larger than necessary, costs more, and to have the head of one bolt the size of the nut of a smaller bolt, gives this advantage—with one set of wrenches the workman always has one wrench to hold the bolt from turning and another to turn the nut.

The head of a ¾-inch bolt the size of a ⅝-inch nut is large enough, looks right, and has this wrench advantage.

My original proposition was to make the wrenches ¾-inch, ⅞-inch, 1-inch, 1¼-inch, etc., regardless of the bolt head or nut, so that one could use a flat or thin head or nut or a thick and small one for any size, which would have reduced the number of wrenches still more, but the present standards are now too well established to change. The United States standard, 1½ plus ⅛ inch the size of bolt for nuts, and the size of bolt and cap screw-heads the size of nut one size smaller, makes a rule that any workman can remember, brings the number of wrenches down and looks well. I understand no bolt ever ought to be put in so as to require holding to screw on or off the nut, but they are, and the trouble is a constantly recurring one.

JOHN E. SWEET.

*Syracuse, N. Y.*

### Slipping Without Steam.

*Editors :*

A heavy ten-wheeled passenger engine running on the North Shore limited created quite a sensation here recently by slipping so badly that it was impossible to hold her on the rail upon any train after a speed of forty or forty-five miles per hour was attained without using sand to do so. I wish it to be understood, however, that upon a good dry rail she would run along all right and cause no trouble. When the trouble did exist was when the rail was either slightly wet or frosty. When first turned out of the shop a box of sand would last a week, and the greater portion of that would be used in stopping. One morning, after she came in on the limited express, I met the engineer who had run her that trip, who for convenience we will call Ike, he stopped me and said : "Mac, that engine will slip after she has been shut off, and won't stop till you put the sand under her."

Of course, I thought my old friend was trying to have some fun with me, and just said, "She must have the Devil in her, Ike," and passed on.

A few moments later I met the M. M., and he also asked me if I heard of the mogul being ghosted. I replied that I had, and we enjoyed a laugh at the expense of our friend Ike. There were two engineers for this engine, she being double-crewed, her regular mileage for month of thirty days being ten thousand and eighty miles. The other engineer, also a veteran, had the same trouble as Ike, but was just holding back for Ike to break the news and be laughed at.

This engineer, who for convenience we will call George, was to take her—the mogul, I mean—out on the North Shore limited on the morning in question, so I concluded to take a ride on her to see for myself. It was quite early, not yet sunrise, when we coupled to the train and there was a heavy white frost. Everything passed off pleasantly until about the time the sun began to start the frost from the rails, and I had just fixed myself for a quiet and comfortable smoke, and had about concluded that I was the victim of one of my old friend's practical jokes, and was wondering how I was going to get even, when we entered into a piece of woods about three-quarters of a mile in length, when all without warning the old hag tripped. She was then running about fifty-five miles per hour. The racket she made was something deafening. The engineer had shut her off instantly upon her letting go, but the racket still continued, and after running about half a mile down the grade George pulled the sand-lever open, which stretched her out O.K. After the noise was over I looked at George, and he said "That is just a little one," which I afterwards found was a logical remark on his part. The engine in question had 68-inch wheels, 19x24-inch cylinder, carrying 160 pounds steam, built at Schenectady Works. She has been through the shop since and the evil has been remedied. What was the trouble with her? MAC.

*St. Thomas, Ont.*

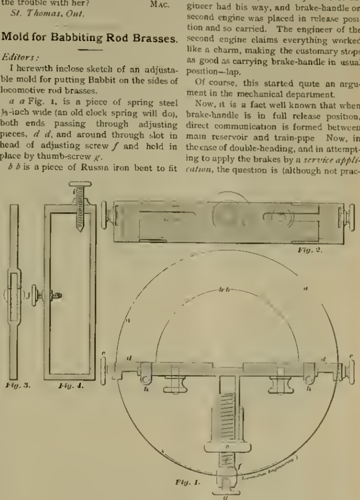
### Mold for Babbiting Rod Brasses.

*Editors :*

I herewith inclose sketch of an adjustable mold for putting Babbit on the sides of locomotive rod brasses.

*a a* Fig. 1, is a piece of spring steel ⅜-inch wide (an old clock spring will do), both ends passing through adjusting pieces, *d d*, and around through slot in head of adjusting screw *f* and held in place by thumb-screw *g*.

*b b* is a piece of Russia iron bent to fit inside of brass, with the sides cut to a taper. Care should be taken before getting ready to pour the metal, to have the mold adjusted to diameter of boss on brasses and everything ready ; then, after heating and tinning the brasses (one at a time), the mold can be put in place and the Babbit poured in before the brass gets cold.




MOLD FOR BABBITING ROD BRASSES.

When there is no boss on brass, and only a flat surface, the mold can be adjusted to size and clamped to brass by clamps shown in Figs. 3 and 4. These clamps, which are hinged to adjusting pieces *d d*, at *h h*, swing around to back of brass, and are held by screw *i*. The band, *a a* is held to brass by screws *j j*.

This mold has been in use here about two years, and has proved a very handy device. I send the sketch in hopes that it may be useful to other readers of LOCOMOTIVE ENGINEERING. N. W. SLATTER.

*Grand Bend, Pa.*

### Both Engines Supplying Air.

*Editors :*

The divisions north and south from this point (A. T. & S. F., Las Vegas, N. M.) are, to a certain extent, quite mountainous, and it necessarily becomes a common occurrence to double-head both ways, passenger as well as freight, and in doing so the general practice is for the second engine to carry engineer's brake-handle at lap, using the pump on second engine to help charge train, thereby lessening the work for the pump on first engine.

A short time ago one of our passenger trains (north) double-headed from this point, the engineer on second engine carrying his brake-handle, as usual, at lap, pump working, and occasionally charging train. One or two stops were made in this way, when engineer of first engine requested the second engineer to carry his handle in full release position.

The latter protested, saying it was impossible and act ; but finally the first engineer had his way, and brake-handle on second engine was placed in release position and so carried. The engineer of the second engine claims everything worked like a charm, making the customary stops as good as carrying brake-handle in usual position—lap.

Of course, this started quite an argument in the mechanical department.

Now, it is a fact well known that when brake-handle is in full release position, direct communication is formed between main reservoir and train-pipe. Now, in the case of double-heading, and in attempting to apply the brakes by a *service application*, the question is (although not practicable), is it possible to run with a first-class pump on the second engine and brake-handle in full release position?

Not being satisfied that it was, I experimented with two light passenger engines, coupled together and standing in yard. I pumped up a pressure of 80 pounds, both main reservoirs being in communication with train-pipe. The pressure on both engines registered alike.

The pump on second engine was in first-class order.

I then reduced about 1 pound (service application) on first engine, and *moved brake-handle to lap*. There followed a strong blow from service exhaust port, and, of course, *continued to blow*, while pumps began working on both engines.

At the expiration of 2½ minutes I gave it up, being convinced that the pump on second engine was supplying system with air as fast as it was being exhausted from service exhaust port on first engine.

Upon this small data I advanced the theory that it would not work in practice if the pump on second engine was a good one, or in first-class order, and explained why I thought it would not.

Some suggested that if the same operation were tried on forty cars we would get different results, as the pump in the case of two light engines would supply same quicker than forty cars.

I grant this is correct if the pressure is once lost, and in attempting to regain it ; but the area of service exhaust port being the same in brake-valve with either two light engines or forty cars, 80 pounds pressure in both cases, and the pump on second engine being able to supply system as fast as it is allowed to escape through service exhaust opening on first engine (brake-handle at full release on sec-

ond engine), I fail to see but what brakes would remain off in the forty car case just as long as on two light engines, regardless of the difference in *volume*.

In the forty car case I would reduce a larger *volume* of air (in comparison to two light engines) in reducing *pressure* sufficiently to bring governor on second engine into play; but after this point was accomplished, the reduction that had taken place would be just small enough to start my pump on second engine, but not enough to push brake-pistons past leakage grooves in cylinders, and after pump has been started, it appears to me, would keep *pressure* stationary. Of course, in both cases I am presuming areas of *service exhaust openings* are the same.

I would like to have the opinion of some air men on this subject No doubt there are faults in my method of reasoning, but should like to have them pointed out.

GEO. A ELLIS,
*Inspector of Engines*
*Las Vegas, New Mexico.*

## Ingenious Remedy for Broken Air-Pipe.

*Editors:*

To settle a controversy, please give your opinion as to the feasibility of the following remedy for an accident to the air-brake.

The pipe that connects the brake-valve reservoir to brake-valve was broken, and a blind gasket was put in pipe at connection. With the brake arranged in this manner, it was impossible to make a good stop, for the reason, as I contend, that with the loss of the brake-valve reservoir there was such a very small volume of air above the piston 17 (W A B. Catalogue) that controls the discharge of air from train-pipe in making a service stop, that it was all exhausted by the first movement of brake-valve lever to service stop position. The train-pipe pressure would then force piston up and escape, and would continue to escape until the handle was returned to full release or running position.

In case of an accident of this kind, would it not be advisable to put a plug in discharge-pipe from brake-valve, a blind gasket in the connection of the ruptured brake-valve reservoir-pipe at brake-valve, and then regulate the discharge of air from the train-pipe through the emergency ports only? Would this method of handling the valve not render it the same in its operation as the old style three-way cock, and is there any reason why a good, smooth stop could not be made with valve in this condition, provided the valve was handled with good judgment?

E. P. BISHOP.
*Birmingham, Ala.*

[Mr. Bishop has hit the matter with a degree of intelligence that is unusual. The purpose of the 10 x 12-inch reservoir, in connection with the engineer's brake-valve, is solely to give volume to the chamber which is above the equalizing piston in the brake-valve. In order that the pressure may be reduced in this chamber sufficiently slowly, so that the engineer can make any desired reduction, a certain relation must exist between the volume of the chamber and the size of the port through which the air is permitted to escape from it

There are three ways to do this. One is, to leave the volume just what it naturally is, and make an exceedingly small preliminary discharge-port. The objection to this is, that a small discharge-port would become easily clogged with dirt, and a very small amount of dirt would very materially alter the rate at which the air could discharge through the port. The second method is, to make the discharge-port as large as is necessary to prevent difficulty from the accumulation of dirt in it In doing this, it is necessary to have a chamber of much larger volume, which might be accomplished by making a very bulky brake-valve. Of course, the natural objection to this is, that one does not wish a very large mechanism in the way, at the point where the brake-valve usually has to be placed. The third method, and the one employed by the Westinghouse Air-Brake Company, is to make the preliminary discharge-port of a sufficient size to prevent irregularities from collection of dirt, and to make the volume of the chamber above the piston, in the brake-valve, sufficiently great for such size of discharge-port, but adding in some convenient position, out of the way, a reservoir communicating directly with this chamber, and giving it the necessary volume.

It is at once apparent that under these circumstances, if anything should happen, such as Mr. Bishop speaks of, which would necessarily cut off this reservoir, the volume in the chamber above the piston is very small in proportion to the size of the discharge-port, and when the engineer opens the discharge-port to let the air out, it would issue so rapidly that it would be impossible for him to make a small reduction of pressure in it, and it would be almost impossible for him to do good braking by its use. It would therefore be much better for him to close the opening through which the air usually discharges from the train-pipe in making service stops, than to depend upon careful discharge of air from the train-pipe through the emergency port in the brake-valve. He is quite right in supposing that this may be done. The brake-valve then simply becomes a three-way cock, so far as discharge from the brake-pipe is concerned. We all know that a train of quick-action triple valves can be nicely handled, as to graduation, by the three-way cock; but it requires skillful handling, and one that in practice cannot be at all relied upon with the average engineer. At the same time, under such circumstances, this method proposed by Mr. Bishop would be the only proper one.—EDS.]

## Breakage of Cylinder-Heads.

*Editors*

C. B. Conger's explanation of front cylinder-head breaking is not satisfactory. Most likely made to excite discussion.

He says when bolt broke valve stopped in back end of steam-chest, leaving forward port open to live steam and piston traveling against it. If such were the case compression would equalize with boiler pressure, which pressure cylinder-head was calculated to stand.

If forward port was closed to exhaust and chest, as I suggested, compression would run up enormously, depending on amount of steam in front part of cylinder, for the reason that you have, say, 20 square inches of valve exposed to pressure due to compression, tending to raise valve, while you have about 150 square inches of valve surface exposed to boiler pressure, tending to hold valve to its seat, and, of course, valve could not raise.

A few years ago I was running a locomotive that sheared bolts in forward end of main rod at top and strap breaking at bottom. I always thought it was caused by reduction of clearance space, brought about by the adoption of larger packing rings, which materially increased the thickness of piston.

In answer to C. B. Conger's query in March issue, as to whether valves could be set so as to give excessive compression after exhaust closure and shear bolts in forward end of main rod, would say That excessive lead would necessarily be followed by early exhaust closure, especially so when working the engine cutting off close, and too much inside lap, together with restricted exhaust-nozzles, would all aid in running the compression line up and forming that loop in the indicator card which Brother Tabor is now telling us about; and if the bolts in front end of the main rod were the weakest link in the chain, I see no reason why they would not be the first to show signs of distress.

A few years ago Mr James Meehan, of the Cincinnati, New Orleans & Texas Pacific, experimented with an Allen valve, and found by cutting out some of the inside lap of the supplementary passage it allowed compression to equalize with chest pressure without advancing the period when compression began.

C. P. CASS.
*Monett, Mo.*

## Wrong Material.

*Editors:*

Under the above caption I wish to make a few comments on the rules of the M. C. B. Association, not through criticism, but with the hope that they may be discussed, modified and amended at their next convention

When going over the road I find many cars set back for wrong material It may be a wrong hanger, a wrong brakehead, or a wrong drawhead, the material is as good as that of the company owning the car, but the connecting line, trying to make matters as disagreeable as possible for their neighbors, keep an expert at that junction who exercises the potential powers of the M C. B. rules in chalk marks on the side of a car, regardless of delays or losses to his own or the connecting line. The interchange of cars is necessary, and a car that is properly cared for as to defects that do not impair its usefulness or endanger its going through to its destination should be received, or the company receiving required to pay a fine. Such fine to be decided by a committee of arbitration.

Rule 4 says "A car with defects which do not render it unsafe to run, or unsafe to trainmen, must be accepted." This rule should be enforced; but it is daily violated by some smart crank who wants to make it disagreeable for his neighbor There is here a wide field in which the members of the M C. B. Association can measure harmony and co-operation. A sounder and more expansive policy is necessary to secure perfection. Enforcement of present existing laws are unfair, and in many cases unjust, and gives inspectors too broad a field to exercise their authority. Let us hope that the next convention will eliminate all unfair rules and recommend a uniformity of inspection, and not allow cars to be set back for trivial defects. Rules 4 and 6, if complied with, will not hamper or check the movement of cars, and will cause a better feeling among connecting lines than now exists Iron-clad rules of their own making should not be tolerated when they have agreed to comply with the rules of the association There are only three defects that it is fair to reject a car for, *i e.*, bad trucks, bad wheels, or draft-irons in bad order The rules should be modified and made so explicit that every car foreman can understand them, so plain and so emphatic that a wrong construction cannot be placed upon them

J. McD.
*Galveston, Texas.*

## Defective Triple Valve.

*Editors:*

The question asked by Mr. Wood in the last issue of your paper is not perfectly clear. The defective condition to which I had reference was a broken pin in the graduating valve, said pin in normal condition performing the service of opening the graduating valve on the first movement of the triple valve piston in applying brakes.

If the pin is broken of course the valve cannot open, the auxiliary reservoir pressure holding it shut, and the result is that the pressure on the inner side of the triple valve piston finds no relief until the slide valve is forced far enough to open the supplemental port that affords passage for air from the auxiliary reservoir to the cylinder in emergency applications, when, of course, the quick action valve also opens.

The duration of time that elapses before this application takes place depends, of course, on the amount of pressure drawn out of the train-pipe and the rapidity or slowness of such reduction.

This action can be very easily obtained on a testing rack by plugging up the port in the slide through which graduated applications are made, and reducing the train-pipe pressure gradually and slowly, when it will be found that all the brakes except the altered one will begin to set before that one makes any movement, until finally when it does set, it goes on with a heavy blow. The inference that Mr Wood draws is scarcely warranted by my statement. Ordinarily, on a three-car train, seven or eight pounds reduction should be sufficient to actuate the emergency valve in any triple in which the graduating port did not open. The fact remains, however, that a defective valve of this kind will not act under such conditions as promptly as the rest in the train.

PAUL SYNNESTVEDT
*Chicago.*

## Lubricators Acting Unevenly—A Bent Side-rod.

*Editors*

I have run fifteen or twenty engines equipped with Nathan lubricators, and all except one feed faster when *not* working steam in cylinders. This one exception always feeds the same, working steam or not. Now, what is the cause of this one working with such regularity and the others not?

I have another nut for some one to crack. I was running an eight-wheel engine working at a wreck one night Some time in pulling I sprung the right-side rod out 3½ inches I backed up one mile to sidetrack after it was done and did not notice it The brakeman came along with lantern and noticed it. He looked up at me with a "Say, mister, do they run that kind of rods on this road?" I looked down and sure enough it had the bow-gee I got down with torch, expecting to find something wrong on the other side, but everything was all right. Engine had been out of shop six months, was in train, and rods always free on all points. Nothing wrong except rod sprung. What was the cause?

J. F. WALLACE.
*Corry, Pa.*

## Does the Air Surge or Equalize?

*Editors*

Mr De Long's air-wave theory in the March number may give a wrong impression to some who read his letter, the more so as his argument is backed by the Westinghouse instruction book, which states that the abrupt opening and closing of the three-way cock will, on a long train, cause a violent surge of air forward, releasing the breaks at the head end of the train

The instruction book aims at brevity in giving this very plausible reason, but the fact is it doesn't surge, it equalizes. Air wil flow from a brake-valve at emergency, or from a three-way cock, quicker than it can equalize in a lengthy train-pipe

In working a long train line carrying 70 pounds of air, make a sudden reduction of train-pipe pressure with a three-way cock, drawing off enough air that, on closing the cock, the gauge will show a reduction of 8 pounds While the air flows from the train-pipe, the black pointer will fall away back to 50 pounds or less, indicating that the pressure in forward end of train-pipe is so reduced that some of the brakes at the head end will go full on, their auxiliary pressures expanding to about 50 pounds When the discharge of air has been stopped by placing the cock on lap, the train-pipe pressure will immediately equalize, and the black pointer run right up and stop at 62 pounds. A train-pipe pressure of 62 pounds, with initial help of the compressed graduating spring, will overbalance 50 pounds auxiliary pressure, force up the triple piston and release the brake, this operation being the same as "dipping into emergency" with the engineer's brake and equalizing discharge-valve as mentioned by Mr De Long.

The correspondent also refers to a service application where the handle is

brought back half way between lap and running position before air stops blowing from equalizing discharge-valve, and claims that the air "piles up" and releases the brake. Now, with the use of 1¼-inch angle-cocks, air will flow through the train-pipe about as fast as it can pass out at the equalizing discharge port, the brakes are applied uniformly, and the sudden closing cannot release the brakes. The question is asked why do they release? When the valve handle spring is upon the shoulder, between running and lap, the valve is in the running position, but the ports have a very slight opening; train-pipe pressure fills the large cavity in valve fare, and passes down through the partially-opened equalizing port to the equalizing discharge-valve, which it forces down, stopping the flow of air from train-pipe, at this point the rotary valve slightly uncovers the feed-valve port, and main reservoir pressure will pass through the feed-valve to train-pipe, and release all the brakes, if held in that position long enough.

WILL W. WOOD.

*Terre Haute, Ind.*

## Mistake in Expansion Curve.

*Editors:*

I would like to try to tell Mr. Fickinger where the mistake of one pound is in Mr. Tabor's expansion curve. The piston is supposed to have no weight or friction with atmospheric pressure above and below it. We now put weights on piston, forcing it downward two inches or one-sixth, which will give us ⅚ of the pressure that was under the piston before it started to move, which is 18 pounds, or 3 pounds above atmospheric pressure. We now put on more weights, forcing the piston ⅕ of the remaining distance, which will give us ⅘ of the pressure we had at the first move, which will be 22½ pounds, instead of 21½, or 7½ pounds above atmospheric pressure.

ONE OF FIEK'S BOYS.

*Roanoke, Va.*

*Editors:*

In answer to the question of "Where is it?" regarding the expansion line as shown by the Tabor Indicator, should say that the mistake was in the third position of the piston, which should read 22½ lbs. in place of 21½ lbs., as it now is.

F. C. EMERY.

*McComb, Miss.*

## Casting a Patch on a Cylinder.

*Editors:*

In your experience and observation have you ever known of a piece being successfully cast in a cylinder—piece having broken out in service? Would you accept the statement as being gospel, and gulp it down as did the writer, or propose him for full and non-assessable membership in the Ananias Club? Inclosed please find card for reply.

MEMBER OF FLAT WHEEL CLUB.

[The thing might be done, but the chances of a permanent job would not be very good.—EDS.]

## Wood for Plugs.

*Editors:*

In a recent issue you direct a correspondent to use soft wood plugs for broken gauge-cocks. In my experience I have found hard and dry wood the better. I was once firing a passenger engine when our whistle blew out. The engineer had just shut off to roll down a hill, when away went the whistle. I started the left injector and he pulled his pump on full. Then I covered the fire over with fresh coal. When we stopped at the foot of the hill we had a glassful of water and 15 pounds of steam. We made a plug out of an oak block and drove it in the hole, which was 2 inches in diameter. Steam was then raised, and we took in the train with the full pressure of 140 pounds without the least escape of steam from the plug.

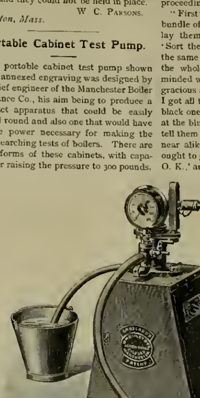
I have seen soft wood tried to plug up holes and they could not be held in place.

W. C. PARSONS.

*Boston, Mass.*

## Portable Cabinet Test Pump.

The portable cabinet test pump shown in the annexed engraving was designed by the chief engineer of the Manchester Boiler Insurance Co., his aim being to produce a compact apparatus that could be easily moved round and also one that would have all the power necessary for making the most searching tests of boilers. There are three forms of these cabinets, with capacity for raising the pressure to 300 pounds, 400 pounds and 1,000 pounds respectively. The device has been patented in this country, and the proprietors, Crosland & Bailey, wish to dispose of the patent rights. They can be addressed through this office.



PORTABLE TEST PUMP.

## Color-Blind Tests.

BY CLINTON B. CONGER.

My friend "Doc." came up from Indianapolis last week to visit me, and gave me a graphic account of an examination he passed a few days previous, which is given in his own language:

"There has been quite a hubbub on our road amongst the boys about a test of our eyes. Ike, that's our traveling engineer, called me into the office the other day, and gave me a letter to a young doctor to examine my eyesight.

"'For the land's sake,' says I, 'my eyes ain't giving out, are they?'

"'No,' says he, 'but that is what I got orders to do. Now, you go down to his office, give him this letter, answer his questions, do as he tells you. Let him try your eyesight any way he wants to, hold your temper and don't say any more than is required. I am sending you down first because I know you will get along all right.'

"'Ike,' says I, 'what is he going to do?'

"Says he, 'I can't say just how he will do it, but what he wants to know is whether you are short sighted or got weak eyes, if you can tell red, green and white signals apart, and how far off you can tell a brakeman with a flag from a section-man with a tamping bar.'

"So I went down to the doctor's office, give him my letter and sat down. He read the letter and got out a big memorandum book and says, 'How old are you?' 'Forty-seven,' says I. 'How long have you been running an engine?' 'Twenty-four years,' says I. 'Have you ever had any disease of the eyes?' 'Not as I know of,' says I. 'Have your parents always had good eyesight?' 'Don't know,' says I. 'Both of them died when I was a kid,' says I.

"So he telephoned for another young Sawbones to come in and help him and the proceedings began.

"First thing they did was to get out a big bundle of little bunches of colored yarns, lay them down on the table and say, 'Sort them out and get all the skeins of the same color together.' I wanted to ram the whole bunch down his neck, but I minded what Ike told me and went at it as gracious as a schoolma'am at a quiltin' bee. I got all the red ones together all right, the black ones and white ones, but when I got at the blue ones it pretty near beat me to tell them from the green ones, they was so near alike. Says I, 'A man of my birth ought to get the green ones picked out all O. K.,' and I sorted them in good style.

"The doctor looked over the pile, and says to the other fellow, 'I guess this is a good test. Now we will give him something harder. Hold your hand over your right eye and look at this card with your left eye.' I looked at the card. It was less than fifteen feet off, but I couldn't read any on it. Then he made me cover the other eye and look at it, that wasn't any better. It kind of worried me, till I got it in my hands after he laid it down to get something else. It was a blank card. Then he had me read fine print at all sorts of distances, and tell the letters on a big card across the room. Every time he gave me something fresh to do his helper would write something in his book, so I saw why he wanted a big one. One thing he did was not fair, and I told him so, too. He set a postal card up on top of the lower sash, right in the middle of the only window of the room, so you had to look against a bright light to see it, but I beat him at that, for I see it before he picked it up.

"He sat down and made out a certificate that my eyes were all right, and give it to me. I waited a minute while thinking about what Ike told me, and says I to myself, 'I'll go him one round anyhow, if I get fired for it.' Says I, 'Doctor, do you think it is a fair way to test a railroad man's eyes—on a lot of girl's yarns and a few fine-print cards? We have to see colored flags and lights, and look down the track a long way, and know for sure whether a man is waving a flag at you or just walking along, and your sight has got to be fine enough to read orders and time-cards without any specs. Some of the orders we get the man that wrote them can't read after they get cold. Now,' says I, 'what do you know about all these things? Have you ever been out on an engine and seen what is required of an engineer's eyes?'

"He allowed he had never been out that way, but it was a scientific fact that some eyes were defective when the men could not tell it themselves.

"'Scientific grandmother,' says I, 'come down into our main passenger yard and I will show you something.' He laughed and said 'All right.' So we went down in the yard, and I says, 'What is the shape of the first switch-target beyond the Twenty-second street depot?' I had to explain to him what a switch-target was. A nice outfit of knowledge he had to test railroad men with!

"'Round,' says he. 'What color is it?' say I. 'White.' 'Any yarn on it?' says I. 'Now just ask me questions about those targets, engines and tracks you see down there. I don't care how far off they are, I can see just as far as any one.'

"It was pretty well along to six o'clock then, so we staid till the switch-lights began to show good, and says I, 'Can you tell which of them lights are on main line switches and what color they are when set right?' I'll bet there was more than a hundred switch-lights and signals in sight from where we stood, and he did not say a word.

"Says I, 'Don't you think your examination of railroad men is a little lame? Suppose you take the next fellow that is sent up to you, scared out of his wits for fear he is marked to lose his job, out on the road and try him with the signals he has to work with.' The other young doctor says, 'He has got you in a tight place if you are an ophthalmologist.'

"The upshot of it was he allowed the right way to test eyes was to try colored lights instead of yarn. I took my certificate down to Ike and told him the whole proceedings. Says he, 'Now you see why I sent you first. You will likely be the last till he gets his kit of tools fixed up to suit him. The doctor is all right as far as he goes, but he don't go far enough. He ought to try you on colored lights instead of colored yarns. You will pass.'"

Doc asked me what I thought of it, and was told that I had rather not say anything either way about the matter till he had seen something more. I said to him, "Doc, we have an eye-tester here in town that uses the Pennsylvania Railroad system and appliances. We will go down and see him after supper. We went down and found a set of cards with different sized letters printed in good plain black type, the usual pile of yarns of various colors, but something else took Doc.'s eye, there were eleven incandescent lights with colored glass slides in front of them. When the current was turned on these lights, any color could be shown or all lit at once. The glass shades could be changed so that at one time a certain light was green; at another it showed red, without the glass, it was white. Doc. said to me, "This is something like. If we have got to be tested, let it be with lights not with yarn."

I told him that the doctor in charge of it knew a good deal about railroading and the wants of railroad men. His aim was to give the men a practical test in their own business as well as a scientific one.

One of our best and most intelligent engineers who was up here with me the other night, was examined himself, to see how it was done, and came away satisfied that it was what it claimed to be—a practical test of ability to distinguish colors both by day and night.

There is a good deal of prejudice against the color-blind test, because the men do not think it is fair to go through the form of sorting yarn or reading fine print, especially when a man fails on this test when he can tell red from green and white lights. When the tests of eyesight first commenced twelve years ago, if they had been a little more practical, *maybe* it would have worked better.

Doc has not said a word about it since we came out of the office, but he will have something about it the next time I see him. He is not one of the fellows that can keep still long. Tests and examinations of a man's ability are all right, if they are fair and practical. No one that can pass them need be afraid. If they are not fair and honest, we do not need them.

The drawings for the New York, Susquehanna & Western new shops at Paterson are about completed, and work will be commenced in a few weeks, and will be pushed forward to rapid completion. This company will order in a few weeks some additional power. Their order for 300 coal gondolas and fifty box cars has been let.

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The Lukens Iron & Steel Company report a good and steadily increasing railroad trade, having recently booked steel orders from the Lehigh Valley, N. Y., Susquehanna & Western, N. Y., Ontario & Western, Del., Lackawanna & Western, K. C. F. S. & M., Central Vermont, Buffalo, Rochester & Pittsburgh, N. Y., Providence & Boston, South Carolina, Missouri Pacific, etc. It has been specified on eight engines building by Cooke Locomotive Works for the Louisville & Nashville Railroad, and for fifty engines building by the Baldwin Locomotive Works for the Missouri Pacific Railway.

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The Louisville & Nashville Railroad have placed a large order for new locomotives with the Cooke Locomotive Works, Paterson, N. J. These works are very well equipped for doing good construction work, and the proprietors appear determined to do their best on the fine engines designed by Superintendent of Motive Power Leeds.

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The New York, Ontario & Western have ordered five consolidation engines from the Dickson Locomotive Works. These works are also building eight engines for the Delaware, Lackawanna & Western.

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On the Warren branch of the Richmond & Danville road they still have in use some of the old U section rail; it was taken up from the main line years ago.

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The Illinois Central have placed an order with the Rogers Locomotive Works for forty-two locomotives. The engines will all have the same kind of Belpaire boiler as Leeds uses on the Louisville & Nashville locomotives.

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The Brooks Locomotive Works are building some 10-wheel engines for the Toledo & Ohio Central. The compound which these works built about the beginning of the year is now at work on the Lake Shore & Michigan Southern and is giving satisfaction. The engine is of the 2-cylinder type.

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The Pittsburgh Locomotive Works have delivered the lot of engines ordered by the New York Elevated Railroad and they are doing very well. The officers of the road say that the work done on these engines is better than anything they have previously had from contract shops.

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The Baldwin Locomotive Works are crowded with orders. Among orders of most recent date are: Central Railroad of Brazil, six compounds. This follows an order for seventeen sent out last summer. Western Railroad of Cuba, one compound; Missouri Pacific, thirty 10-wheelers, simple; Grand Rapids & Indiana, sixteen consolidations and seven passenger engines, all simple; Missouri, Kansas & Texas, six moguls, one of which is a compound; Southwestern Company, nine moguls, simple, Chicago, Rock Island & Pacific, five passenger 10-wheelers, simple; Chicago Street Railway, two compound motors.

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On the St. Louis and San Francisco road no paint is furnished for front ends and stacks, but instead plumbago or black lead is used. This is lighter in color, but makes a very neat front, and causes no scale. A scaly, patchy front end and stack are the reverse of neat and cleanly in appearance. Don't use tar.

The practice throughout the South of putting a spittoon at every seat in all cars tends to make the cleaning of coaches an easier matter, and prevents in a great measure the coloring of dress trains to the shade of navy cut plug.

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Put a three-way cock in the exhaust pipe to your air pump, and arrange it so that the engineer can open it from the cab and start with the exhaust going under the engine instead of throwing a shower of wet soot on the engine—this discourages the firemen.

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The Rhode Island Works are building forty-seven locomotives for the Wabash.

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## Texture of Steel and Iron Axles.

The annexed engravings are etchings of locomotive axles. One is steel and the other is iron. The character of the two kinds of material can readily be understood by an examination of the etchings. The iron is a conglomerate mass formed into a rough unit by the blows of the hammer and the pressure of rolls. Working the iron fails to eliminate the whole of the clay, and some of the pieces that make up the pile from which the axle is formed

IRON AXLE.

are improperly welded, so that the elements of disintegration are present from the time the forging leaves the hammer.

The texture of the steel axle, on the other hand, shows a homogeneous material, not a collection of fragments indifferently stuck together. The steel axle ought to be better than iron if made of the proper material. There have been many failures of steel axles, and there is not a little prejudice against them, but most of it comes from using Bessemer steel, which is decidedly unsuitable for axles, just as unsuitable as it would be for boiler plates or firebox sheets.

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Mobile, Ala., has a unique institution in the shape of a Railroad Social Club. The club has been established for about a year, and promises to be a decided success financially and in the attendance of members. We do not see why railroad social clubs cannot be established in the leading cities. The common interests that spring from being engaged in the same business has formed many social clubs, and it is strange that men who travel so much as those engaged in railroad work have not established more centers of gravitation in the form of clubs.

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The suburban passenger service of most of the Chicago railways is excellent in respect to equipment, frequency of trains and speed, and the rates are so low as to afford little if any profit, but still improvements are liberally added. The Chicago & Eastern Illinois Railroad, although required by city ordinance to carry passengers between Chicago and Englewood, six miles for five cents, has just added ten suburban cars which probably are not surpassed for such service. The cars are fifty-two feet long and are equipped with Hale & Kilburn high-back seats covered with maroon plush, have a seating capacity of sixty-four passengers each, and are lighted with the best improved lamps.—*Railway Age.*

In a boiler that had recently had a hot crown sheet, it was found that around each stay there had been wiped a packing of good cement to insure a tight joint. The stay-bolts were well headed over, but the cement did the water-tight business. When the crown sheet was dropped, this cement was hard enough to remain on the stay and clean enough to show the finger-marks made in applying. Is this practice carried to any great extent?

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Mexico has certainly the most luxurious, if not the most comfortable, railways in the world. The rails of the Mexican Gulf Railway are laid on sleepers of mahogany, and the bridges are built of white marble. On the west coast of Mexico there is another line which has sleepers of ebony and ballast of silver ore drawn from old mines beside the track. The reason for this apparent extravagance is that the engineers had no other materials on the route, and found it cheaper to use these than to import the ordinary plant.—*Galveston Paper.*

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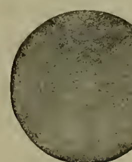
The Secretary of the Railway Master Mechanics' Association has issued a circular calling upon members to answer cir-



STEEL AXLE.

culars. This is about the time of the year when the circulars received from committees are generally drawn out of the loop-holes where they have been placed for "consideration." We would suggest that the season of consideration is about finished. Get them all out and send in all the information you can.

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We have received from Mr. Wm. Montgomery, master mechanic of the Central Railroad of New Jersey, some ends of boiler tubes that had the copper ferrules and iron ends nearly all corroded away. It looks as if the corrosion were caused by galvanic action. An analysis of the water showed that chlorides and sulphuric anhydrides were present in large quantities. The latter impurity would be sufficient to account for the very rapid destruction of the tube ends.

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It is a long time since differences of opinion arose between the public and railroad companies as to the equity of transportation charges. In an English publication, under date of 1846, we find an answer from railway directors to a charge that the fares were excessive. The directors say "It is true we charge you twice or thrice the fares exacted in other countries, but you paid more on stage coaches before we enabled you to travel on railways comfortably. We have accelerated your journey and given you every luxury that a traveler could desire, and carrying free three times the amount of baggage you could have taken on a stage coach. What right have you to complain of high fares when you enjoy so many advantages in return? If you dislike our charges, you are not compelled to pay them. You are at perfect liberty to use the turnpike, and if you prefer the old coaching practices, introduce them again. Only in God's name stop uttering your complaints against the benefactors of the country."

## Long Mileage.

The claim made by Engineer George King, of the Wabash, of having made the longest mileage ever reached in this country is contested by Engineer John E. Baird, of Wymore, Neb. He tells that he has run engine No. 20 on the B. & M. Railroad, in Nebraska, and in the month of January made 6,824 miles, and in February 6,268 miles. The auditor of the road claims this to be the longest mileage ever made in Nebraska.

Mr. Geo. M. Hankinson, time-keeper of the Michigan Central Railroad at St. Thomas, Ont., writes us:

"In reading over the March issue of your paper I noticed where Engineer Geo. King, of the Wabash, claims to have made the largest mileage with his engine in one month ever made in the country—that is, 6,627 miles—but we have an engineer here on the Canada Southern Division of the Michigan Central Railroad who leaves brother King in the rear by 601 miles. The distance between St. Thomas and Buffalo, via Niagara Falls, is 139 miles, and in January last Engineer John Nolan doubled this distance twenty-six days or fifty-two trips over the division, leaving St. Thomas at 2 o'clock A. M. and returning at 4 50 P. M. Total mileage, 7,228.

"There were five days during the month that he did not work. He had the same engine all the time, and handled two of the heaviest passenger trains that are pulled over the line."

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We happened to call on a master mechanic lately who was ordering new locomotives that were to have highly-pressed boilers, and he had agreed that a steel should be used which is noted for nothing but its cheapness. He was highly elated with the tests stood by the steel as shown by the makers' figures. On our suggesting that he should have tests made for himself, he protested that it would be casting suspicion upon reputable men. There are some reputable men who are worth looking after in business, and the infant who thinks otherwise is not fit for the head of a railroad mechanical department.

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A discovery is reported at Helsingfors of an ancient chest, containing a lot of curious pieces of iron machinery with a mass of parchments, the latter being a treatise on the possibility of applying steam to mechanics, while the machinery is a very tolerable approximation of the steam-engine of a century ago. Both iron-work and documents purport to have been made by Suger, the famous abbott of St. Denis and administrator under two kings of France in the twelfth century. Great interest will, of course, attach to the investigation of authenticity of these antique remains. If they really are Suger's he will have a new distinction as antedating all the other pioneers of steam application by hundreds of years.

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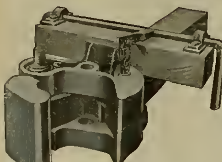
We have a long article from a fireman in Nashua, N. H., proposing a reformation in the handling of locomotive firemen. The proposal is made that firemen be relieved from the work of scouring brass, blackening boiler-heads and similar menial duties, and that the time of these men while in the engine-house should be devoted to the learning of an engineer's duties, the engineer to act as instructor. We do not consider that railroad companies or even engineers are quite ready to agree to this change, and we must postpone the publication of our correspondent's letter until it is likely to meet with more support than it would receive in this benighted age.

We have received a pamphlet giving some points about grinding tools by J. Wendell Cole, Columbus, O. It deals in a comprehensive way with the advantages of using the Sellers tool-grinding machine for grinding tools. Those who read this pamphlet and have had any experience with tool-grinding machines are likely to acquire a hard opinion of the poor old grindstone.

# THE STILGER & STROSLER AUTOMATIC CAR COUPLER



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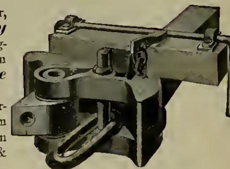
This coupler has been in use on the Birmingham Division of the L. & N. R. R. seven months without a break. We take pleasure in referring to the Supt. Motive Power, L. & N. R. R., as to its merits.



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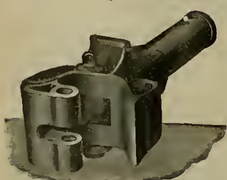

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By J. E. PHELAN.

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## The Shaw Electric Traveling Crane.

Until within a few years nearly all the cranes in use in machine shops and foundries in this country were of the jib type, despite its serious limitations as to area of floor served and the large proportion of floor occupied by the mast and thus rendered useless. A few traveling cranes had been built, but they were generally so crude in design and workmanship, and consequently so slow and jerky in their movements, that they met with little favor, especially in foundries, where smoothness of action was most important.

The comparatively late development of the traveling crane was undoubtedly due not only to the fact that a higher order of design and better workmanship was required to produce a traveling crane which would operate satisfactorily than to construct a jib crane which would work with equal steadiness, but also to the difficulties connected with the transmission of power from an external source to a moving machine. This necessitated either a square shaft with its cumbersome and expensive tumbling bearings, or rope transmission, which in practice has proven expensive to maintain and liable to unexpected breakdowns.

With the advent of electric transmission of energy, the latter difficulty was at once done away with, and the invention and introduction of the system of applying an independent electric motor to each movement by Mr. Alton J. Shaw, then of Milwaukee, Wis., so simplified the mechanism and increased the smoothness of action and the delicacy and accuracy with which the traveling crane could be handled and controlled, that now the electric crane, constructed on this system, is easily first for nearly all purposes.

The first triple-motor electric traveling crane put in practical operation anywhere is believed to have been built from the designs of Mr. Shaw by the Edw. P. Allis Co., and erected in their foundry in Milwaukee, Wis. Although an experimental machine and naturally somewhat crude in many of its details, it was at once pronounced by all who saw it in operation to be superior to anything previously produced. The molders were especially enthusiastic in its praise, as it was far smoother and steadier in its movements and capable of much more accurate handling than the power cranes in use at that time.

While the mechanically driven cranes had but two speeds of traverse and four of hoist, the electric crane had an indefinite number, and any movement could be smoothly and gradually accelerated or retarded or maintained at any speed between the highest and lowest at the will of the operator. All this was accomplished without clutches or mechanical disengagements of any kind.

Next to the smoothness of action the simplicity of this crane was the first feature to impress one accustomed to the intricate mechanism of the older machines. Instead of six, eight or more friction clutches, four or five dozen gears and diverse square shafts and tumbling bearings, it had but twenty-two gears and no clutches or square shafts. The remainder were replaced by three electric motors, each of which had but one moving piece—the armature.

THE SHAW ELECTRIC TRAVELING CRANE.

There have since been installed in the works of the Edw. P. Allis Co. two more electric traveling cranes built by the Shaw Electric Crane Co., one crane of thirty tons capacity, operating on the same tracks with the first, and the other of fifteen tons capacity, in the Alliance Works No. 2 Erecting Shop, an interior view of which, taken from a photograph, is shown in the accompanying cut.

This crane, while not as rapid in its movements as some which have since been constructed, was, when put in, much faster than the majority of cranes then in use. It has a maximum hoisting speed of twenty-five feet, a bridge or longitudinal traverse speed of three hundred and fifty feet, and a trolley or transverse traverse speed of one hundred and twenty-five feet per minute. The speed of each of these movements may be raised from nearly zero to the maximum simply by moving the reversing lever a greater or less distance either side of its mid-position. As but one lever is required for each movement, the manipulation required is of the simplest possible character. The crane is fitted with incandescent lamps of six hundred total candle-power, which brilliantly illuminate the floor below whenever the crane is used at night. This crane, as are all those built by this company, is fitted with duplex automatic brakes, to which, in large part, is due the accuracy with which the load can be handled in hoisting and lowering. These brakes not only insure against the accidental dropping of the load from any cause other than breakage of parts, but absolutely prevent any possibility of "racing" in lowering.

These brakes are entirely automatic in their operation, and do not depend for their action on the skill or vigilance of the operator. One of them is applied continuously by the reaction of the load itself, the power with which it is applied being proportional to and increasing with the load, and released by the pull of the motor. The other is applied by a powerful spring, and is always "on" except when withdrawn by the action of a solenoid in series with the hoisting motor. Without the mechanical brake the crane would "race" in lowering, as the magnetic brake is then withdrawn by the current which actuates the motor, and both the motor and the load act in the same direction. Without the magnetic brake the load could not be stopped promptly after either hoisting or lowering, on account of the momentum of the armature. Without the capability of instantly checking the movement of the load, accurate handling would be impossible, as, when the current is thrown off, it would always go either a little too far or not far enough. The two brakes acting in combination give great accuracy of control, which, together with the extremely slow speed at which the crane may be run, enable the heaviest loads within the capacity of the crane to be set with absolute accuracy.

All truck wheels are cast from charcoal iron and the treads are chilled deep and hard and ground true. These wheels are considered by the makers to be better than steel, as the hard surface insures great durability, while the accuracy attained by grinding causes the traverse movements to be extremely free from vibration.

All the shafts are large and the bearings are unusually long. Great attention is given to the matter of accessibility, the machinery being so arranged that all important details may be removed and replaced readily without disturbing other parts. Bearings are capped wherever possible.

The girders are very rigid, laterally as well as vertically, and have a large margin of safety.

These cranes are built by the Shaw Electric Crane Co., Muskegon, Mich., and are handled by Manning, Maxwell & Moore, New York.

## A Texas Car-Wheel Foundry.

While on a recent visit to Houston, Texas, I was very much interested in the modern foundry of the Dickson Car-Wheel Co. These works were established some years ago by the present president of the company, Mr. John T. Dickson, then general superintendent of the Texas & Pacific Railway.

Mr. Dickson's attention was first called to the great strength and the chilling quality of the brown hematite ores then melted with charcoal at the old furnaces in Marion County, Texas. After leaving the road, Mr. Dickson established wheel-works, and has made large numbers every year since.

No mysterious "mixtures" are indulged in—plain Texas ores and old wheels are alone used.

The shops at Houston are new, and of modern plan—wood, covered with iron, there are five "floors," of eighteen flasks each, set in a circle, and each floor served by a crane of its own. The melting is done in two Byram-Colliau cupolas of the latest form, and so arranged that one elevator serves both charging floors. In the charging-room, instead of doors in the cupola, the feeding apertures are only closed with a wire screen on a light frame, the air going through this keeps it cool, while it is almost impossible to keep the fire-brick lining on the ordinary door.

The foundry is fitted up with the Barr contracting chill, steam being used to expand the chill until the moment of pouring, and the contracting being done by the substitution of cold water for the steam. The works have an independent water supply and electric light plant.

The usual test of car-wheel mixtures is to take a piece of the iron two inches square and fourteen inches long, support it twelve inches apart, and apply a load in the center, the usual breaking strain being 18,000 to 26,000 pounds. Reihle Bros., makers of testing machines, at Philadelphia, recently tested six bars of the Texas metal, and found that it required a breaking strain of 27,000 pounds to break the poorest of the specimens and 32,000 pounds to break the best.

The Dickson people have great faith in their wheel, for they give a guarantee exceeding the requirements of the M. C. B. standard guarantee, who only ask 60,000 miles in passenger service and four years in freight. The Dicksons guarantee 70,000 miles in passenger and five years in freight service.

At one end of the shop are arranged the annealing pits and the machine to grind the tread; this last device takes all the chill fins off and insures a round, true wheel.

Most of the roads in Texas and the Southwest in general have some of these wheels in service, and we see no good reason why the works cannot be doubled by properly pushing the merits of the wheel. Certainly the works are in fine shape to do good work and do it cheaply—everything is new.

J. A. H.

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Sand is an item of considerable expense to a great many roads, and good, gritty sand is a mighty scarce article. We know of roads that haul sand for more than 500 miles. This is expensive, yet it is the using of large quantities under trains that costs fuel-money. It would pay any road to make a trial of some of the jet sand distributors now on the market. They are very economical of sand, put it where wanted, and spread it evenly.


The Northern Pacific are building 100 street cars in their shops at Tacoma, Wash.

The Southern Pacific Refrigerator Co. is building 100 patent refrigerator cars of their latest pattern for the Schoenhoefen Brewing Co.

The Hale & Kilburn Manufacturing Company have, within the last eight months, equipped about 700 passenger cars with their seats.

The Erie Car Works has begun the delivery of 500 cars which it is building for the Pennsylvania. The first 300 built have been ordered for the Philadelphia & Erie Division.

The Wells-French Company are building a number of Rodgers ballast unloaders, including an order of 150 for the Great Northern. They are also building 125 ore cars for the Duluth & Iron Range.

The New York, Susquehanna & Western has placed orders for 300 gondolas and 50 box cars. They will have Smillie couplers, Lee composite roofs and Cambria steel axles made by the Coffin process.

The Mount Vernon Car Manufacturing Company of Mount Vernon, Ill., have contracted to build 200 refrigerator cars for the Frost Proof Car Company. These cars are to be operated over the Canadian Pacific Railway.

The Safety Car Heating & Lighting Company have recently equipped twenty-five Wagner palace cars and fifty passenger cars of the New York, Lake Erie & Western, and twenty passenger cars for the Jersey Central with their heating system.

The Ohio Falls Car Company of Jeffersonville, Ind., have just completed 300 fruit cars for the Alabama Great Southern and are delivering 300 thirty-ton hopper coal cars for C. N. O. & T. P. Ry. This company has also closed contracts for 550 freight cars for the L. N. A. & C. Ry. and 500 for the Pennsylvania lines.

The Burlington & Missouri River have just received ten handsome passenger cars from the St. Charles Car Co. They are finished in mahogany and have the Scarritt high-back seats. The same car company are working on orders from the Missouri, Kansas & Texas, and the Atchison, Topeka & Santa Fé. They are very busy.

We have received during the month several circulars from committees of the Master Car Builders' Association calling for information. There seems to be great activity among the M. C. B. Committees. We understand that most of the Master Mechanics' Association Committees are collecting without the aid of circulars the information required to make up reports.

The Standard Oil Company now own and operate nearly 8,000 tank cars, the latest ones holding 8,000 gallons of oil. Crude and refined oil weighs about $6\frac{6}{10}$ pounds per gallon. The company also have a large number of very small tanks for handling acid; acid weighs from 13 to $16\frac{1}{2}$ pounds per gallon. Some of these cars, loaded, got knocked off a float in the harbor at Baltimore recently and the men in charge could not account for the small cars sinking so quick—they went down like lead.

## Plant Freight Cars.

The Plant system of roads have lately ordered a great many large freight cars for carrying fruit, and one of them as finished is shown in the annexed engraving. The cars are built in first-class style and equipped with all the most approved attachments. They have Janney couplers and Westinghouse air-brakes. The cars are 33 feet 6 inches long and have comfortable room inside for a 30-foot rail. The cars are all painted yellow, and have the striking figure seen on the side which is put only on cars belonging to the road which has all the latest improvements.


PLANT VENTILATED FRUIT CAR

The Missouri Pacific people are about to make important additions to their rolling stock. They have ordered fifty locomotives from Baldwins, thirty of them being ten-wheelers, intended for fast freight. An order has also been placed with the Ensign Mfg. Co. for 500 Canda cattle cars, and one with the St. Charles Car Co. for 1,000 box cars and 500 coal cars.

## Work at Pullman.

Among recent car building work done by the Pullman Car Co., Chicago, is: One private car for the Baltimore & Ohio. Twenty-two coaches for the Southern Pacific. Six parlor cars for the Chicago & Northwestern. One passenger coach for the Chicago & Eastern Illinois R. R. Co. One private car for the Pecos Valley. One private car for the Minneapolis, St. Paul & Saulte Ste Marie. Twenty-five passenger coaches for the Central Railroad of New Jersey. One parlor car for the Windsor & Annapolis Railway Company of Canada. Twenty-five passenger coaches, ten express, ten baggage and five postal cars for the Norfolk & Western. One hundred passenger coaches for the Philadelphia & Reading. Two passenger cars and two dining cars for the Chicago, Rock Island & Peoria. One thousand box cars and four hundred coal cars for the Norfolk & Western R. R. Co.

The street car department has been unusually busy during the month. The principal demand is for motor cars and the fine center vestibule double-decked cars designed a short time ago by Mr. C. L. Pullman.

The committee appointed by the Master Car Builders' Association to report on compound locomotives are getting the apparatus in shape for making complete tests of a compound ten-wheeler of the Vauclain type with a single-expansion engine of the same dimensions, with the exception of the compound cylinders. A dynamometer car is nearly completed, which will be a duplicate of the one used by the Chicago, Burlington & Quincy Railway. It is expected that the latest improved apparatus will be used in making all readings in connection with the tests which are intended to be complete in every detail. The plan is to make tests of the compound every day for a week, and the following week make the same tests with a single-expansion engine, and to follow out this plan for a period of about three months.—*Railway Review.*

The adoption by railroad companies of the M. C. B. type of coupler appears to be proceeding very satisfactorily, but it looks as if Congress intended to spur on the railroads to greater energy in this line of improvement. There are several bills before Congress proposing to compel railroads to adopt automatic couplers within a certain time. The most practical and sensible of these measures is one introduced by Senator Allison, which proposes to have railroad companies decide by letter ballot upon the type of coupler. The vote will be based upon the number of cars owned by each railroad company. The Board of Interstate Commerce would be required to receive and count the ballots. In the event of no decision being arrived at by the votes of the railroad companies, the M. C. B. type of coupler would be made the legal standard. We see no objection to the enactment of this measure. A great many railroad companies do not require any urging to adopt safety appliances, but others do. Compulsory measures of a mild kind would do no harm to progressive roads, and they would have a good effect upon the companies that will do nothing until kicked into action.

## Prompt Repair of Moving Cars.

By EUGENE CHAMBERLIN.

At all times, but more particularly when railway traffic assumes unusual proportions, a company will find it necessary to keep in service as large a percentage of its freight equipment as possible. The problem is presented as to how the execution of car repairs may be facilitated and cars kept moving.

To successfully accomplish this, particularly in localities where freight yards cover an extensive area, and the arrival, shifting and making up of trains are carried on simultaneously in several sub-yards, and at widely separated points, and always at some distance from the shop, requires no small amount of study, patience, and above all perseverance. We will assume that inspection is promptly cared for on the arrival of each train, by competent men working intelligently under the wise provisions of the M. C. B. rules, and bearing forcibly in mind that the object to be accomplished is the rapid movement of freight *en route*, and that all things must be subservient thereto.

The first step to consider is the necessity of making all repairs possible "in train"—keeping cars in line—and thus avoiding the expense of shifting out many cars which are condemned by inspectors, and the consequent delay to freight which would be caused by hauling these cars to some convenient point for repairs. In making "train repairs" it has been found wise to employ a sufficient number of repairers and others to follow the inspectors closely, and thus avoid holding trains for any length of time after inspectors and oilers have performed their respective duties.

In many instances defects are found upon loaded cars which can be readily repaired in train, providing the seals of car are broken and doors opened, and much delay to freight avoided if a sealer, or some person authorized by the freight department to break seals and take records, works in conjunction with the repairers. It should be borne in mind that every facility should be afforded the men making "train repairs," the basis of their supplies being the repair branches, at which point the repairers may be returned for duty, in case trains do not arrive in sufficient numbers to occupy all their time. Having thus executed all that may reasonably be expected in the matter of "train repairs," and having kept in line many cars that under ordinary circumstances would be cut out and sent to shop, there still remains in train a number of condemned cars, upon which repairs cannot be made until cars are separated and placed in a more convenient position to handle. As a matter of convenience, we will call this the second stage of repairs, as here shifting becomes necessary. Very satisfactory results have been obtained and much delay avoided by establishing repair branches at convenient points, and always as near as possible to the tracks where inspection is made to trains—in the larger freight yards.

If possible, these repair branches should consist of two tracks, one for empty and one for loaded cars, with ample working room between, and having connection at both ends with the main freight yard, so that cars for repairs placed in at one end may be taken off repaired at the opposite lead, and thus avoid filling and pulling from the same lead. An ample store-room is necessary, and in it the stock classified, plainly marked, and placed so that any kind of material sought for can be readily obtained. Too much stress cannot be laid

upon the necessity of keeping the stock, and all appurtenances of the repair branch in systematic shape. As this store-room is also to be the basis of supplies required by train repairers, it serves a double purpose, as also does the repair branch, which becomes the working-place of the train repairers when not on duty with trains.

It will also be observed how readily cars repaired upon these branches may be delivered back to freight yards, in many instances taking the same train or group before it is ready for delivery from freight yards to connecting lines, thus obviating the delay which would necessarily occur if the crippled car was hauled some distance to a shop and brought back to freight yards after being repaired.

If these repair branches are properly conducted, it will be a pleasant surprise to find what a variety of work—much of it of a heavy character—can be accomplished thereon, and the fact of having one of the repair tracks reserved for empty cars gives constant employment to the force in case there is a falling off in the number of loaded cars to be repaired.

From the foregoing it is of course discovered that many empty cars and nearly, if not all, loaded cars arriving in a crippled condition have been repaired and returned to service or sent directly to the transfer-house with but little delay and without unnecessary shifting, and that the shops have been reserved for more extensive repairs or rebuilding, of which there is always plenty at hand.

## Speed of Fast Trains.

The fast Empire State Express run daily on the New York Central between New York and Buffalo continues to excite great interest in England, which long held the broom for fast trains. The correspondent of a London daily lately made the following comments about fast trains:

"A comparison between the runs made by the Empire State Express and those made on English roads shows that that train is entitled to the palm for long runs. From New York to Buffalo, 439½ miles, the run is made by the Empire State in 8 hours and 40 minutes, an average of 50.71 miles per hour including stops, and the engine draws a train weighing about 175 tons. From Euston to Perth, Scotland, 450 miles, the run is made in 9 hours and 50 minutes, with an average time of 45.76 miles including stops, weight of train 80 to 130 tons. From King's Cross to Perth, 439 miles, the run is made in 9 hours and 55 minutes, with an average of 44.27 miles per hour including stops, by a train of about 130 tons weight.

## The Latest Locomotive Humbug.

The picture of a locomotive, with all the wheels of engine and tender resting on other wheels secured in separate trucks, has been sent us by a correspondent. Beneath the picture we read: "Should the standard locomotive now being constructed on this plan prove a success, as is expected, and the five dollar non-assessable fractional shares now being sold increase 150 times, as is proposed, a five dollar investment would amount to $750 at par value. Address H. J. Caldwell, Mankato, Minn."

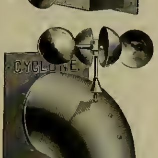
We consider that the post-office authorities ought to look after Mr. Caldwell if he is sending that circular through the mails. The whole thing is a palpable humbug. It looks like an attempt to use a mechanical monstrosity as a means of obtaining money that might as well be burned up. The unfortunate feature about the thing is, that any oddity is certain to attract attention, and a plausible advocate can make ignorant people think that they risk little perhaps to gain much by taking stock in a scheme like this. It has strong lottery elements.

## Cyclone Car Ventilation.

We illustrate in this issue, two styles of the Cyclone car ventilator just being placed on the market by M. C. Hammett, of Troy, N. Y., the manufacturer of the well-known and popular Richardson and Allen-Richardson balanced slide-valves.

The Cyclone as it was very properly named by Superintendent of Motive Power Blackall, of the Delaware and Hudson, after seeing it tried, is the invention and design of W. S. Rogers, Superintendent of the works of M. C. Hammett, who is thoroughly familiar with the question of car ventilation and has made it a study to contrive something that would be of practical value and at the same time not be so complicated that it would be too expensive and impracticable for adoption by railways. The ventilator is placed on the side of the deck of the car in the same manner as the ordinary ventilators generally in use.

The semi-spherical vanes actuated by the currents of air caused by the speed of

the moving train, rotate an exhaust fan in the body of the case and mechanically withdraws all foul air and gases from within the body of the car.

The methods employed in arranging the fan and the vanes together makes them sensitive to the slightest air currents, so that when the cars are standing still, the lightest breeze will cause the ventilator to do what all ventilators are supposed to do, and keep the atmosphere within the car pure and clean.

On cars of modern construction they are placed outside the movable deck sash or outside the screen guards. Their construction is such that they will run for years without requiring attention and care more than is ordinarily given to such apparatus, and any one can apply them in very short order without revamping or changing the present deck arrangements. They are furnished by the manufacturer all ready for putting on the coaches.

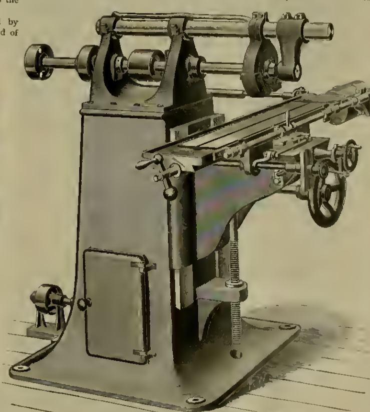
Coaches equipped with the Cyclone ventilator need not have the windows made to raise and lower. Neither can currents of air blow in through the deck windows from the outside and cause annoyance to passengers, all air within the car being drawn upward and forced outward by the fans.

On one of the Delaware & Hudson Canal Co.'s smoking cars on a local train, ten Cyclones have been put on and twenty-six of the ordinary ventilators taken off. From forty to fifty pipes and cigars have been seen lighted and being puffed at once, the smoke being at once taken away and the air left clear and pure. A more severe test than this could hardly be required.

Its simplicity and quick application should commend it to the entire railway community of presidents, managers, car-builders and passenger department alike without reference to its saving in cost over present methods with such superior results.

## Emery Wheel Surface Planer.

The tool illustrated herewith is intended for doing with an emery wheel a portion of the work usually done with a file, planer, shaper, milling machine or similar tool. It will do flat and true surface grinding and finishing, thus proving an effective substitute for filing and stoning. The entire cost of files and three-quarters of the labor usually expended on these operations are saved, besides obtaining better surfaces upon the work done. It is especially adapted for surfacing iron in the



rough where but a small amount is taken off, and for finishing and cutting down work where the material is of a hard nature, as the surfaces of hard iron, chilled iron, steel dies, punches, etc.

On tempered work it saves drawing the temper and rehardening, and is true when done, while, if finished on an iron planer, on hardening it will spring, warp and twist out of shape. It is also adapted to finishing work that has been roughed off on a planer where it is desired to take out the tool marks. The emery wheel cuts as fast when carriage is running backward as when running forward, while an iron planer cuts only one way. It will grind the very hardest castings made freely, so stronger and less expensive iron can be used than with an iron planer. Castings have only to be made a little above the actual size they want to finish, as the emery wheel only needs to remove enough stock to bring the work to a nice finish, while with the iron planer it is necessary to go under the scale to plane it. The work can be fastened on the table by chucks, draws and straps, same as in common milling machines and iron planers.

The machine is very substantially made, and great attention has been directed to convenience of operating. It is made by the Springfield Emery Wheel Co., Bridgeport, Conn.

The Boston & Maine Railroad Company are putting in some good new tools into their locomotive shops at Boston.

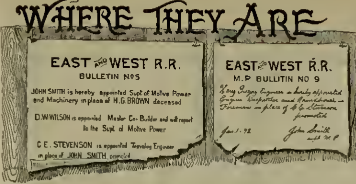
## Fast Running.

There is a Baldwin compound locomotive on the Central of New Jersey that is making remarkably fast running. She has been on a train leaving Philadelphia at 5:15 P. M., which makes the run of 89.4 miles to New York in 2 hours and 13 minutes and makes seventeen stops. At one place a run of 13 miles has to be made in 15 minutes, including the start and stop. The fastest running is done on this stretch. A report of an engineer who was indicating the engine made out that one mile on this part of the run was made in 39¼ seconds. As the catching of the mile-posts is a matter of some delicacy, we should be inclined to let the ¼ second go and make it 39 seconds.

The writer timed the engine during one trip and was very much struck with the speed capacity displayed. The second mile after leaving the starting point was run in 61 seconds; then the time for succeeding miles was 51, 50, 50, 55, 53, 50, 44, 41, 47 seconds. The last mile was made as the engine was slowing down for the purpose of losing some of the time gained. The train consisted of four cars. When running at the highest speed the engine rode very steadily and with little jar. When running one mile in 50 seconds, the steam popped at the safety-valve, showing that there was no difficulty in keeping up the pressure. When running one mile in 41 seconds, the speed is 88 miles per hour. Having in mind at the time the possibility of making a speed of 100 miles an hour, we concluded that such a velocity was within the capacity of this locomotive.

In the matter of high speed a compound locomotive has no advantage over a simple one, unless it be that there is less drain of steam from the boiler. With very high piston speed the difference is likely to be on the side of the simple engine. This engine has two pairs of coupled driving-wheels 6½ feet in diameter.

Our correspondent, Mr. W. De Sanno, mentions a curious engine accident, and assures us that the case is not intended for our Ananias column. It was an upright stationary engine. The piston-rod key broke, and the piston went up like a rocket through the sky-light, turned over and dropped into the cylinder with the head reversed.




Mr. Samuel F. Prince, Jr., has been appointed superintendent of motive power of the Long Island Railroad.

Mr. C. L. Aiken has been appointed division master mechanic of the Boston & Maine, with headquarters at Worcester, Mass.

Mr. J. Conroe, formerly traveling engineer of the Atchison, Topeka & Santa Fé, has been promoted to be master mechanic at La Junta, Col.

Mr. J. T. Lord has been appointed master mechanic of the Northern Pacific at Mandan, Dak., in place of George W Gardner, deceased.

Mr. Theodore P. Jacobs has been appointed master mechanic of the Toluca & Acambaro subdivisions of the Mexican National, including the Patzcuaro branch, with headquarters at Acambaro.

Mr. Alfred Child, formerly general foreman of the car department of the Northern Pacific, has been appointed division master car builder of the Chicago, Rock Island & Pacific.

Mr J. L. Greatsinger, who has lately been made general manager of the Duluth & Iron Range Railroad, began work for the company as master mechanic. He attended several of the conventions and took an active part in the proceedings.

Mr. Porter King, of Springfield, Mass., has just left the throttle after running locomotives for forty-eight years on the Boston & Albany. He was previously on the New Jersey Railroad, and there guided the restive steed when the road was operated by horses.

Mr. C. A. Thompson has resigned from the position of superintendent of motive power of the Long Island Railroad. Mr. Thompson has been crowded out by what are reputed to be progressive influences. No railroad company ever lost the services of a more faithful and devoted servant.

Hon. Judson C. Clements, of Georgia, has been nominated by President Harrison as Interstate Commissioner. Mr. Clements is a lawyer and successful politician. His knowledge of railroad matters has not yet been demonstrated, but it is probably as profund as that of the other members of the board.

Mr William Voss, master car builder of the Burlington, Cedar Rapids & Northern, at Cedar Rapids, Ia., has been appointed superintendent of the Barney & Smith Car Works at Dayton, O. Mr. Voss is one of the ablest men in his line and is very well fitted to be superintendent of a manufacturing concern.

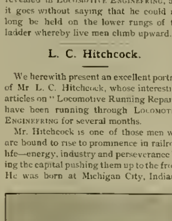
We desire to present the strongest evidence in our power to the good judgment and literary taste of Mrs. J A Baker, Oakland, Cal. In renewing the subscription of LOCOMOTIVE ENGINEERING for her husband this lady has the sense to remark "The paper was always good, but since its enlargement, it seems to me from the way I see it studied you might as well call it 'The Engineer's Bible.'"

Mr. W. E. Symons has been promoted to the position of master mechanic at Raton, N. M., on the Atchison, Topeka & Santa Fé. Mr. Symons has been an active agent in spreading the gospel of mechanics as revealed in LOCOMOTIVE ENGINEERING, and it goes without saying that he could not long be held on the lower rungs of the ladder whereby live men climb upward.

## L. C. Hitchcock.

We herewith present an excellent portrait of Mr L. C. Hitchcock, whose interesting articles on "Locomotive Running Repairs" have been running through LOCOMOTIVE ENGINEERING for several months.

Mr. Hitchcock is one of those men who are bound to rise to prominence in railroad life—energy, industry and perseverance being the capital pushing them up to the front He was born at Michigan City, Indiana,



May 4th, 1853. In 1869 he entered the service of the Michigan Central Railroad Co., in the capacity of locomotive fireman. In the fall of 1871 he went into the machine shop at Michigan City as machinist apprentice under Master Mechanic A. P Farrar In the spring of 1876 he went to work as machinist in the shops of the C. B. & Q Railroad at Beardstown, Illinois, under Master Mechanic Henry Whiting In March, 1878, he went to work in the Northern Pacific Railroad shops at Brainerd, Minnesota, first under Mr. Farrar and later under Superintendent of Motive Power George W Cushing and Master Mechanic H. J. Small. While there he had charge of the air-brake and water-pump repairs and locomotive valve setting In December, 1887, he was made roundhouse foreman at Minneapolis, Minnesota. In October, 1889, he left the service of the N. P. Railroad and entered that of the Minneapolis, St. Paul & Sault Ste Marie Railway as roundhouse foreman at Minneapolis, at which point he is at present employed as general foreman of their main shops.

Col. R. E. Ricker, general superintendent of the St. Louis & Iron Mountain Railroad, is spoken of as general manager of the Boston & Maine. Col. Ricker is a Maine man, and began his railroad career in New England He has few equals as a railroad man, and he is very familiar with all branches connected with railroad operating. He has been chief engineer, superintendent of transportation, superintendent of motive power and general manager.

President Oakes, of the Northern Pacific, and a party of railroad officers were concerned in an accident at Nork Yakima, Wash., last month, which came near being fatal to several of the party. A wagon in which they were fording a stream was overturned by the current Mr. Oakes succeed in reaching a shallow point, Mr. Mellen was able to swim to the shore, but Mr E. V. Smalley, editor of the *Northwest Magazine*, was rescued only after sinking twice.

Mr. James E. Greensmith has accepted the position of general manager of the Portland Locomotive Works, Portland, Me Mr. Greensmith received a good training in locomotive building under William Mason. He has been with the Pond Machine Works for six or seven years. It is the intention of the Portland Works people to put a good equipment of modern tools in the shops, and Mr. Greensmith proposes to follow the most approved methods in the manufacture of locomotives.

Mr James M. Foss, general superintendent of the Central Vermont, has been appointed assistant to the president of that road. Mr. Foss rose through the mechanical department. He learned the machinist trade in the Concord Railroad shops, where several men graduated who have risen to distinction in the railroad world. The upward grades were through the positions of engineer, foreman, master mechanic and superintendent Mr. Foss stands high among the railroad men of New England.

Railroad repair shops are not, as a rule, kept in a condition to impress visitors with the idea that order and cleanliness are considered important, but there are many shining exceptions. Nearly every section has some shop that the railroad men within range point to with pride. In the South the shops under the charge of Mr. C. F Thomas have been noted for the evidences of good management No matter what kind of a shop he takes charge of, it soon becomes a model of neatness and order. Those who have these surroundings have good evidence that their work is carried on under favorable conditions. A man who habitually keeps a dirty shop and slovenly surroundings has no reason to complain if he is taken for a slouch.

Mr. E B. Wetmore, for some years superintendent and master mechanic of the Rapid Transit Railroad of New York, has been appointed superintendent of the elevated railroads of Chicago Mr. Wetmore is one of the most successful railroad men of our acquaintance, and combines in a most happy manner the faculty of making it pleasant for both stockholders and employés. He made an excellent record on the Rapid Transit road for economy of operating, and no railroad officer was ever more popular with the men under him. Mr. Wetmore is a man of ripe experience in railroad work. He entered railroad employment in the Hartford shops in 1850, and remained there five years Then he went West and ran on the Ohio & Mississippi for eight years, until severely injured in a collision. After recovering, he went running as conductor, and continued in this service for four years. In 1867 he returned to the New Haven & Hartford road and took an engine under Mr. E. M. Reed, who was then master mechanic. In 1879 we find him running an engine on the New York elevated railroads, and a year later was made engine dispatcher. From that he was advanced to be trainmaster. In 1887 he was appointed superintendent and master mechanic of the Suburban Line On leaving this road to go to Chicago he was presented by the employés of the road with some handsome testimonials to indicate their respect.

## R. W. Bushnell.

When we received from Mr. R W Bushnell, general master mechanic of the Burlington, Cedar Rapids & Northern, the highly interesting article about the old locomotive "Pioneer," which appeared in our March number, we tried to get a portrait of Mr. Bushnell to accompany his sketch, but the engravers disappointed us and the portrait is now shown.

Mr Bushnell is one of the best educated of our older master mechanics, but a retir-

ing disposition and want of confidence have kept him more in the background than his abilities warrant. His article indicates a man of considerable literary ability. By personal contact the writer knows that Mr Bushnell is well informed on applied mechanics and on engineering science

Richard W. Bushnell served an apprenticeship to the machinist trade in the Rogers Locomotive Works at Paterson, N. J. He remained there for some time after learning the trade, but afterwards became seized with the "go-West-young-man" fever and went to Chicago. He naturally turned towards railroad work, and found employment in the Galena & Chicago Union shops. Here he rose through the usual grades to be division master mechanic. In 1872 he accepted the position of general master mechanic of the Burlington, Cedar Rapids & Minnesota, a small, struggling road with a few locomotives that were kept running by the personal ability to make something out of nothing The requirements of the master mechanic's position were toiling day and night, with the merest sheds for shelter, and tools that could be produced by labor and ingenuity without cost. The road has grown and prospered, and Mr Bushnell has grown with it. He is the kind of man who makes many friends and few enemies.

Mr J H Ruxton has been appointed division master mechanic of the St Louis and Kansas City divisions of the Chicago & Alton Railroad, with headquarters at Slater, Mo., to succeed Mr E. J. Whitington, resigned. He will have supervision of all engine and car work on these divisions, subject to the orders of the superintendent of machinery and the master car builder of the car department.

Mr. M C Leonard, master car builder of the Chicago, Rock Island & Pacific shops at Chicago, has resigned. Mr Wilson, the head of the department, has been making numerous changes in the shops, among them being the introduction of a piece-work system. Mr. Leonard did not feel that he could support the new plans cordially, so he resigned This was a much more manly course than that frequently pursued of retaining the position and covertly opposing the methods introduced

Mr. W H. Whyte has been appointed master mechanic of the Eastern Railroad of Minnesota.

Mr. S. J. Johnson, who was formerly business manager of the LaFayette Car Works has gone to be assistant superintendent of the Allison Mfg. Co., Philadelphia.

Mr. F. D. Casanave, superintendent of motive power of the Pennsylvania Lines at Fort Wayne, Ind., has been offered the position of general superintendent of motive power of the Reading system.

Mr. James E. Keegan has been appointed master mechanic of the Grand Rapids & Indiana. He will have charge of the locomotive and car departments and relieves the road foreman of engines of the charge of roundhouses.

Mr. T. A. Bissell, general manager of the Wagner Car Works, at Buffalo, has been in bad health for some time. He has gone to Bermuda for a few weeks in hopes that the sea breeze and the change of climate may prove of benefit.

Mr. Walter G. Chase, general manager of the Mason Regulator Co., of Boston, and Mr. Charles H. Barnes, son of the general manager of the Boston & Albany Railroad, went to Europe last month. They expect to be away for three months.

We thoroughly sympathize with Mrs. James M Dickson, Moberly, Mo., who writes us: "My husband was well pleased with LOCOMOTIVE ENGINEERING, and certainly would have renewed his subscription, but I am sorry to say that he lost his life in a wreck."

Mr. M. L. Hinman has been elected president of the Brooks Locomotive Works. Mr. Hinman began work in the establishment of which he is now the head when it was used as repair shops for the Erie. The prosperity of the works has been in a great measure due to the business capacity of Mr. Hinman, and his elevation to the highest position in the Company is a just recognition of what was due.

Mr. Lewis Gleason, who has been running a passenger engine on the Eastern division of the Atchison, Topeka & Santa Fé, has gone to Brazil in the interests of the Brooks Locomotive Works. Mr. Gleason spent several years in South America before. The Brooks people expect to push their locomotives upon the railroads in all South American countries and Mr. Gleason goes as an *avant-courière* with two of the engines.

Mr. J. N. Lauder, Superintendent of Rolling Stock of the Old Colony Railroad, has been visiting Mexico and the southwestern portion of the United States during the greater part of last month. Mr. Lauder was Superintendent of Motive Power of a Mexican railroad for some time, and he went to visit old friends and note the progress of the country. He thinks Mexico to be in a very hopeful condition. "The country is falling into line," as he expresses the situation.

Mr. Walter G. Oakman, lately vice-president of the Jersey Central, was elected president of the Richmond & West Point Terminal Co. last month, which makes him the head of a large Southern railroad system. Mr Oakman is becoming one of the railroad magnates of the country. Not many years ago he was a poor division superintendent of the Delaware, Lackawanna & Western. With no backing of position or family he had the audacity to fall in love with the daughter of the late Senator Conklin. Like young Lochinvar, his suit was denied, but he followed the Scotch hero's example. The energy that won a bride in the face of hopeless opposition seems to be pushing him to the highest pinnacle of professional success

## Ross Kells.

In the March number of LOCOMOTIVE ENGINEERING we announced, on what seemed to be the best authority, that Ross Kells, superintendent of motive power of the New York, Lake Erie & Western, who had been sick for some months, was so far recovered that he would return to duty about the beginning of April. The disease from which Mr. Kells was suffering

was of a very deceptive character. Instead of getting better he was merely passing through the temporary revival of energy which in kidney complaints often precedes rapid collapse. An unexpected bad turn came on about the beginning of last month and he died on the 10th.

Mr. Kells was born at Steubenville, O., in 1840. He learned the machinist trade in the shops there of a road that became part of the Panhandle. On this road he rose to be foreman, general foreman and master mechanic, leaving it only to take the higher position of superintendent of motive power of the Nickel Plate. While on the Panhandle Mr. Kells was associated with Mr. S. M. Felton. When the latter gentleman became general manager of the New York & New England, he induced Mr. Kells to take charge of the mechanical department. The New England road did not prove a permanent position for Mr. Kells any more than it has for many others, and he went into the railroad supply business for a time, but returned to railroad work in 1887 as superintendent of motive power of the western lines of the Erie. He became head of the department two years later. His forte was shop-work and the management of men.

## Exploded Shop Boilers.

The writer visited the scene of the explosion of the boilers at the shops of the S. F. & W., at Savannah, Ga., which occurred on February 29.

The boilers were nearly new, 14 feet long and 54 inches in diameter, they had thirty-four 4-inch tubes each, the shell sheets were $\frac{11}{32}$ of an inch thick, and the tube sheets $\frac{1}{2}$.

The two boilers are connected to a steam drum 24 inches diameter and 10 feet long, having 3½-inch gate-valves in the upright connections.

Sunday the boilers were washed out, and it is now supposed that the engineer packed these valves and left them closed, for after the explosion they were both found closed. The safety-valve and steam-gauge were attached to the steam-drum instead of to the boilers themselves; this was the only fault.

The workmanship of the boilers was good, and the wreckage showed no weak point; in some places the sheets tore, double and single-riveted seams alike gave way, rivets sheared off, stays broke or sheared off their rivets—the rupture was universal.

The damage done to shops was considerable, the pattern storage rooms, which were almost over the boilers, were totally destroyed, and all the patterns came down in the shape of kindling wood.

One piece of the boiler struck the track and sheared off a sixty-pound steel rail, and another struck a pair of wheels on a flat car and broke the axle short off.

The shops looked as if they had been bombarded.

The engineer and two colored men, one of them the fireman, were killed.

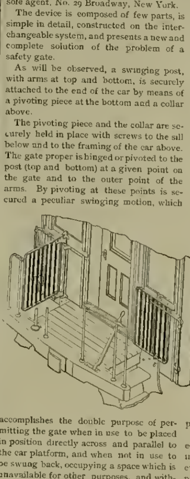
## Wood's Car Platform Gate.

We show the accompanying illustration of the Wood Car Platform Gate, manufactured by the R. Bliss Mfg. Co., Pawtucket, R. I., and introduced by J. B. Goodwin, sole agent, No. 29 Broadway, New York.

The device is composed of few parts, is simple in detail, constructed on the interchangeable system, and presents a new and complete solution of the problem of a safety gate.

As will be observed, a swinging post, with arms at top and bottom, is securely attached to the end of the car by means of a pivoting piece at the bottom and a collar above.

The pivoting piece and the collar are securely held in place with screws to the sill below and to the framing of the car above. The gate proper is hinged or pivoted to the post (top and bottom) at a given point on the gate and to the outer point of the arms. By pivoting at these points is secured a peculiar swinging motion, which



accomplishes the double purpose of permitting the gate when in use to be placed in position directly across and parallel to the car platform, and when not in use to be swung back, occupying a space which is unavailable for other purposes, and without interference with any existing condition of platform, step, brake-staff or coupling-lever.

Attached and pivoted to the gate is a "grab iron brace-bar," which extends to and is pivoted to the outer corner of the car by means of pivoting pieces, which are securely fastened to the framing with screws. The "grab iron brace-bar," when the gate is in use, securely holds the same in position, serves as a hand-rail and is an important factor in holding the gate in place when it is folded back. Particular attention is called to the fastening of the gate when open or closed, which is secured by one double-acting latch attached to top of post, as shown in cut. No fastenings are required on the buffer beam end of gate or platform, thus permitting of an adjustment to all widths of openings.

The gate closes to within 5½ inches of the platform and is parallel with same, and it may be particularly observed that the swinging motion of the gate is inward, towards the car platform, not outward.

To operate the gate, the latch is turned, the gate swung, when it will automatically lock itself in the opposite position and *vice versa*. The standard gate is made strong and simple in design, as shown in cut, and is adjustable to all cars and widths of car platforms.

In this simple but effective device is secured a practical safety gate that fulfills in every respect the requirements for which it is designed. A large number have been placed during the season of 1891 (practically the first year of business), and in every case are giving perfect satisfaction, as may be shown by the numerous requisitions which have followed trial orders.

## Work at Alexandria, Va.

At the Alexandria shops of the R & D. —one of the old Government shops during the war—they are doing some work in a little different way from that done elsewhere. Men who have to depend much on makeshifts of their own become inventors. One of the men in the shop has gotten up and they have built a screw machine with several entirely new features. One, the changing of tools instantly and maintaining the same length of tool, is a neat and novel feature. Screw machine makers should look this device up.

Having no tool to slot out forked rod ends, knuckles, etc., they made a disc some 14-in. in diameter and set tools in its periphery, this was put on the drill press spindle and revolved, the rod being fastened to the table.

Chris. Thomas, who by the way is one of the best shop managers we have seen, is making solid ended rods of I section finished all over and ready for service for $101 per pair.

In the car paint shop a system of steam heating has been adopted, the pipes being laid just inside the rails and directly on the floor, no trouble is had from it, and the heat is where wanted, both sides of the car getting the same amount, which is not true where ordinary radiators are used.

Much trouble has been experienced here from the cracking of driving-wheel centers on some classes of engines, and a new pattern of wheel is being introduced. The same engines were found to be some eighty pounds short in counter-balance weight for main wheel and an increase has been beneficial.

There is at this shop an old Smith & Perkins engine built shortly after the war, and is yet able to do a fair day's work.

The stationary engine was built by the Government, and some of the old tools used thirty years ago are on the pension list.

The R. & D. people recently had an economical fit and cut the number of men in this shop down to a baker's dozen, but even then they seem to keep the power in pretty good shape.

## Conflicting Reports of an Accident.

An accident happened to a locomotive in the yards of the Pennsylvania Railroad near Philadelphia a month ago, which gave the daily paper reporter an opportunity to spread himself tangental to the facts.

Among the headings directing attention to the accident are the following 1st. Four frightfully scalded—The water-jacket of a locomotive blown off with serious results. 2d. An engine explodes—Locomotive explosion about midnight. 3d. Injured in an explosion—The drawbar of a boiler bursts and four men are scalded.

The drawbar of a boiler bursting is worthy of Mrs. Partington The facts were that a switch engine backed into some cars hard enough to break the pin in front end of drawbar between engine and tender, and the blow sent the drawbar through the casting into the boiler, permitting the steam and hot water to escape into the cab.

The Congdon Brake Shoe Co. is erecting an iron building 200 x 110 feet, which will contain a twelve-ton open-hearth steel furnace and a twenty-four pot crucible steel furnace. It is expected that the plant will be in full operation by June 1, making general steel castings and material for the Ross-Meehan shoes.


## Familiar Spirits.

"Speakin' o' ghosts," said the old-timer, crossing his lean shanks at the end of the row in the Ananias Corner, "speakin' o' spirits reminds me of a gaak we put up on old Terrence Costhello, out at the front—which, incidentally, gentlemen, are the place to see life.

"Old Ted was night wiper in the roundhouse—the biggest one on earth, had the bull sky for a roof—and every time the pay car came in the old o' the moon Ted saturated his hide with sheep-dip and was among the missin' for about forty-eight hours.

"Ted owned a small shanty and a large wife, who—the wife, I mean—always hunted for him when he was burdened by a 'jag,' and invariably wept on finding him, declaring that he had her heart scalded.

"Well, me an' Baldy Hooten, Flat-Wheel Davis an' Stutterin' Jim, we went to the old woman and 'lowed we'd help her to scare Ted so's he forgit to drink enny more. Ted war powerful superstitious.

"We got the old woman to dress up in sheets, like a made-a-purpose ghost—only she was sorter a bad build for spookin'—and stand in a dark corner of the path, and then we hunted Ted up, threw a bracer inter him, and started him fer home.

"We sneaked around to hear the interview, knowing that the old woman had learned her part well.

"Ted was a-hummin' 'Wearin' o' the Green,' and stumblin' along the path, when alter onct he slammed up agin the ghost.

"'Oi cum, oh, dammed bibbler of a pizened stew, to take away thy carrion sowl,' says the ghost, with an accent that gave away its nativity.

"Ted started as if stabbed, clapped his hands to his head, never takin' his eyes off the ghost, that pointed its finger at him.

"Finally he found his blarney spiggot and says

"'Who, in the name of the Howly Mother, are ye?'

"'Oi am the divel!'

"'The divel!' says Ted, kinder thinkin' like, 'the owld divel hisself? Well, sir,' (advancing an unstiddy step), 'shake hands wid Ted Costhello, *I'm married til a sister o' yourn!*'"

## A New Air-Brake.

"Speaking of your Ananias column," said the division superintendent, sitting down in the "sleepy hollow" of the holy of holies, "Speaking of the literature of prevarication, I have got a conductor who will some day shine as a gilt-edged liar.

"His studied lies I know nothing of, but for an extemporary-spur-of-the-moment liar I will match him against all-comers.

"He gets into more scrapes than all the other men together—too good a liar to be good at anything else—but call him up on the carpet and he would make you believe that he left a switch open to prevent an accident, and he'd prove it. And gall—why, my dear sir, it was sublime.

"I determined to dispense with his services the first time he crossed the dead line, and waited for him.

"One day I saw his train making forty miles an hour down a long grade, with half the car doors in the train open, some of them swinging—strictly against rules and a recent bulletin order. I ordered him up.

"'Mr. Prevaricator,' said I, looking as severe as possible, 'I guess we will have to get along without your services hereafter; you seem to read rules and bulletins so that you can understand how to disobey them.'

"'What rules do you refer to?' said he.

"'I saw you come down Cumming's Hill, heleytarrup, with half your doors open—I won't stand that.'

"The liar turned around, carefully deposited his chew in a spittoon, and answered

"'Opened 'em a purpose.'

"'What for, I'd like to know!'

"'Jest to prevent an accident, and save money and reputation for this company. I knowed we had but half the cars braked; that the rail was frosty and the men green, but there was a heavy quarterin' wind a blowin', and so I told the boys to open some of them box-car doors and let the wind get a holt to help us, and we got down nicely. Don't you want a man to use his own judgment to save trouble?'

"I just turned around to my porter and said, 'Jim, take that spittoon out of this office; give one of the north-end conductors a chance to spit and he'll lie out of an accusation of having been born.'"

"What did you do with him?" we asked.

"Gave him a cigar and a passenger run, but I expect to lose him, now, pretty soon, one of these railroad newspapers has got onto him, and are bound and determined to make him an advertising agent, he's an artist in his line."

## A Bad Piece of Engineering.

"Oh! dear me, is this tunnel safe, George, is there anything wrong with it?" she exclaimed as the train dodged under the Bergen Hill. "Yes, darling," he whispered, "It's too short by half and altogether too light."

## A Mixed Recommendation.

"When I was on the Kansas Pacific," said President Mackenzie during a recent session of the Flat Wheel Club, "I had an engineer named Con Consadine (Double Con, the boys used to call him), who was one of the best men I ever saw with an engine, but he got into bad habits. When he was all right there was no more reliable man than Con, for there was nothing about railroading that he was not away up in, and men of that stamp were valuable in a country where good engineers were scarce. Feed water that was all froth as soon as it entered the boiler, was supplied at the most of the water stations, and engines were rushed so much that many of them were in bad shape. An engineer that can be depended to take his train through with drawbacks of that kind will be excused for a great many shortcomings. Con was excused a great many times, and lightly punished for numerous other lapses, but all would not do. He went from bad to worse so that he was full nearly all the time, and I was compelled to let him go.

"Con was a hail-fellow-well-met man and highly popular with everybody, which did much to lead him into drinking habits. The droll stories he told and the funny 'bulls' he was constantly making kept the division in fun. But with all that to shield him he was finally discharged

"A few days after he got his time Con came to me sober for once and asked for a letter of recommendation. I wrote out a good letter telling that he was a first-class engineer Con looked it over and said 'Faith, sur, would not ye's put in that I was a sober and industrious man of poor but honest parents?'

"'Well, Con,' I replied, 'I do not mind putting in the poor but honest parents, but I can't say anything about your being a sober man.'

"'Well, sur,' he said, 'you might put down that I was sober frequently.'"

## A Developed Hero.

"Man in the undeveloped condition," remarked the secretary of the club, clearing his throat for a yarn, "is very much like the diamond when first seen among other gravel in the mine.

"This truth was very forcibly brought home to me by the heroic act of a Scotch engine-driver that happened a good many years ago. The papers were full of the thing for weeks afterwards.

"This driver, whose name is David Wilkie, was walking through a yard on his way to the engine-house, when an alarm was raised that a switching engine had started up the down main line with no one upon her. Great excitement ensued, for a passenger train was nearly due. A rush was made towards the station-house for orders from the station agent, men being trained by rigid rules and habit to do nothing without orders. When the others were paralyzed for want of orders, Wilkie acted. He jumped on to a switch engine that was near, and, under the protests of the man in charge, took possession and started after the runaway engine.

"Those familiar with the story will remember that the engine was overtaken; that Wilkie climbed on to the runaway and reversed the engine. That the heroic act was scarcely in time, for the coming passenger train struck the engine when she was getting into speed, and that Wilkie was badly injured.

"It may not be so well known that this man was mildly censured by the officers of the company for acting without orders, but that he was excused on account of previous good character By special favor the act was not allowed to prejudice his prospects in the service, and he was permitted to resume his old engine and run when he recovered from the illness resulting from his injuries.

"I cannot think of Wilkie's truly heroic action without seeing him doing other things that partook more of the ridiculous than the heroic.

"One April morning, in what was the springtime of my own life, I was sitting in the office of the foreman of the locomotive department at Arbroath when an overgrown lad of about seventeen years came in and reported that he had come ready to begin work He was an ungainly looking youth of great size, composed mostly of legs and arms. His rosy face and general demeanor betokened rustic raising. He was dressed in a suit of the white duck overalls much affected by the British workman, and appeared to be proud of the snowy whiteness of his apparel. This was the introduction of David Wilkie to railway life, and to me.

"The foreman directed the youth to go to the engine-house and ask for a man he named, who would set him to work wiping.

"He went to the engine-house, as directed, and the first one he met was Jack Moncrieff, a lad whose purpose in life seemed to be mischief and deviltry.

"'Are you Mr. Speedyman?' asked the greenhorn.

"'No,' said Moncrieff, taking in the situation, 'I'm Mr Speedyman's assistant, is there anything I can do for you?'

"'A dinna ken', replied the rustic, 'may be there is, am come tae be a cleaner.'

"'Oh, yes,' said Moncrieff. 'I understand. You will be under my orders Come along,' and he led the youth outside the engine-house, cudgeling his brains in the meantime what trick he could play on the new-comer. An engine was standing on the pit outside, and a bright idea struck Jack.

"'Do you know what the first duty of a cleaner is?' he asked his victim.

"'No, a hinna ony idee,' said Wilkie.

"'Well, the first thing you have to do, is to sweep the lums (chimneys) of the engines.' This seemed reasonable enough, as all house chimneys have to be swept of soot regularly in Scotland.

"'Now, come, and I'll help you to make a start,' said Jack.

"With that he got a broom out of the engine-house, and led the new wiper to the front of the engine standing on the pit

"I happened upon the scene a few minutes afterwards, and found Wilkie pushing a broom up the chimney of the engine, his long legs were sprawling all over the buffer beam, his head and arms were inside the smoke-box and the soot was showering all over the white overalls. Jack was shouting directions with merely a quiet smile on his face. I fell down and roared.

"Wilkie looked round and seeing me laughing, concluded something was wrong. His red cheeks had received several patches of black, and his big nose looked like the handle of an ebony cane. His appearance was so ludicrous that Jack could not maintain his rôle of serious overseer, and he began to laugh.

"Wilkie slowly emerged from the smoke-box and his slow powers were roused to anger. His first act was to seize Jack by the axis of his trousers and push him into the smoke-box. Looking round, he saw a bucket of the yellow grease used for anointing the bearings of British cars. With his hand, which held as much as an ordinary shovel, he scooped up a 'gob' of this grease and plastered it over Moncrieff's head and face.

"Jack, who was a natural boaster, never blowed about making Wilkie sweep an engine's chimney.

"It came to pass that two years afterwards, when I was beginning to have some experience in engine-driving, this Davie Wilkie was firing for me. He was growing into a big man, and his leading characteristic was an inside void that could not be filled. A lunch basket is a poor substitute for a big basin of porridge

"On returning light one evening after running an excursion train, we stopped at a junction refreshment bar for lunch. They had small buns cut in two to make sandwiches. I ate two or three of them and felt satisfied. Davie said

"'These things do not make a good bite. I could eat twenty of them.'

"David, my boy,' I remarked, 'you have a fine appetite, but you should not slander an institution of the road by saying that you could eat five of the lunches set up for a hungry public.'

"'Oh, get out,' said Davie, 'I only wish somebody would pay for twenty of them to give me a fair meal.'

"'David,' I said, 'it is not in my nature to encourage excess, but if you eat twenty of those sandwiches in ten minutes, I shall pay for them. If you fail, you may pay for your own feast.'

"He readily agreed to the terms. There was a crowd of trainmen and others in the place, and great interest was manifested in the gastronomic feat Judges were duly appointed, watches were pulled out and David began to eat. He ate leisurely, but he finished the last sandwich nine minutes after starting.

"Then he said, 'Will you bet that I cannot eat twenty more?' I answered sadly, 'No, not if you make it a hundred.'"

# NILES TOOL WORKS,

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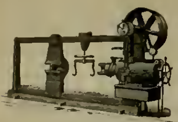
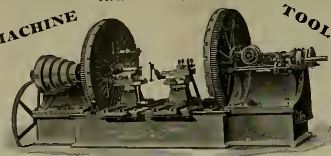
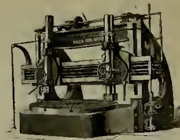
MACHINE TOOLS.



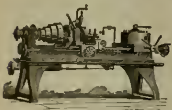
HYDROSTATIC WHEEL PRESS.



DOUBLE DRIVING WHEEL LATHE



BORING AND TURNING MILL.



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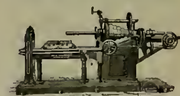

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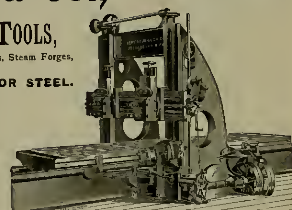

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ATLANTIC WORKS, { 23d and Arch Streets, Phila., Pa. 136 & 138 Liberty Street, N. Y.

## WOOD WORKING TOOLS,

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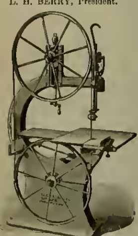

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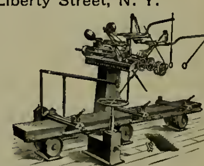

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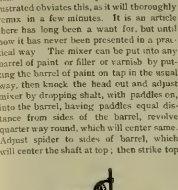
**THE SELF-ADJUSTING INJECTOR OF 1876 —AND— THE SELF-ACTING INJECTOR OF 1887.**

## Wheeler's Adjustable Barrel Paint-Mixer.

There has always been an objection with master painters to buying paint in bulk, for the reason that it takes so much time to "reincorporate" the paint, also a great deal of exertion. The paint-mixer here illustrated obviates this, as it will thoroughly remix in a few minutes. It is an article there has long been a want for, but until now it has never been presented in a practical way. The mixer can be put into any barrel of paint or filler or varnish by putting the barrel of paint on tap in the usual way, then knock the head out and adjust mixer by dropping shaft, with paddles on, into the barrel, having paddles equal distance from sides of the barrel, revolve quarter way round, which will center same. Adjust spider to sides of barrel, which will center the shaft at top; then strike top



of shaft several times, so as to drive points on the step into bottom of barrel. Turn up set-screws to fasten spider to sides of barrel, and adjust collar on shaft to close under upper bearing.

This mixer makes it practicable for painters to carry paint in bulk, saving cost in cans. It can be adjusted in a few minutes to any ordinary sized barrel, and will thoroughly combine or agitate the paint in much less time than by the old way of mixing with a paddle by hand, saving time, which is money. It is reversible; it is simple; it is durable, it requires no experience. A boy can use it with perfect ease. Besides the paddles, there is a two-edged scraper attached, which will break up all settlings that form in the bottom of the barrel. It is the only practical adjustable barrel paint-mixer in the market.

This mixer is controlled by the Senour Manufacturing Company, Chicago, who are manufacturers of a high grade of freight-car paint, ready for use or in paste form, to be thinned with linseed oil, and who furnish the mixer to their patrons.

---

The March greeting of the Jos. Dixon Crucible Co. was highly appropriate, and even prophetic. A storm of pencils is flying round propelled by the breath of Old Boreas. The sting from the sharpest of them would hardly equal the stings sent out by the piercing winds of last March.

---

A joint grievance committee of the Brotherhood of Railroad Conductors and of the Brotherhood of Railroad Trainmen has been in conference with the Santa Fé officials on the adjustment of wages for trainmen. All the grievances were amicably settled. A schedule of wages was agreed upon that will give passenger conductors and brakemen between Coolidge and Denver $5 more per month. Freight conductors will receive an average raise of a quarter cent per mile west of Coolidge. Brakemen east of the Missouri River will receive a raise of $5 per month. Two brakemen will also be put on passenger trains east of the Missouri River. The rules were revised in a manner that the employés considered beneficial to them.


(31). W. E. B., Galesburg, Ill., asks

Who invented the water-glass. *A.*—Thos. Watt.

(32) P. E. N., Sycamore, Ind., asks

Who ran the first locomotive in America? *A.*—Horatio Allen, on August 9, 1829.

(33) C. K., Pittsburgh, Pa., asks

What is the highest pressure you know of carried in a locomotive boiler? *A.*—200 pounds per square inch.

(34) Reader, Pine Bluff, Ark., asks

Where are the heaviest locomotives in the United States? *A.*—St. Clair tunnel, between Canada and Michigan.

(35) B. C. R., Buffalo, writes

What do you consider the safe limit for locomotive tires before being turned? *A.*—One well-known railroad has made the limit $\frac{3}{8}$ inch. We think from that to $\frac{1}{4}$ inch as much as can safely be used.

(36) C. L. S., Detroit, Mich., writes

Is the traction force of an engine increased when the pop is blowing off? I have heard it said that the friction of the escaping steam upon the atmosphere causes a downward pressure. *A.*—There is a downward pressure, but not enough to be perceptible.

(37) G. A. G., Chicago, asks

Do the drivers of a locomotive slip in rounding a curve, and if they do, is it those on the outside or inside that do the slipping? *A.*—As the wheels on the outside have to travel further than those on the inside, the latter do the slipping. Model wheels and track ought to be experimented with to settle questions of this character.

(38) W. H. P., Vicksburg, Miss., says:

Please give me through LOCOMOTIVE ENGINEERING formula for calculating the hauling capacity of locomotives running at a speed of twenty or thirty miles per hour on level track or on any grade. *A.*—A detailed answer would take too much space. Full particulars can be learned from Forney's "Catechism" or Sinclair's "Locomotive Engine-Running."

(39) H. H. K., Ennis, Texas, says

If 120 lbs. pressure has been pumped in main reservoir and brake-valve is put in full release, is there any place for air to escape to the atmosphere? *A.*—There is no means for the air to escape. Pumping to high pressure is bad practice. It is apt to damage the diaphragm of the pump-governor, and it puts such high pressure into the reservoirs of the direct brake and tender that there is difficulty in releasing them after coupling on to the train.

(40) Subscriber, ——— ———, asks

What do you think of an M. M. that will order a man out to his office about two miles from his home, after coming in one night, to find out why he did not estimate the cost of a coupling-pin between tank and engine in his report of a broken one? *A.*—We think this M. M. a good deal like the new policeman who arrested his old chum. "Pat," said he, "it's not that I hate ye that I have to bate ye into submission—it's because av the aut'ority I have over ye!"

(41) S. S., Mantua, Pa., writes:

I would like to have you give the reason why that brakes applied to the front part of a train will stop it quicker than if the same amount of brakes were applied to the rear part of the train? I would also like to know how much sooner a train of fifty cars, with ten of them loaded, with air-brakes on the loaded cars only, would stop than if the ten loaded cars (with air-brakes) were placed on rear part of train? *A.*—It would not make any difference. This applies to both questions.

(42) F. S. H., Denver, Col., writes

1. Did you not make a mistake in answering 27. Is not the link block pin always in the center of link slot? *A.*—Yes, we should have said *saddle* or *suspension* pin. 2. You say that exhaust clearance is the amount the cavity of valve is wider than the exhaust port and both bridges, this is wrong. *A.*—We fail to see how wrong; if the cavity were less than the width of both bridges and the exhaust cavity it would have inside lap, if it were exactly the width stated it would be line-and-line. Point out the mistake.

(43) Fireman, Waukesha, Wis., writes

We had an argument about plugging flues, and some one said it would take more pressure to force out a plug if it was pointed at the end than it does to blow out a blunt plug. Can you tell us why the plugs are not pointed to make them hold better? *A.*—It would not make any difference. A pointed plug would offer as much hold for steam as one with a flat end. The idea that a pointed plug would offer reduced area for pressure is a fallacy long exploded, but it seems to deceive the inquiring minds of every new generation.

(44) L. H., Johnstown, New York, writes.

Will you tell me how to figure thread-cutting on a lathe. The screw is 4 threads to the inch, and the gear on it has 144 teeth used for all threads. Gear on spindle has 96 teeth and is stationary, while the stud carries two gears which can be changed. *A.*—Divide the number of threads to be cut by the pitch of the feed-screw, and multiply the quotient by the number of teeth on one of the gears and the product by the number of teeth on the other gear; then any divisor that will leave no remainder to this last product is the number of teeth in one of the gears required and the quotient is the other. Remembering which is required to run the fastest, the spindle or the lead-screw will easily determine how the two gears found are to be placed on the intermediate stud.

H. H. F., Huron, S. D., wants to know the average crank leverage of an engine with 24-inch stroke. *A.*—The average leverage is as .6366 is to 1. The length of the crank being 12 inches, the average leverage is 12x.6366=7.64 inches.

A. G. C., Trotwood, O., is not satisfied with an answer given in these pages directing how to find the horse-power of an engine. He cites directions from a hand-book which he thinks different from ours, and asks which is correct? *A.*—They are both correct, except that we use the indicated pressure, and the other uses two-thirds of the boiler pressure.

## Training of Mechanics.

A contemporary greatly given to guessing says that the future mechanic will be a very different person from the present and past mechanic. The engine of human regeneration, according to our contemporary, will be the training-school, which is going to develop skill and sense much more rapidly than the shop. The boy in the shop goes and works on a machine and sees the work done without asking the reason why. The boy in the training-school will be taught all the whys and wherefores, therefore the conclusion is come to that he must be the more valuable workman.

We think there has been a lot of senseless gush written on this subject. If training-schools could alter the nature of boys and convert them all into the material from which first-class mechanics are made, there would be a great improvement in the future mechanic. As it is, a boy intended by nature for a dry goods clerk passes through the training-school for mechanics and comes out a hopeless incompetent. The training-school does him no more good than the shop does for similar graduates.

The boy cut out for a mechanic comes out of the shop as well equipped to perform the duties of a workman as he would be if subjected to years of training-schools. The special advantages enjoyed in a training-school are those needed by the men who become foremen and leaders in the business. Only a small number of the workmen can reach this elevation. The man with the natural parts for a foreman generally manages to acquire the knowledge necessary, even when his experience is confined to the shop. When we find a better place than the shop for the training of good mechanics, we will write it up for the benefit of our readers.

---

The New York Central Railroad people have decided to rebuild the "De Witt Clinton" for exhibition at the World's Fair. This was the first locomotive run on a railroad in New York State, the road having been the first link of what is now the New York Central Railroad. There is very little of the original engine preserved, but Mr. Buchanan has the drawings from which the engine was built. It will now be in order for the Baltimore & Ohio people to build for exhibition a reproduction of Peter Cooper's locomotive "Tom Thumb." This was really the first locomotive used on an American railway, and ought to excite as much interest among us as the "Rocket" does among Englishmen. The "Tom Thumb" performed as important a service for American railroads as the "Rocket" did for those of Europe.

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The Boston & Maine people are fitting driver-brakes upon all their locomotives as fast as they can be put on. Numerous other practices lately introduced indicate that there are men at the helm who wish to steer in progressional waters.

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Notice has been given that the Grand Union Hotel, at Saratoga, will be opened for the accommodation of the Master Car Builders' and the Master Mechanic' conventions. The headquarters for both associations during the conventions will be at Congress Hall Hotel.

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The most enthusiastic advocate of the compound we have as yet met is Mr. C. H. Hudson, general manager of the E. T. V. & Ga. After a full year's experience his statements, based upon a most carefully kept record, must naturally entitle him to the position of one speaking upon authority. Figuring at cost of coal on a basis of 90 cents per ton, calculating relative cost of repairs, etc., 100 compounds would effect a saving of $110,000 per year. A discussion on the relative merits of the two types with Mr. Hudson will prove to be most edifying to those who may have this privilege.

# LOCOMOTIVE ENGINEERING.

A Practical Journal of Railway Motive Power and Rolling Stock.

VOL. V, No. 5. NEW YORK, MAY, 1892. PRICE, { 20 Cts. Monthly. $2 00 per Year.



## FREMONT'S PASS.

**The Highest Railway Point in North America, 11,540 Feet Above the Sea.**

The upper picture on this page shows one of the Denver & Rio Grande's narrow gauge consolidations with her train on the summit of Fremont's Pass, on the Continental divide.

The lower picture was taken looking east from the summit down the 211-foot grade; the track makes a big loop in the basin shown in the upper left corner of the picture, and a high trestle-work can be seen in the valley there; from this the track comes back directly under the one in the foreground and below the line of trees.

This pass is noted for snows in winter and beautiful flowers in summer, and the branch on which it is located is a popular picnic route.

The great Arkansas river heads in this gulch below the pass, and starts on its 2,000-mile journey to join the Father of Waters, having in all a fall of over two miles, over half of this being lost in 162 miles, to Pueblo, at the edge of the plains.

The bald-headed old storm-king in the lower picture always has a crown of snow, and the trains on this pass are often above the clouds.

From the western slope of this pass on a clear July day, the Mount of the Holy Cross shows its white symbol of Christianity, fifty miles away, and this is the only spot where the cross can be seen from the railroad.

The D. S. P. & P. branch of the U. P. road have now a line over this pass, and the grade has been made a little higher at the summit to get to the highest point.

The Rio Grande built over this pass in 1880, in order to reach the mines at Robinson and Kokomo, and the tie timber along the upper waters of the Blue river.

HIGHEST RAILWAY POINT IN NORTH AMERICA, 11,540 FEET ABOVE THE SEA.

LOOKING EAST OFF FREMONT'S PASS. GRADE 211 FEET PER MILE.

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There is at McAdam Junction a water-tank eighty feet high which is supported on a trestle of rails designed by Mr. George A. Haggerty, master mechanic at that place. The posts, beams and braces are all made of old rails. The structure is very stiff, and shows little vibration during the severest gales.

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At a railroad division shop in New Brunswick we recently examined a pile of broken Nashua tires that had failed on driving wheels. Nearly all the fractures were circumferential, the species of failure so common with this make of tire. The making of steel suitable for tires is now so well understood that there is no excuse for offering to railroad companies tires that will fail in service. The company that buys tires of this kind assumes a very serious responsibility.

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The Plant System's new refrigerator cars, 500 of which have just been turned out by the Madison Car Works, will have part of the series equipped with the Smillie Coupler, the rest with the Janney.

---

Cy Warman, of the *Western Railway*, Denver, has sold out that paper and started a daily at Creede, the new, red-hot mining camp of Colorado. We sincerely hope that Cy "gets there," but a little experience of eight months as owner, editor, manager and slave satisfied the writer that working in a treadmill or sawing wood was a snap as compared to work on a daily.

---

At the Phœnix Foundry, St. John, N. B., they have lately finished the construction of a fine 17x24 eight-wheel engine of the same pattern as the standard engines belonging to the Intercolonial Railway. The place is an ordinary jobbing machine shop with an able superintendent, who has made small facilities go a long way in producing good machine work.

---

A very simple and ingenious form of journal-box lifter has been invented by Emery E. Taylor, Minneapolis, Minn. It consists of a bracket which is hooked on the top of the wheel and a chain that can be passed under the box. By turning a nut on a screw which fastens the chain to the bracket the journal-box is raised up, the wheel acting as the support. We are inclined to think that this will be a decided improvement on the small screw-jack usually employed for lifting axle-boxes when a brass has to be put in.

## On the Oldest Road.

[Editorial Correspondence.]

As is probably well known to the readers of this paper, the South Carolina road was the first one of any consequence built in America, and employed the locomotive "Best Friend," the first railroad locomotive made on the Western hemisphere. This engine was built at the West Point Foundry, in this city, to the designs of Allen Hallard, and Horatio Allen, the civil engineer of the road, and the man who ran the "Stourbridge Lion" on her trial trip.

EARLY ENTERPRISE.

The business men of Charleston must have been foresighted fellows in those days, for they planned to build up their city by making it the center of a great transportation system. This was before the days of practical railroads, river steamboats and canal barges were the best. The people of Charleston took hold of the railroad idea with a hurrah, and took out a charter for the South Carolina & Hamburg R. R. in 1827. A little later the plan was proposed to push through lines of road to the Mississippi and Ohio rivers and make Charleston a great seaport. In 1835 a charter was secured for the Louisville, Cincinnati & Charleston R. R. These were consolidated in 1843.

THE FIRST 100 MILES.

The South Carolina road was completed to Augusta, Ga., 137 miles, in 1833, and was for some years the longest road in the world—the main line is the same length yet.

The gauge was five feet, but this was changed after the war, and the road rebuilt—having suffered fearfully from the destructive ravages of the soldiers. The rebuilding and changing of gauge put the road fearfully in debt, from the effects of which it is suffering yet.

IN EARLY DAYS

the road was operated by South Carolina men, who, of course, had no experience or precedent to go by. That the mechanics who had charge of the engines and cars were able men there are many evidences extant. Some of the old drawings are preserved, not only of locomotives and cars, but machine tools as well, and better drawings are not made to-day.

There were some inventors here who were men for emergencies, but none of their inventions that I know of ever came into general use, unless the credit of the eight-wheeled car can be placed here—which is doubtful.

Long years ago, in the '40's, they used barrel cars, the bodies being made up of staves hooped, the car being cigar-shaped; this car was illustrated in *The Locomotive Engineer* for April, 1891.

The roadmaster recently dug up an old flanged car wheel with a 12-inch tread and in the shop yard there are still a few of the old iron U rails.

THE ROAD

runs through a swampy country, and in an old report to the stockholders, made in 1831, Chief Engineer Allen and his associates devote considerable space to explaining why the road cost more than at first estimated—not unlike present practice.

THE MOTIVE POWER

was horses at first and then sail-cars, and there are still alive people who rode in these old sailers; and one man lives in Charleston who was a conductor on one.

THE "BEST FRIEND"

was used here. Her colored fireman held down the safety-valve one day and the boiler exploded, and after that they hauled a flat-car next to the engines loaded with bales of cotton as a sort of a breastworks to protect the people in the coaches.

THE SHOPS

as they now stand were built in 1854, and are very large for the size of the road—about the only case I know of where they have too much room. The buildings are of red brick, put up very substantially, but are somewhat scattered.

THE EARTHQUAKE

of 1886 did considerable damage to these buildings, as it did to most of those in the entire city; some of the cracks were cemented up and some left alone, these latter have closed up very much since the "settlement." While on the subject of the 'quake let me call your attention to the photographs of the two wrecks caused by the shake. In many places the track was thrown off the grade, but in only these two did trains find the breaks too late. In each case the fireman lost his life

WAR MEMORIES

cling around these old shops; the Confederates used them as gun-shops during the war, and most of the tools there are of the Whitworth make and came from England on blockade runners "endurin 'de wah." One man is still running a large lathe on which he bored out guns in the '60's.

The Nasmyth steam-hammer, now pursuing its arts of peace in the blacksmith-shop, was dropped overboard in the harbor to prevent capture and was afterward fished out.

SLAVE RAILROADERS.

The S. C. road owned its own trainmen in early days and had a great deal of money invested in humanity. They had special quarters for these men and provisions for feeding them.

In the old-time records still preserved in the shops it is not unusual to see reference to an accident giving the names of those hurt, but behind some say "company man." In the time-books the words "company man" often appear where the rate of wages and time put in should appear. They still employ colored firemen, some of them putting in long years tossing fat pine.

THE ENGINES

are mostly 8-wheelers, and the average of them are comparatively light, 16 and 17-inch cylinders, and very few of them are so awfully old, though I guess there are six or eight that ought to vote.

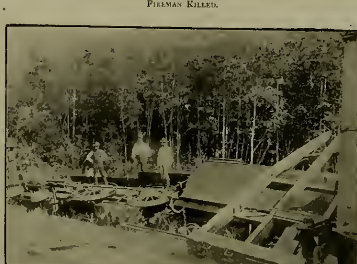
THE CARS

are mostly modern ones, but there are some old-timers, most of them made here, a great many of them with cross-framing, and some odd old draft gears. There is an old

WAR CAR

here, built entirely of iron, and once used by General Thomas as headquarters of the Army of the Tennessee. This car is very strong, has cross-framing and no truss rods, but it has been lifted on jacks at the center without springing, and it has been in the ditch repeatedly, but never hurt. The outside panels are pressed out and riveted up to cleat pieces over an iron frame with wood filling; the inside of the car was finished in the same way. The car was so insufferably hot that some years ago it was sealed inside with wood. It is now painted like a box car, and is used to take the colored laborers out to the phosphate works around the city.

EARTHQUAKE WRECK, TEN MILES NORTH OF CHARLESTON, AUGUST 31, 1886. FIREMAN KILLED.



EARTHQUAKE WORK AT PATH, S. C., 130 MILES NORTH OF CHARLESTON, AUGUST 31, 1886.—FIREMAN KILLED.

SOME OLD RULES.

I got hold of an old book of rules issued by General Superintendent H. T. Peake, in 1860, that contained a few odd rules. Here are extracts from some of them:

"Any person engaging himself, and the owners of slaves employed shall, if required, sign articles of agreement releasing the company of all liability for damages in case of injury to the person or loss of life occasioned by accident while in their service."

"Smoking not allowed and positively prohibited on freight trains carrying combustible material * * * Any person in the service using profane or obscene language in the presence of a passenger will be dismissed."

"* * * Each conductor must keep a watch."

"At end of trip conductor and train hands will clean the cars."

"In meeting trains of the same class the one to the right takes siding."

"Engineers leaving engine under steam will throw the engine out of gear, screw down the tender brake and leave the fireman in charge."

Part of rule 7 for engineers: "When there is a possibility of a collision with another train the speed must be reduced to four miles per hour * * *"

"It will be a particular part of an engineer's duty to see that all switches and turnouts are right before crossing them; to insure which, it will be necessary to approach all switches, water stations and depots at such speed as will enable him, on discovering a switch out of place or any obstruction on the track, to bring his engine to a stop in day-time; and at night he must not cross a switch or turnout until he assures himself it is right by stopping and getting off his engine to examine it, if so dark as to render that necessary."

"* * * When there are more trains at a turnout than can get into it they will stand on the main line, and the conductor of the forward one will shift the gate to let the meeting train into turnout, he will then shift the gate back to main line, and the conductor in the turnout will shift the gate to let his own train out and then replace it to main line."

"* * * When two trains running in the same schedule, and can not see more than a quarter of a mile, on account of fog or other reasons, the second train will go into a turnout and wait for the next schedule. In the case of a train in this schedule the delayed train will go on, and if still foggy the last train will wait in a like manner."

"15. Freight trains will not leave Aiken without a brake-car, when they have over ten cars."

"* * * Foremen of shops must never suffer a locomotive to go out without a fender or cow catcher to remove cattle and other obstructions."

"Engineers and conductors are forbidden to strike their firemen or brakemen, either free or slave."

NOW

the men in charge are trying to operate the road on modern principles, and not on its "before the war" history. The superintendent of machinery, Mr. E. M. Roberts, formerly occupied the same position on the Ashland Coal & Iron Co.'s road, and lately the position of master mechanic of the E. T. V. & G. at Atlanta. Mr. Roberts wears a very handsome watch that was presented to him when he left the East Tennessee which bears the inscription: "From the Boys."

G. H. Grambling is the master car builder, and has been with the road a long time. J. T. Blackwood is general foreman, and came there from the L. & N., while the machine shop is looked after by E. Pugh, a Pittsburgh mechanic.

THE ROUNDHOUSE

is, like most of those in the South, an outside circular wall and a roof; no doors or inside wall in the house. They have a little crane mounted on an old engine truck, this is used to lift stacks, cabs, air-pumps etc., and to handle tire. I must tell you about their

TIRE HEATER,

which is simple and effective; the plan is used on several roads, but is new in most places. The burner is formed as shown in the sketch, Fig. 1; the lower pipe is perforated on its upper half with small holes, and the connection is made to the center of the upper pipe; this connection is carried away some twenty feet to an upright pipe some twelve feet high, and is there connected to a ten-gallon can. A globe valve in the vertical pipe, which is ½-inch, serves to control the flow of oil, a cheap quality of crude oil being used; the flame from the small jets heats the upper pipe, and the oil passing through it flashes into gas, making an intense blue flame.

This burner is placed under a tire and a sheet metal shield placed around the top half of same; this serves to guide the flame around the wheel

After the pipe is h[illegible]
to barely break the [illegible]
very small quantity [illegible]
to generate all the ga[illegible]

In handling tire t[illegible] ...ket to
the wheel, as shown i[illegible] that the
top is level with the to[illegible] el center
This serves to pul[illegible] it upon
and a place to hang a [illegible] heating
and just ready to pu[illegible]. Ten
minutes is long enou[illegible] y tire,
the whole apparatus w[illegible] dollars.

A NEW [illegible]

is being put in at its r[illegible] his is of
home make, but was [illegible] when I
was there.

A VARNI[illegible]

is made in a practica[illegible] ting in
small letters the nan[illegible] ker and
date of varnishing o[illegible] all tenders and on passeng[illegible] allows
the officers to judge [illegible] of var-

nish from actual work, and to tell the make of material and age at a glance whenever the stock is noticed on the road.

WOOD BURNERS

are still employed here as on many roads

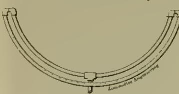


Fig. 1.

in the South, but they are fast working in coal burners.

A FEW BRAKELESS CARS

are still to be found on the road, and it is only two years since they stopped hauling empty brake cars up the incline at Aiken in order to hold others down with them.

Several things of especial interest are illustrated elsewhere. J. A. H.

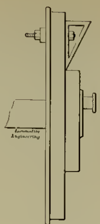


Fig. 2.

dred dollars in Confederate money, and the highest wages were for mechanics who had trades, as many of the South Carolina slaves had.

This roll is for outside slaves hired from owners, and is probably about the last one made out.

The Emancipation Proclamation shortly after announced that the cancer of chattel slavery had been cut out of the fair body of the Union by the sword, and the wound washed in the blood of her sons.

## One Cause of Leaky Flues.

An intelligent boiler-maker who had been for years engaged on contract work of flue-setting in a locomotive building shop, in a conversation with us lately about methods of doing work, revealed the secret of a practice which might account for a good many leaky flues. The price paid for setting flues is surprisingly low, and we expressed surprise that living wages could be made by the workmen. "Well," he said, "there are ways that we can help ourselves out."

"What kind of ways?" was the inquiry "Do you mean that you can slight the work and deceive the inspector?"

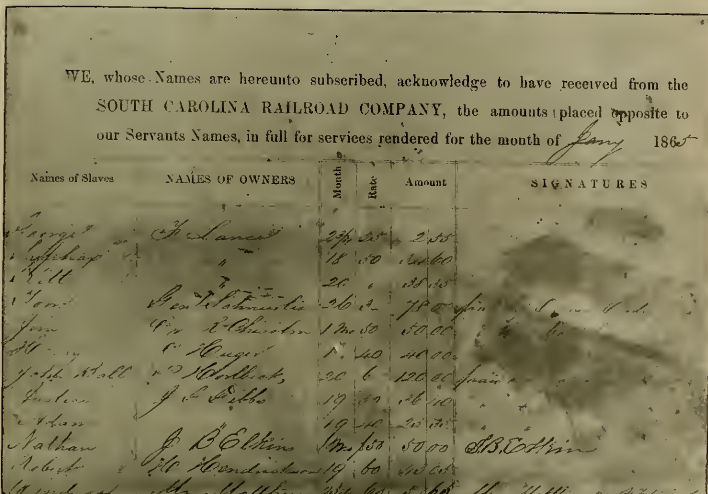
"No, not exactly that," said the boiler-maker. "I'll tell you how it is done. When the holes for the flues are drilled the exact size the flue is hard to center, and there is loss of time placing it. A few seconds lost on each flue counts at the end of a day. The plan we followed was to go to the man drilling the flue-holes and quietly get him to make the hole $\frac{1}{16}$-inch larger than the size called for. It does not make any difference to him and it helps the boiler-maker wonderfully."

We took occasion afterward to measure a variety of holes in flue-sheets, and always found that they were drilled too large. Some of them measured as if they had been intended to hold a copper ferrule, when they had nothing but the bare flue to fill the hole.

Some conductors belonging to the Pittsburgh & Western have seriously proposed that a part of the baggage car be partitioned off as a pen for the accommodation of drunken and unruly persons. We think it is a very good idea, but it would be difficult to consign all the persons to such a place who infest railroad trains and yet are unfit to mix with respectable people. When a railroad has regular passengers who require accommodation of the kind suggested, we would ask, What is the matter with a stock car? The human hogs would be nicely provided for in a strong stock car, with plenty of straw to soak up tobacco refuse.

The S. P. road, Atlantic system, recently put into service some fine Schenectady passenger engines having the Pennsylvania standard sand-box—in the front wheel cover. After six months' trial they have been voted a nuisance all around, and ten new engines of the same class now building will have the old-fashioned sand-box on top of the boiler. The P. R. R. box is made of sheet metal, and is down where it gets no heat from the boiler, and, the boys say, is constipated.

General Superintendent Voorhees, of the New York Central & Hudson River, announced on the 4th of April that the plans had been completed for the establishment of block signals along the entire line of the road from this city to Buffalo. The work, he thinks, should be completed to Albany by the 1st of August, and to Buffalo by the 1st of November. This is, on the whole, a very prompt application of the lesson taught the company by the disaster of Christmas Eve and by others of less magnitude. The plan, when completed, will put the management of the road, in point of safety, where it already is in other regards—abreast of the times. It has only lacked block signals to give those magnificent 870's a chance to show what is in them.



WE, whose Names are hereunto subscribed, acknowledge to have received from the SOUTH CAROLINA RAILROAD COMPANY, the amounts placed opposite to our Servants Names, in full for services rendered for the month of Jany 1865

| Names of Slaves | NAMES OF OWNERS | Month | Rate | Amount | SIGNATURES |
|---|---|---|---|---|---|
| George | [illegible] | 23½ | 25 | 2 55 | |
| [illegible] | | 18 | 50 | [illegible] 60 | |
| Bill | | 20 | | [illegible] | |
| Tom | [illegible] | 26 | 3 | 78 00 | [illegible] |
| Jim | [illegible] | 1 Mo | 50 | 50 00 | |
| [illegible] | [illegible] Huger | 1 | 40 | 40 00 | |
| [illegible] | [illegible] | 20 | 6 | 120 00 | [illegible] |
| [illegible] | [illegible] | 19 | 40 | 26 [illegible] | |
| [illegible] | | 19 | 40 | [illegible] | |
| Nathan | J. B. Elkins | 1 Mo | 50 | 50 00 | J. B. Elkins |
| Robert | [illegible] | 19 | 60 | [illegible] | |
| [illegible] | Mr Matthews | [illegible] | 60 | 5 65 | [illegible] |

## On Tick.

There are 900,000 miles of telegraph lines in the world with approximately 2,500,000 miles of separate wires. Europe alone has 67,465 telegraph stations out of the total of 465,000. The world's yearly messages are put down at 296,000,000. From this number 57,500,000 are messages transmitted from one country to another. The total receipts for the world's telegraph service amount to upward of $450,000,000.

When you want to cut rubber gaskets wet your knife-blade in water, or better yet, in potash and water, and you will find it cuts much easier and cleaner. In putting rubber gaskets into steam-tight joints coat them with black lead and they will not stick to the metal when you want to take them down. If you have no black lead common chalk is a good substitute.

## The Last Slave Railroaders.

While in Charleston, S. C., recently, the writer ran across an old pay-roll of the slaves employed by the S. C. R. R. Company. Perhaps it is not well known that for many years this company owned their own firemen, brakemen, switchmen, cleaners, etc.—some sixty persons. These were housed, fed and clothed by the road.

In looking over the old time-books of the company, such entries as follow were on every page:

Engine 11, Engineer, Allen, 26 days, $70.60

" 11, Fireman, Mose (Company man).

There are to-day old colored men in the South who fired locomotives for more than thirty years.

The pay-roll, one quarter of which is exactly reproduced here, is double, both sides used. The wages in some cases are very high, but it will be remembered that this was just at the close of the war, when a pair of boots was worth five or six hun-

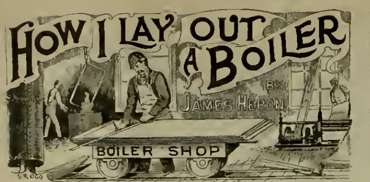
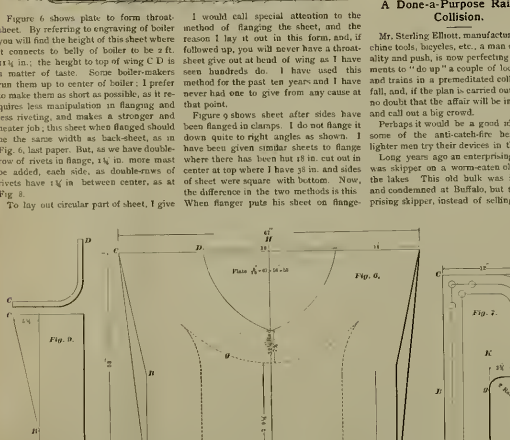



Figure 6 shows plate to form throat-sheet. By referring to engraving of boiler you will find the height of this sheet where it connects to belly of boiler to be 2 ft. 11¾ in.; the height to top of wing C D is a matter of taste. Some boiler-makers run them up to center of boiler; I prefer to make them as short as possible, as it requires less manipulation in flanging and less riveting, and makes a stronger and neater job; this sheet when flanged should be the same width as back-sheet, as in Fig. 6, last paper. But, as we have double-row of rivets in flange, 1¾ in. more must be added, each side, as double-rows of rivets have 1¾ in. between center, as at Fig. 8.

To lay out circular part of sheet, I give height to where ¼ circle commences as at g, Figs. 6 and 7, to find the height; the sheet we are working on is 9-16 in., but to simplify matters, I make it ½ in., height from bottom of mud-ring to belly of boiler, or bottom connection sheet, 2 ft. 11¾ in.; radius of corner as at g, Fig. 7, 2 in. inside, 2½ in. outside; 2 ft ½ in. from 2 ft. 11¾ in. will be the height as at g, Fig. 6. Now you want to find amount of material required to form ¼ circle and straight part of flange. Where you find the abbreviation radius, it means radius in all cases where you get a given inside diameter, you must add thickness of material to diameter to find circumference. We have here an inside radius of 2 in., which means a diameter of 4 in., adding thickness of material ½ in. or the equivalent decimal .50, make 4½ in. or 4.50×31.416 = 14.137 or 14⅓ divided by four, as we only require length of ¼ circle 3½ in., to this add 2½ in. for laps and 1¾ in. for center, between knit-holes, length required 7¾ in.

Note radius at H 32¾ in., plan of boiler, shows radius 2 ft. 5¾ in.; this should be the radius of circle when finished, but I have added 2½ in. to that radius because my line on sheet is to guide flanger showing him where his bend commences.




I would call special attention to the method of flanging the sheet, and the reason I lay it out in this form, and, if followed up, you will never have a throat-sheet give out at bend of wing as I have seen hundreds do. I have used this method for the past ten years and I have never had one to give from any cause at that point.

Figure 9 shows sheet after sides have been flanged in clamps. I do not flange it down quite to right angles as shown. I have been given similar sheets to flange where there has been but 18 in. cut out in center at top where I have 38 in. and sides of sheet were square with bottom. Now, the difference in the two methods is this When flanger puts his sheet on flange-block to flange circular part, and comes down with the mauls—or what is more generally to the deterioration of the material, sledges—on point D, Fig. 9, down goes the wing at point C with it, and I have seen sheet heated four times after flange was down to hammer back that wing so as to have edge straight as at A B C, Fig. 7. Now this is the cause of so many throat-sheets giving out at point marked K, Fig. 7. That is the point where the sheet has the most strain in flanging, as it has to stretch both ways—down and out. Then knocking wing back point K, as a center, has to stand the blunt of all the hammering, and is very often burned at that point in trying to get material as hot as possible, so as to get wing back to its place with least amount of work, which is no easy job.

Now, by having sheet wider at top and cutting to shape as at A B C, Fig. 6, point B is a weak point and when flanger strikes on point D, Fig. 9 wing at point C goes down with D and I have the material there to let it go, so needs no knocking back.

I insist on flanger bringing point C straight with A B, to do this he has to come down with heavy sledges at C on edge of plate. It is plain to see the 5½ in. at point C has to be upset in flange where it has to stretch the most, and sheet is not reduced by heating so often. By this method of flanging you can scarcely perceive a difference in thickness of material when cahpered.

I will take up connection sheets in the next paper, as requested by letters from several of your readers, 2½ in. *loss* in last paper should read 2½ in. lap.

J. Heron

## A Done-a-Purpose Railroad Collision.

Mr. Sterling Elliott, manufacturer of machine tools, bicycles, etc., a man of originality and push, is now perfecting arrangements to "do up" a couple of locomotives and trains in a premeditated collision this fall, and, if the plan is carried out, there is no doubt that the affair will be interesting and call out a big crowd.

Perhaps it would be a good idea to let some of the anti-catch-fire heater and lighter men try their devices in the trains.

Long years ago an enterprising Yankee was skipper on a worm-eaten old brig on the lakes This old hulk was inspected and condemned at Buffalo, but the enterprising skipper, instead of selling her for old wood, advertised to let her go over the falls of Niagara if enough spectators, at a dollar ahead, would come. He was the original inventor, and got enough out of the exhibit to buy a new ship.

Perhaps Mr. Elliott's plan will open up a new way to sell old engines and cars, teach an object lesson, and at the same time leave on hand as much scrap as if the exhibition had not taken place.

Mr. Elliott is an interesting humorous writer, as the following article from the *Bicycling World* will bear witness

"At the suggestion of any extensive and elaborate amusement enterprise the average mind turns at once to P. T. Barnum. Barnum and the show business are synonymous. He was to the amusement world what Napoleon Bonaparte was to war, or what Bob Ingersoll is *not* to the Orthodox church. Given some extremely odd and unusual freak and little Jimmy Jones, of Dead Horse, Dakota, says the same thing that little Ralph Waldo Browning, of Boston, would utter, viz.: 'Why, Barnum ought to have that.' *Why Barnum?* Because Barnum stands not simply as the name of a man, but as an idea, and that idea embodies all that is startling enough to warrant a charge for the privilege of seeing it. Barnum has 'strut his brief hour upon the stage' and passed away. Who will be his successor? Of course we know who succeeded to his show business, but who is to be the 'bright, particular star' that will outshine all the firmament of amusement managers? Who is to 'take the cake,' so to speak, that will be baked by our grandchildren? Will it be some man who began at the foot of the amusement ladder and patiently toiled his way along, who perhaps even now has reached a respectoble mediocrity and will win by slow degrees? *I don't believe it.* It seems to me that he will come tumbling into the ring with a jolly 'Hi, hi, here we are again'' and not only begin where Barnum left off, but leave the genial old godfather of Thomas Thumb several lengths to the rear on the first lap.

"Now my natural modesty makes it hard for me to say it, but do you know I believe I am that man. I have got an initiatory scheme that would have made Barnum turn pale. Something which will make Jumbo and the sacred white elephant look like a couple of dwarf rats. Something as compared with which the 'Last Days of Pompeii' and the 'Fall of Babylon' would be absolutely noiseless. What do you think? *A railroad collision.* Not one of these tame affairs where both engineers are doing their best to stop, and where at most but a few human lives and a few thousand dollars' worth of engines and stuff are lost, but a real, genuine done-on-purpose collision with full steam and everything right, and have them come together smack square in front of the grand stand; every man at his post and no half-way business about it. Haven't you traveled miles to see the wreck or even the location where such a thing happened, and haven't you carried away slivers and things and had them labeled and put on the 'whatnot' in the front room? Haven't you bragged for years that you went to the scene of the wreck and personally—'Yes, sir, personally,' and with your own hands pulled off a piece of the smoke-stock, or whatever, and brought it away with you? What wouldn't you give to sit in a comfortable chair in the grand stand and see such a magnificent sight as two beautiful trains of modern vestibule cars coming at full speed around a specially constructed curve, each engineer blowing his whistle like the last trump, and the other pretending not to hear it. A flagman wildly waving the wrong color, an open switch, 'the hot breath of the engine,' the customary, 'Oh, my God, we are lost!' the usual 'dull sickening thud, and all is over.' Then the train is cut up into small bits and sold to you (probably 100,000 of you) and the affair passes into history as the greatest thing in the amusement line the world ever saw. *How do you like it?* I am negotiating with a prominent railroad to furnish the road bed and rolling stock with every prospect of success. The hitch, if any, will be the selection of the passengers. There are some who say they would like to be on board and yet others that we are waiting to hear from. If you want to be in the first premeditated smash-up that ever happened, please file your application at once. Details and prospectus later.

"P. S. The peanut, lemonade, and undertaking privileges are to be sold to the highest bidder.

"P. S. No. 2. The same engineers will not be allowed to enter such tournaments often enough to become professionals."

## Car Building in New Brunswick.

The J. Harris Co., Limited, of St. John, N. B., build cars of all kinds. The place originated as a foundry and gradually developed into a manufacturing establishment, where any kind of mechanical work was undertaken. The specimens of cars which we examined showed that they can do first-class work, but it must be done under great disadvantages, for there is scarcely any machinery in the place adapted for car building. After going through the place the reflection of a mechanic naturally is, if these people can get paying prices for cars, wouldn't we like to build cars in competition, with the facilities of a first-class American shop.

A big business is done in making cast iron wheels, and the facilities for this business are fairly good. They are putting in machinery to roll and cast iron wheels under great pressure while they are hot. From experiments made by the process there is reason to believe that it will greatly strengthen the wheel and make it more durable. If I am not mistaken, the process is an American invention. It is also claimed that when the wheel comes out of the rolls it will be perfectly round.

## Boilers for High Pressure.

BY PULASKI LEEDS.

In answer to an inquiry about boiler matters Mr. Leeds sends the following exposition of his views:

In regard to combining safety and high pressure in boiler construction, I find that with boilers carrying 160 pounds of steam there are more broken stay-bolts than there was when the pressure was lower. The breakage of stay-bolts occurs mostly near the top of the firebox, and at both forward and back corners. With the 62-inch shells and firebox 120 inches long there is a great deal less trouble in every way with the Belpaire form of boiler than with any other that I have had experience with. The Belpaire I consider the proper form of firebox, because the flat surface is stayed to a flat surface, and it is possible to strengthen all points that are weak in in other forms of firebox.

With boilers having radial stay-bolts there is a tendency in two ways to break the upper rows of stay-bolts toward the top of the inside box. First there is the pressure of the steam, putting direct tension on the bolts, and then there is a tendency of a bad form to change its shape. The sides of the firebox become like a Bourden tube, and the pressure is always trying to straighten it out. If you cut out a narrow strip from the transverse section of a radial stay firebox, with the water leg passing down between the frames, it will be seen that the strains coming upon it must be of a very complex character. The tendency of this section to straighten out the part that is seen as concave from the outside, puts side strains on the upper stay-bolts that must soon prove destructive, and is, no doubt, in a great measure the cause of so much breakage of the stay-bolts in this form of boiler.

Another objection to the radial stay firebox is that it is nearly impossible to put heads on the inside of the crown-sheet on the two or three outside rows of stay-bolts, and I do not consider a crown-sheet properly or securely fastened unless the stays have heads to hold the sheet in case of the buckling of the same or of the stretching of the holes. The slight riveting of the stay-bolt sometimes practiced is not reliable.

My idea of the best boiler for high pressure is the "Belpaire type," braced at the corners in such manner as to prevent any tendency to assume a circular form over the water space in front of the firebox, and to relieve forward row of crown-bolts of any excessive strain due to the unstayed space at that point with sufficient "T's" or angle-irons across roof sheet to stiffen it and resist the tendency to assume a cylindrical form. The stay-bolts should be passed directly through the inside sheet without thread. The bolts should have spacing-thimbles between roof and crown sheet, so that they can be drawn securely and solidly against the head under crown-sheet, and against the thimble. In this form we receive the full benefit of the direct stays between the two parallel sheets of crown and roof sheet. The parallel sheets should be sloped the same, say three inches in twelve feet. By this method of construction, in case one of the crown-bolts breaking, the danger would be discovered at once by leakage in the firebox, and before enough of them had become broken to render it dangerous. With the present general form of construction of Belpaire boilers, no one knows when a crown-bolt breaks until others surrounding it give way and let the sheet bulge. This is the case in both the radial stayed boiler and the Belpaire. Most assuredly no one will advocate the desirability of the thread through crown-sheet, except to save the cost of the thimbles. Perhaps it would be well to screw through roof sheet, so that if bolt breaks there should be no danger of steam enough escaping through the top to injure any one, as might possibly be the case if the bolt passed directly through both sheets. This danger, however, would be almost nil, inasmuch as the thimble would protect the hole from any great escape of steam, while it would not protect the lower end enough so but that it would indicate by leakage that the bolt was broken.

## How to Counterbalance a Driver.

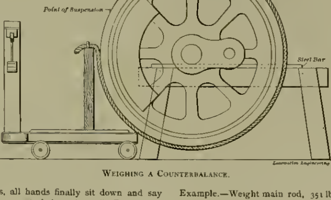
When a bad-riding engine has had her valves altered a few times, her spring rigging overhauled, and a few other well-known home remedies applied without results, all hands finally sit down and say "Her counterbalance is out." That is usually the end of effort to make her a good-riding engine.

"It must be in her counterbalance," seems to relieve the minds of many foremen and shift the responsibility off their shoulders.

The rules for determining the proper amount of counterbalance weight needed in a locomotive driving-wheel are very misty and discouraging to look at, so that most mechanics let them alone.

Down on the South Carolina road they had an old 14x24 engine that gave all the boys the horrors, she rode so badly. Superintendent of Machinery Roberts took her in and removed 80 pounds of counterweight from her main wheels and 56 pounds from her back wheels, and then she rode splendidly, and the boys bragged on her.

The plan employed by Mr. Roberts is used on several roads and is simple, quick, and requires no special apparatus.



WEIGHING A COUNTERBALANCE.

He lets the journals of the pair of wheels rest on steel bars on horses leveled up carefully, the wheels being free to turn. Passing a rope partly around the wheel, as shown, it is fastened to the tire at a point nearly at right angles to the crank-pin, bringing it around under the wheel and up to a post set on the platform of an ordinary pair of scales. The pin on one side is exactly plumb with the center of axle, this brings the pin on the side to be weighed on one side of the axle and the counterbalance on the other side; the weight, of course, tends to go to the bottom and shows the extent of this tendency on the scale. The rule followed is here given.

For Main Wheels.—Take one-third the weight of crosshead, piston and front end of main rod, add weight of back end main rod and front end of side rod; multiply this by half the stroke, and divide this by the distance from center of axle to point of suspension. (If tires are on, the point of suspension will be the outside of tire.)

For Back Wheels.—The same as main wheels, but leave off weight of back end of main rod.

Note.—Pin on opposite wheel from one being weighed must be exactly plumb. Trestles must be exactly level both ways.

Example.—Weight main rod, 351 lbs.
" side " 291 "
" piston and crosshead, 324 "
996 "

$996 \div 3 = 332 \times 12 = 3864 \div 30''$ radius of wheel = 129 pounds—129 pounds being the proper weight for counterbalance.

## A Quarry Railroad.

The annexed illustration shows the quarrying of huge granite blocks as performed on the Barre Railroad in Vermont, which is a peculiar road. General Superintendent Stanyan writes:

The road was chartered in 1888 and work commenced immediately from Barre to the granite quarries, and at the present time has twenty miles of track, including switch-backs, with one and a half miles of track additional now graded to East Barre. The road is standard gauge, is thoroughly ballasted and laid with 60-lb. steel rails and safety switches, tamarack and hemlock ties, laid 20-inch centers and Servis tie-plates. All water-ways and under-passes are of solid granite masonry. Maximum grade, 264 feet per mile, with switch-backs 300 feet grade. Curves, 10 to 20 degrees. Highest elevation above Barre reached is 1,020 feet in distance of four miles. The road runs directly under the derricks of thirty quarries. The same derricks used in lifting the granite from its natural bed place it on the cars, thereby saving transfers or rehandling.


SIXTY-FOOT GRANITE SHAFT ON TWO CARS.

The rolling stock is all new and built especially for this company. Platform cars 20 and 28 feet long, 50,000 lbs. capacity, with double hand-brakes and Westinghouse air.

Three locomotives, built by the Baldwin Locomotive Works 1889-90. Saddle tanks. Soft coal burners. One 37-ton, four drivers, one lead and one trail truck. One 48-ton, six drivers, with one trail truck only. One 50-ton, six drivers, no trucks, built as follows: Cylinders, 16x24 in., steel firebox, 60x34 in.; straight boiler, 48 in. diameter; 140 2-in. flues, diameter of drivers, 46 in.; wheel base, 10 ft., total length, 37 ft. Supplied with two No. 6 Sellers improved injectors, Detroit sight-feed lubricator, United States metallic packing, pistons and valve stems, Richardson balance valves. Capacity of tank, 1,000 gallons; capacity of coal bunker, 2,000 lbs. Weight on drivers (total weight), 100,000 lbs. Westinghouse quick-action air and Le Chatilier water-brakes. Ross-Mehan shoes. This engine will draw ten empty cars up our 264-foot grade at a speed of six miles an hour.

One thousand tons of granite have been drawn from the quarries in a day. The road also does quite an excursion business during the summer, as extended views of the surrounding country are had for miles in all directions, aside from the interesting and instructive knowledge gained of the methods of quarrying and handling the huge blocks of granite. Several millions of paving-blocks are shipped each season in addition to the regular monumental granite shipments.

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Hammering an air-pump on its head with a monkey-wrench, and pounding a check-valve case with a coal pick, are both evidence that the engineer ought to be working in a stone quarry.

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The Long Island road lost another locomotive in April through a boiler explosion. The fireman and brakeman were killed and several others badly hurt. The "48" was, it is said, one of the oldest on the road, and had been reduced to the rank of switching. When will it become the practice to throw away old boilers?

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During a recent visit to St. John, N. B., we examined a train of cars and a locomotive pulling it which were all built under the supervision of Mr. George A. Haggerty, master mechanic at McAdam Junction. The work on both locomotive and cars was all first-class. The cars were, to a great extent, built of the wood of the district, and they were finished inside in the native birch, which makes a unique and striking style of car decoration.

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Professor Goss, who has charge of the mechanical engineering laboratory of the Perdue University at Lafayette, Ind., has consented to permit the committee ("Exhaust pipes, etc.,") of the Railway Master Mechanics' Association to make experiments with the locomotive that belongs to the University. The intention is to make experiments with different forms of exhaust pipes and nozzles and note the results. As the engine is jacked up and can be worked in any way that the investigators think desirable, it is likely that much more reliable results can be obtained than are possible with locomotives working under the varying conditions of ordinary service. It is understood that Mr. Robert Quayle will conduct some of the experiments. He has devoted a great deal of attention to the subject of exhaust nozzles and steam passages, which will be of great service in the experiments to be undertaken.

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An engineer of the C., H. & D. writes us about the item of big mileage, and says that they have the engines that double 131 miles every day in the year, this is 7,860 miles for month of thirty days, and is big mileage, but not extra large for passenger service. Six thousand miles on freight per month is heavy work.


Pedrick & Ayer's New Railroad Tool Factory.

## A Model Manufactory.

There are very few railroad men in the mechanical department who do not know the special machines and tools for repair work made by the firm of Pedrick & Ayer, Philadelphia, Pa.

In 1870 an old locomotive engineer by the name of L. B. Flanders started a little shop in Philadelphia and commenced to bore out steam engine cylinders "in position" by the use of a boring bar of his own invention. Mr. Flanders was a genial, whole-souled man and made many friends. He invented, besides the cylinder boring bar, a radius link planer attachment, portable railroad frogs, a spring piston packing and the crank-pin turning machine.

The portable boring bar, now so common, was developed here and put upon the market, yet a large part of the work was in boring out cylinders of all kinds and sizes with these special tools instead of in selling the tool.

Mr. Flanders died in 1877, and the business was conducted by H. C. Ayer, acting as attorney for the estate, with D. W. Pedrick in charge of the shop.

In a short time the title of the concern was changed to L. B. Flanders Machine Works and D. W. Pedrick acquired a small interest.

In 1881 Mr. Pedrick and Mr. Ayer purchased the business.

These two men made up the firm of Pedrick & Ayer and found themselves with two special tools to build, the portable boring bar and the valve-seat planer—both illustrated herewith.

These tools were advertised so thoroughly and so persistently, guaranteed so well and were so much of a saving that they at once met a fair sale; once tried on a road, more were ordered for other shops, and to-day there are more than a thousand of each in use, and boring bars are made with a shaft 10½ inches in diameter and 20 feet long, capable of boring out a cylinder 110 inches in diameter.

New tools were added to the shop and new work secured to build, and it soon became known that the firm could introduce and push new tools for repair work better than anybody else, and they soon had the refusal of new devices.

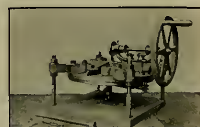
They commenced to build heavier machines, notably milling machines, and more recently the Richards planer which bids fair to overrun the shops or call for a special plant of its own.

Two years ago the old shop on Hamilton street was given over exclusively to the local repair department and the concern moved into their new shop at 1001 Hamilton, running clear through to Buttonwood street.

This shop is shown in our large illustration, and a view given of each of the floors, that describe them far better than can be done by words.

The office of this shop is fitted up like the library of some gentleman of leisure, while the shop is considered by all who see it as a model one for a small factory.

Every convenience is furnished the men; splendid light day and night; steam heat



Cylinder Boring Bar and Valve-Seat Planer—the Start.

in winter and cooling fans in summer; the best of tools and appliances.

In the busiest time they work about 116 men, and from that down to 70, depending on the volume of business.

All the tools are served by cranes, and power sliding devices are used to move heavy parts, being fitted by scraping.

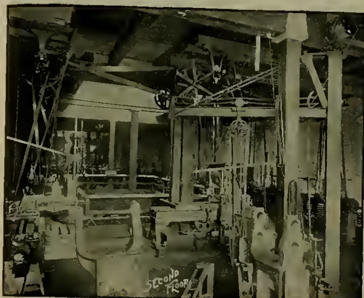
Mr. Ayer is the business man, attends to all the business affairs and oversees all office work, while Mr. Pedrick is at the head of the mechanical department; he came through the shop himself, can do any job done in the works and knows when a man does it well.

The success of this concern shows well what can be done by pushing, energetic work in one line. They made their name and goods known by the use of ink, and they made the reputation their product enjoys by doing honest work

## A Florida Railroad.

The Jacksonville, Tampa & Key West road, in Florida, is the best one on that great coral peninsula. Its roadbed is like the others, sand and swamp, but it is laid with 55-pound steel rail, and operates the best looking and most modern power and rolling stock.

There are some 200 miles of standard-gauge road, and the Florida Southern, under the same management, is narrow gauge, and strings out 307 miles.





The shops of both narrow and standard-gauge roads are at Palatka, Mr. Wm. Rutherford being master mechanic of both.

The shops are of wood, but are covered with corrugated iron and neatly painted. Florida shops, as a rule, are composed of a roof and a few posts. The narrow-gauge shops are separate from those of the standard and some distance away from them.

All the tools in the shops are painted blue and kept scrupulously clean, as are the yards around them.

The narrow-gauge engines have a great deal of brass, but the firemen keep them


looking like jewelry. White firemen are employed.

The most noticeable thing about the standard engines is the extension front and straight stack on wood burners.

This plan is being tried on several roads in the South, but is a success, so far as we could see, only on this road.

The fuel is pitch pine, and the smoke from it is as black and dense as that from soft coal, the pitch makes it very difficult to use any netting of small mesh, as it stops up with a tar-like substance. Mr. Rutherford uses perforated plate with openings ½ x 1 inch.

The writer rode on one of these engines on a six-car passenger train, behind time, and a better steamer, doing heavy work, would be hard to find. Of smoke there was plenty, but there were no sparks or cinders thrown out.

The truly remarkable thing about the use of wood this way is that a cord of it goes further than a ton of coal, a cord being about equal to a ton and a quarter of soft coal. The reverse of this is generally true where wood and coal are burned on the same road.

Many of the engines here had a high exhaust stand without a partition, and a change in pattern helped the steaming very perceptibly.

Florida has drawn the color line in passenger cars, and most of them have a partition through them, and a person "off color" is not allowed to ride in the special partition reserved for the other race; it is said that the colored folks are very particular to kick against the intrusion of the whites.

The principal freight business of the road is phosphates and oranges, and they had handled nearly two million boxes of oranges up to the middle of March.

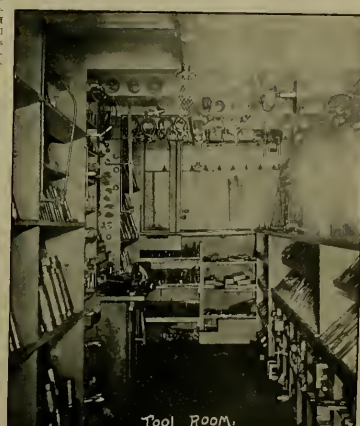
## Effects of Water Purifier.

We have received from Mr. C. F. Lape Master Mechanic of the Wabash Railway, a report of the performance of engine 69, which was equipped with the Barnes water purifier on February 18, 1890, and ran till March 31, 1892, without the boiler having any of the flues removed for cleaning. During 1890, the engine ran 35,912 miles and was washed out eleven times; in 1891, she ran 43,834 miles and was washed out thirteen times; while during the three months of this year she ran 12,270 miles and was washed out twice. The total mileage made was 92,066 or about 3,500 a month, which is good steady work for an engine. She was washed out once for every 3,500 miles run, which is remarkable for an engine using Illinois water.

In commenting on the performance of the engine Mr. Lape says: "Engine 69 was taken into shop on account of bad tires. Condition of boiler and flues would warrant six or seven months additional service, but, owing to the fact that engine was in shop for repairs, we took out her flues. The crown-sheet and crown-bars are apparently as clean now as when engine first came out of shop. The boiler had about three bushels of fine scale such as is usual in boilers without purifier, that have had five or six months' service. When the water is let out of engines to do necessary work on boiler or firebox, we wash engine out at that time to save holding engine in at some future time for washing out. This explains why this engine was washed out at shorter intervals than at other times."

Mr. Lape justly attributes a considerable share of the success of the purifier to the care bestowed upon it by the engineer, Mr. Leroy Killmer. This is an equation that cannot well be left out on any improvement that is applied to a locomotive.

Master Mechanic Briggs, of the K. C. M. & B. road, speaks very highly of the Luttgen's stack damper, and says that by its use in passing cotton platforms and other places where fire is liable to be set no danger is run, it prevents tearing fire when starting and opening the door to cool the engine down.




The Morris Box Lid Co., Pittsburgh, are manufacturing the Roberts dummy air-brake coupling illustrated in a recent number of LOCOMOTIVE ENGINEERING.

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## Special Notices.

*We invite correspondence on practical subjects from all men in the Motive Power and Rolling Stock departments of Railroads.*

*We will illustrate proprietary devices that are novel or interesting and that properly come within the scope of the paper. This will be done without charge, and without reference to advertising considerations.*

*The editors reserve the right to use or discard matter for the reading columns entirely on its merits. The reading columns will not be sold.*

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## Special Notice.

Some over-zealous members of one of the Brotherhoods have recently made an attack on the character and reputation of one of the editors of this paper.

Many of our friends have expected us to take the matter up, and offered ammunition. LOCOMOTIVE ENGINEERING is a mechanical paper solely, and can not and will not descend to the level of vile, personal journalism. Our readers expect mechanics, and will get it.

The charges as made are false and malicious; that's all.

In a recent interview, Mr. P. M. Arthur, Grand Chief of the B. of L. E., exonerated the accused of all blame in the premises, and, further, asked us to refer those who would not be otherwise satisfied, to him. This we gladly do. The truth hurts no honest man.

## Triple-Expansion Locomotives.

As soon as the compound locomotive was an admitted success, it was inevitable that a triple-expansion form should next be tried. We have been watching for this kind of a locomotive to be offered to railroads by some of the American inventors who are going around with drawings of ridiculously designed compound locomotives in their pockets; but a man in Beloochistan has got his work in ahead. Beloochistan is not a town in Indiana, as one of our visitors with compound locomotive on the brain thought it was; it is a country in Asia, lying between the Persian Gulf and Afghanistan. Coal is said to be very dear there, and Mr. John Hickey, the locomotive superintendent of the Northwestern Railway, who is a Scotch marine engineer, has designed a triple-expansion locomotive with cylinders 14½, 20½ and 28 inches diameter and 26 inches stroke. The cylinders are set like those of the Webb locomotive, the largest one being in the middle.

The engineering details of the locomotive appear to be very well worked out, but we believe that the steam has to pass through too many cylinders before it reaches the atmosphere for an engine to work successfully that is dependent upon the exhaust steam to create draft. It is well-known that the ordinary compound locomotive uses more steam than a simple engine when running light. This prevents the compound from being such a good all-round locomotive as a simple single-expansion engine. The causes that operate to make a compound locomotive wasteful of steam when working light, would have increased force with a triple-expansion engine, and it would be likely to prove a most expensive motor unless worked under exceptional circumstances.

It would be difficult to imagine a form of mechanical god strange enough to prevent its having worshippers in this country, and we shall be greatly mistaken if many months pass before we hear that some railroad in America is going to try a triple-expansion locomotive. A great many men think in mechanical matters, as a New Jersey citizen of our acquaintance reasoned about medicine. His daughter had been taking a medicine in which there was ipecacuanha, a drug that is a strong emetic when taken in large doses. The father was suffering from gripes one day, and he reasoned that when small doses of the medicine helped his daughter's asthma, a large dose must settle his perturbed inwards. A big dose was taken, and the results were far from satisfactory. It will no doubt take equally drastic experience to convince some of our people that locomotives which effect saving by having the steam passed through two cylinders will not be improved by having still another cylinder added.

The exposed condition of locomotive cylinders will always be an obstacle to the successful use of triple-expansion; but the high boiler pressure that may be carried will tempt some engineers to see a medium of saving in the possible protracted expansion. There are certain duties that locomotives have to perform where the use of triple-expansion might be practical. In some places locomotives are employed constantly on heavy mountain service, and it is common for the simple engine to work with the steam following close to full stroke nearly all the time. This is service well fitted for compounds and triple-expansion might be used to advantage. But two or three departures from ordinary practice would be necessary to promote the success of triple-expansion locomotives. In the first place, the exhaust steam would have to be abandoned as a means of creating draft, and a direct method of forcing the fire resorted to. Were this done, a large exhaust opening could be used that would permit the steam to escape quickly at pressure little higher than the atmosphere. In the next place, it would be desirable to build the engine so that it would be possible to throw one or two of the cranks or crossheads out of gear when the engine was working light. This would be a rather difficult mechanical problem to solve, but it is quite within the possibilities of invention. The same arrangement might be applied with advantage to compound locomotives.

These are to some extent idle speculations, but we feel certain that American railroad men will soon begin to receive visits from the inventor, who is prepared to save the greater part of the fuel by means of a triple-expansion locomotive. Our remarks may offer suggestions for conditions to be imposed.

## Responsibility for Fires from Sparks.

A decision recently rendered by the Court of Session in Scotland on the liability of railroad companies for fires caused by sparks from locomotives has excited universal attention, because the highest court in Scotland affirms that a railroad company is not responsible for damage caused by sparks where ordinary precautions are taken to prevent spark-throwing. The parties who were plaintiffs, or pursuers, as Scottish law terms it, in the suit attempted to show that spark-arresting appliances had been employed on early locomotives which were not in use on the engine that caused the fire, and that consequently the railway company had not exercised proper care. In reply to this, evidence was given that special spark-arresting appliances interfered with the draft so much that they could not be used successfully on fast running locomotives, and the court held that this was a good reason why the spark-arrester should not be employed.

Decisions of a similar character to this one have been repeatedly rendered in American courts of late, with the difference that they require the locomotive to be equipped with the best-known appliances for preventing spark-throwing. It has been customary for American locomotives to be choked down with spark-arresting appliances, and the making of steam freely is a secondary consideration. The spark-arresters in use defeat the purpose of their introduction to a great extent, for the blast has to be made so sharp to overcome the obstruction that as many sparks are thrown out as would be thrown were a free passage left to the atmosphere and the nozzles enlarged to suit. It would be a great boon to railroad companies if American courts would decide that railroad companies were not compelled to decrease the efficiency of their locomotives to prevent spark-throwing.

Most railroad companies, however, are disposed to be satisfied with the decision that they are not liable for fires raised by sparks when they have in use the best-known appliances for preventing fire throwing. When this is generally understood to be the law, there will be more care exerted by those having property close to the right-of-way of railroads to prevent its taking fire. This will be a highly desirable change, for in the past it often looked as if fire raising was aided rather than obstructed by some owners of property. There have been numerous cases where people were able, by fires, to dispose of property to the generous buyers railroad companies are known to be under the threat of an Alliance jury.

## An Exhaust Injector.

One of the most alluring fields of improvement that ever inveigled inventors to disappointment and ruin is the perfecting means for saving fuel by using the exhaust steam from locomotive to heat the feed water. No engineer of experience and fairness will venture to deny that feed water heaters for stationary engine boilers are a success. Then why should the same principle not apply to locomotives? The difficulty of answering this question satisfactorily is at the root of the many efforts to do for locomotives what has been accomplished in stationary engine practice. The story from John Alexander in a recent issue of LOCOMOTIVE ENGINEERING explains in humorous fashion the real difficulty, yet few inventors can be convinced that the exhaust steam is all required for the generation of draft. If any part of it is taken away to heat feed water, smaller exhaust nozzles must be resorted to as a means of making the reduced volume of exhaust steam equal to the work required. Methods of taking heat from the smokebox meet with similar objections, the loss must be compensated for in some way that takes away all the profit.

Our attention has been directed to this old subject through an account that appeared in a British engineering paper, of the success achieved by the use of an exhaust injector for locomotives. Using a portion of the exhaust steam to operate an injector is merely an ingenious form of feed-water heater. It has been tried repeatedly and we are under the impression that patents of an English exhaust injector are controlled by a firm of injector makers in this country, but there are numerous serious objections to the device. In the first place, the saving promised or predicted is never forthcoming, and exhaust steam varies too much in pressure to be used successfully for operating a boiler-feeder. Calculations have been made that an exhaust injector saves about ten or fifteen per cent. of fuel on account of the heat put into the feed-water, but we have seen no figures to indicate the loss due through the exhaust being robbed of its energy.

## Going Back to Iron Fireboxes.

We have the authority of the *Railway Age* for the report that a prominent road in Chicago has specified Low Moor iron for fireboxes in a number of locomotives recently ordered from an Eastern builder. The superintendent of motive power believes he will have less trouble with Low Moor sheets giving out where impure water is used than with steel which is liable to pit and crack under such circumstances.

We will venture to express the opinion that the superintendent of motive power referred to is not well-posted concerning the literature of his business, and consequently he is ignorant of facts which he ought to know. To go from steel to Low Moor iron for firebox sheets is stepping backward twenty years. There has been nothing settled more definitely in the world of engineering than the fact that the best quality or iron ever produced is unreliable as compared with good steel for firebox sheets. Low Moor iron is superior to any other metal for many engineering purposes, but in firebox sheets it is out of place.

In our last issue we showed etchings of iron and steel axles where it could be plainly seen that the iron was a mass of fragments stuck more or less securely together, while the steel was homogeneous, or a single mass. Good Low Moor iron might appear more homogeneous than the specimen which we illustrated, but it would at best show different pieces welded together, with more or less foreign matter mixed in the welds. When a mass of this kind is rolled in a sheet, the welds become points of deficient adhesion. The sheet will stand physical tests satisfactorily, but when it goes into service the steady expanding and contracting caused by the extremes of temperature a firebox has to endure, work the sheet apart, and it fails from blistering or laminating.

It would just be as sensible for the chief engineer of the road that has gone back to the use of Low Moor iron for fireboxes to recommend his management to abandon Bessemer steel rails and adopt iron on the plea that it is less liable to crack. Iron fireboxes and iron rails fail in the same way; wear loosens the welds and the material comes apart.

## Inferior Steel.

Several cases have been reported lately of failures of steel firebox sheets from lamination and blistering, and there has been considerable discussion on the subject. We do not consider that there is any mystery about the causes of such failures. Steel has been used long enough for fireboxes to demonstrate beyond peradventure that good homogeneous metal, when rolled into sheets, gives no trouble from lamination or blistering. Trouble of that kind is absolutely unknown with proper steel. All the steel offered for firebox sheets is not however of first-class quality, and it is the inferior steel that laminates.

That failures of this character are becoming common enough to attract attention, is merely a sign that it is time the purchasers of steel were using vigilance in the inspection of the material received. There was a movement in the line of false economy by certain railroad companies a year or two ago to dispense with the laboratories, which were becoming a feature of all well-managed railroads. This helped to break down the pressure that was put upon manufacturers to produce goods of a high character, and we suspect that other material besides firebox steel has deteriorated in consequence. Railroad companies have this matter of inferior steel and inferior goods generally in their own hands, and they are to blame if material unfit for use is supplied. The steel sheets which laminate may not really be dangerous but they are made of material that will not be durable, and on that account sheets of that inferior quality ought to be rejected.

There is a committee of the Master Mechanics' Association investigating the subject of iron and steel and they are reported as doing valuable experimental work. We understand that the plan followed is to request manufacturers to supply specimens of the material to be tested. We should like to see that committee take specimens of the steel from the different makers as it has been sent out without selection and subject it to searching physical and chemical tests. The likelihood is that they would find the specimens to give different results from those specially selected or prepared for the use of the committee.

## Water Purifiers.

On another page of this paper will be found a statement of the performance of a locomotive on the Wabash Railway equipped with a Barnes water purifier. One cannot read the statement without being convinced that the purifier worked wonderfully well in eliminating from the feed-water the lime, salts and other impurities that so quickly fill up the locomotive boilers running in the calcareous regions of Illinois and other Western States. The engine ran with less than half the washings out of the boiler that would have been necessary had no purifier been in use. This in itself is no small matter on roads where engines have to be run night and day during the busy season. The cooling down of a boiler for washing out is an objectionable practice which is frequently followed because there is no time to permit natural cooling. Any device which obviates the necessity for doing this is certain to prolong the life of the firebox, besides preventing the leaving on the sheets of scale that takes place every time that a boiler is cooled down rapidly or is washed out without thorough cooling.

We did not receive a comparison to show how long a locomotive boiler that has no purifier would run without washing out, but we feel safe in saying that the tubes would have to be removed by the time the engine made 30,000 miles, or one-third of the mileage made with the engine having the Barnes purifier. If this does not prove the purifier to be a success, we would like to know what will.

In his letter accompanying the statement Mr. Lape gives full credit to the engineer for the care and attention he gave to the purifier, and attributes a share of the success to this care. This suggests the question, Why have so many water purifiers done well on railroads for a few months and then failed? The reason is that they acted satisfactorily while they were operated properly, and they failed when the necessary attention was withdrawn from them.

Bad water is one of the evils that will always be present with many of the railroads on the American continent. Any apparatus, compound or process that will rob the feed-water of its qualities that prove so destructive to boilers, and cause so much waste of fuel, will be worth attention and careful operation. The waste of money due to foul boilers is so great that the means of preventing the waste ought to receive the greatest attention from all concerned in the economical operation of railroads. There is too great a tendency to regard the putting on of a water purifier as the ending of the business. It is left to take care of itself, the same as a new form of safety-valve or a new stack. The same thing may be said of all the chemicals that have been tried to separate lime and magnesia from the feed-water. The compound would be supplied for a time, and no care taken to blow the sediment out of the boiler. Then it would be declared a failure, and, perhaps, a good thing condemned because it had not been treated properly. Our railroad history has repeated itself in this way very often.

In another part of this paper there is an interesting and valuable paper written by Mr. Eugene Chamberlin, master car builder of the New York Central, on "Car Repairs." This article comes with peculiarly good grace from Mr. Chamberlin, for he is in charge of yards and shops where an immense amount of repair work has to be done with expedition, and the plan he preaches is the plan he practices. There is no line of railroad work where a good system is likely to be productive of more profitable results than in car repairs, yet there is no line where good methods are more frequently neglected.

The railroad companies in this country that are illiberal in giving transportation to employés (and they are numerous) and their families, might with propriety take an example from the action lately of the directors of the Midland Railway of England. In the future tickets are to be issued without limit to the employés and their wives, allowing them to travel over the system at a quarter fare for the double journey. This is in addition to the free passes which they have previously enjoyed. These are to be continued without any alteration.

Southern papers are enthusiastic over a train of cars just built at Montgomery, Ala., for the Atlanta & West Point, and intended to be run on the Washington & Southwestern vestibuled express. The train consists of first class, second class, mail, baggage and combination cars. The cars are built of native woods, and are constructed and finished as well as any cars built in the best shops. Captain Tyler, the general manager of the road, decided to have the work done in his own shops to encourage local industries.

At the request of the World's Fair Department of Transportation Exhibits, George De Haven, General Western Agent of the Chicago and West Michigan and the Detroit and Lansing Railroads, has consented to undertake the work of making an historical collection of railroad tickets. To this end Mr. De Haven solicits the aid of general passenger and ticket agents of railway and steamship lines throughout the world, and of manufacturers of all kinds of transportation tickets.

The Baldwin Locomotive Works intend running a novel train from Philadelphia to Chicago this month. They are building twenty compound locomotives for the Chicago Elevated Railroad, and several large ones for the Chicago, Rock Island & Pacific. They intend making up a train of the twenty elevated engines and hauling it to Chicago with the Rock Island engine. It will be a very striking train and an exceedingly heavy load for one locomotive.

A present of 1,000 volumes of books on railroad subjects has been given to the Stamford University of California by Mr. Timothy Hopkins, lately Treasurer of the Southern Pacific. Mr. Hopkins has further agreed to pay for the purchase of copies of all books on railroad subjects in all languages, and a separate railroad library will be formed when the collection is complete. It promises to be the best collection of railroad books in the world.

Street car accidents are reported to be dreadfully common in the streets of Boston, where the electric cars are run. One day when the writer was in Boston an electric car ran over a boy, and it took half an hour to get the mangled remains out of the machinery. Next day the company supplied all their cars with Norton lifting-jacks.

John Russell Young, the widely-known newspaper man, has been elected fourth vice-president of the Philadelphia & Reading.

## PERSONAL.

We have learned with deep sorrow that our occasional correspondent, Mr. Walter F. Dixon, chief draughtsman of the Rogers Locomotive Works, lost his wife last month.

The many friends of Mr. A. J. Pitkin, superintendent of the Schenectady Locomotive Works, will hear with sorrow that he lost his wife last month. She died of typhoid fever after a short illness.

It is reported that Mr. E. E. Davis, master mechanic of the Boston & Maine, at Boston, has been offered the position of superintendent of the Portland Locomotive Works. Mr. Davis is undoubtedly the best shop manager in New England, so far as railroads are concerned.

Captain R. S. Hayes, President of the St. Paul & Duluth, is spoken of as President of the Union Pacific, to succeed Mr. Clark, who has decided to retire. Captain Hayes is known principally on account of his financial connections. He is said to be favored by both the foreign and the Gould interests in the Union Pacific.

Mr. Harry P. Robinson, editor of the *Railway Age*, has gone to Europe, accompanied by his wife. Mr. Robinson was anxious to take his wife on a visit to his fatherland, and his intention is to return home in time for the conventions in June, where the editing of the daily reports has become a recognized duty.

Mr. James E. Sague, who has been for some years mechanical superintendent of the Jamaica railways, has accepted the position of assistant superintendent of the Schenectady Locomotive Works. Mr. Sague has had considerable railway experience in this country, and his numerous friends are pleased to see him working under the Stars and Stripes again.

Mr. Charles S. Mellen has resigned as general traffic manager of the Union Pacific to become general manager of the New York & New England, succeeding Mr. Charles Howard, resigned. Before going to the Union Pacific, Mr. Mellen was general superintendent of the Boston & Lowell, at Boston. Mr. Mellen will have the sympathy of his many friends owing to the death of his wife, which occurred at St. Paul, Minn., March 28th.

We had a pleasant call during the month from Mr. Walsh, of the Falls Hollow Stay Bolt Company, who informs us that there is a very active demand among railroad companies for the hollow stay bolt iron made by his company. Among the companies that have recently sent in orders are: The Philadelphia & Reading, Atlantic & Pacific, Chicago & Alton, Illinois Central, Vandalia Line and the Toledo, St. Louis & Kansas City.

President Calvin Goddard, of the Chicago & South Side Rapid Transit Company, died on the 4th ultimo at San Francisco, Cal. Mr. Goddard was born at Norwich, Conn., and was about fifty-five years of age at the time of his death. He served throughout the Civil War and was a valuable aid upon the staff of General Rosecrans. He had been financially associated with several railroad companies before becoming president of the Chicago road.

Mr. J. J. Henry has resigned the position of general manager of the Universal Brake Beam Company, and is succeeded by Mr. L. G. Cannon. Mr. Henry came to this position from the Wabash Railway, where he was secretary to General Manager Hays. No one has gone into the railroad supply business who has made more friends in a short time than Mr. Henry. He achieved much success with the brake-beam, having placed it on upward of thirty railroads within a year.

Mr. David Preston, mechanical superintendent of the Canadian Pacific Railway, began railroad life on the first railway opened in Scotland. He was an engineer there for some years and about 1856, when there was a movement among Scotch railway men to come to the Grand Trunk he joined the exodus. He rose on the Grand Trunk to be assistant mechanical superintendent and from there went to his present position. We are sorry to say that he is mourning the loss of his wife who died a month ago.

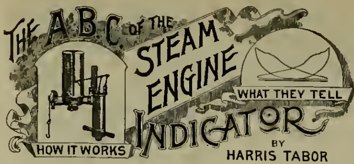
Mr. S. Higgins, who has been master mechanic of the Erie at Meadville for several years, has been promoted to the position of assistant superintendent of motive power of the same road in charge of the lines west of Salamanca and with office at Cleveland. Mr. Higgins had the reputation of knowing more about the engines under his charge than any master mechanic on the system, and for that reason he was selected for promotion. We heard a remark to that effect made in the Erie offices in this city months ago.

We find that Mr. P. H. Patriarch is associate editor of *Sparks from the Crescent Anvil*, a publication issued by the Crescent Steel Co., of Chicago. Mr. Patriarch is well known to a large circle of railroad friends, and many of them will remember that writing "sparks" is not his first effort in trade journalism. Mr. Patriarch was with the National Spring Co. when that firm started the *National Car Builder*, and he did a great deal of the work that first commended that paper to the favor of railroad men. We have no doubt that his *Sparks* will attract equal attention.

General satisfaction is expressed with the circulars issued by President King, of the Erie, and by Vice-President Thomas, of the Chicago & Erie, appointing Mr. A. E. Mitchell superintendent of motive power, *vice* Mr. Ross Kells deceased. Mr. Mitchell has been performing the duties of the position ever since Mr. Turreff died, and the work was done satisfactorily enough to prove that he was the right man for the office. He has been mechanical engineer of the road for several years, and came there with an unusually varied and valuable experience. Mr. Mitchell has experience as machinist, locomotive engineer, draughtsman and master mechanic. Few men go to the top better equipped with the varied stock of knowledge required.

Mr. A. Mitchell has been appointed superintendent of motive power and rolling equipment for the eastern and northern divisions of the Philadelphia & Reading, with office at Wilkesbarre, Pa. Mr. Mitchell is well worthy of advancement to the mechanical department of the road which he has worked for so ably these many years. He has been with the Lehigh Valley, as master mechanic, since 1864, and previous to that was in the best works in the country for acquiring a knowledge of locomotive engineering. No man of this generation has done more than Mr. Mitchell to improve the American locomotive. The first consolidation locomotive was designed by him, and numerous other minor improvements originated in his fertile brain.

At the April meeting of the American Railway Association the following officers and members of committees were elected: President, H. S. Haines, Vice-President of the Plant System; First Vice-President, Lucius Tuttle, Vice-President and General Manager New York, New Haven & Hartford, Second Vice-President, E. B. Thomas, First Vice-President New York, Lake Erie & Western Railway. The Executive Committee elected consisted of H. F. Royce, General Superintendent Chicago, Rock Island & Pacific, and Joseph Ramsey, Jr., General Manager Cleveland, Cincinnati, Chicago & St. Louis. The Committee on Train Rules consists of the New York, Lake Erie & Western, the Minneapolis & St. Louis, and the West Shore Railways.




The superintendent of a road said to the writer, a few years ago, that if it were possible to shoot passengers from New York to Chicago in two hours, with a certainty that only two in ten would arrive safely at destination, he believed the average American traveler would prefer that system. There is a fascination in passing mile-posts at intervals of sixty seconds or less for nearly all men who are not interested in keeping up rolling stock and roadbeds. This inclination cannot be said to come from a desire to save time. A reduction of two or three hours in time between New

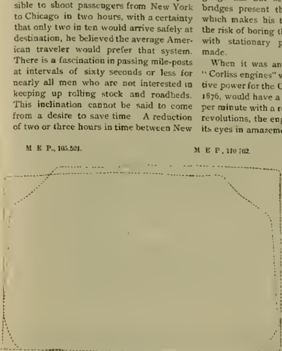



Fig. 2.

Boiler pressure, 130. Lever, full stroke

Throttle ½ open. 4 miles per hour

Scale, 50 Grade, 47½ ft. per mile.

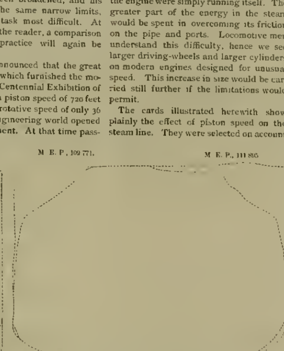



Fig. 1.

Boiler pressure, 130. Lever in fifth notch

Throttle open 8 30 miles per hour.

Scale, 50 Grade, 36 ft. per mile

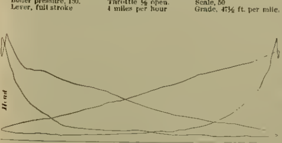



Fig. 4

Boiler pressure, 110. Revolutions, 385 Taken on Bound Brook Express Throttle ⅝ open.

M. E. P., 87 6. I. H. P., 452 5. Initial pressure, 87.5 lbs

Speed, 77 7 miles per hour. Scale, 80 Left cylinder cut off ⅝. Back pressure, 6 75 lbs

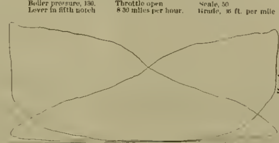



Fig. 3.

Boiler pressure, 132 Revolutions, 162 Taken on Bound Brook Express Initial pressure, 115 2 lbs.

M. E. P., 66 8 I. H. P., 337 3

Speed, 32 7 miles per hour Scale, 80 Left cylinder cut off ⅝ Back pressure, 4 lbs.

York and Chicago would not affect the business interest of one man in one hundred, yet all who travel between these points insist upon the fastest trains. There seems to be an inborn love for fast riding that characterizes this country more than any other —a sort of Chicogoism which is becoming a national trait. This tendency on the part of the traveling public has been an important factor in railway management—in fact, it has compelled all roads to shorten schedules, and often against better judgment. Even that great system which bade the "public be damned" is now running the fastest train in the world. In reply to the question: "Who insists upon these fast trains?" a well-known superintendent of motive power said, "The Public."

Increase in speed has called for radical changes in the construction of locomotives. None but the designer can know how difficult many of these changes are. Passenger locomotives have always been run well-up to their limit. An increase in mileage of 25 per cent. in the same running time means larger drivers, larger cylinders, and more important still, larger ports. The increased horse-power calls for larger boiler. If the designer had plenty of room his task would be comparatively easy. But his road-gauge has not been broadened, and his bridges present the same narrow limits, which makes his task most difficult. At the risk of boring the reader, a comparison with stationary practice will again be made.

When it was announced that the great "Corliss engines" which furnished the motive power for the Centennial Exhibition of 1876, would have a piston speed of 720 feet per minute with a rotative speed of only 36 revolutions, the engineering world opened its eyes in amazement. At that time passenger locomotives were making regular runs with a greater piston speed. In that year the Buckeye Engine Co., of Salem, O., exhibited one of their earliest celebrated high-speed engines, with a piston speed of 500 feet, and a rotative speed of 125 revolutions, and lovers of good qualities in steam engines studied it with admiration. Since then the Buckeye people have increased their piston and rotative speeds, and other makers of high-speed engines have kept pace, until now, engines of the quick-running stationary type have a piston speed varying from 500 to 700 feet, with a rotative speed of 125 to 300 revolutions. Few builders of these engines care to go beyond these speeds. The modern passenger locomotive often has an average piston travel of 1,000 feet per minute, with a rotative speed of 250 revolutions. The piston speed in locomotives is often increased to 1,200 and 1,400 feet, with a corresponding increase in revolutions. In one case, a "Vauclain" freight compound made the remarkable piston speed of over 1,700 feet for a short run. If we consider that the stationary engine has all the natural advantages that go to make high speed possible, we may get an idea of the difficulties in the way of locomotive design, when speeds of from sixty to seventy miles per hour are contemplated.

The indicator illustrates, probably better than any other way, one of the serious difficulties in modern speeds, viz., steam distribution. It is a problem to supply a cylinder with steam when its piston is moving 1,000 feet per minute. An ordinary port counts for nothing in the case of admission and exhaust. Such speed calls for enormous openings, and these openings must be quickly opened and closed. Small ports and pipes would mean an amount of wire-drawing and back-pressure that would make high piston speed impossible, unless the engine were simply running itself. The greater part of the energy in the steam would be spent in overcoming its friction on the pipe and ports. Locomotive men understand this difficulty, hence we see larger driving-wheels and larger cylinders on modern engines designed for unusual speed. This increase in size would be carried still further if the limitations would permit.

The cards illustrated herewith show plainly the effect of piston speed on the steam line. They were selected on account of slow speed in miles per hour. If the steam lines in No. 1 are carefully studied, it will be seen that on one card this line keeps up throughout the stroke, while on the other card there is a perceptible falling away during the latter part of stroke. The card showing the straight steam line was taken when there was no slip to the wheel throughout the entire stroke. The card taken from the other end of the cylinder, which shows reduction in pressures, was made when the driver slipped, during the latter part of stroke, to the extent of giving the piston enough greater speed to cause the wire-drawing shown on card. Cut No. 2 shows this in a more marked degree. Here we see the wire-drawing extended through the entire stroke, showing that the wheels slipped during that period. The effect of speed on the various features of the card is well illustrated by Nos. 3 and 4, taken by students of Stevens Institute, from a Cen. N. J. passenger locomotive. These cards were taken under precisely the same conditions, except as to speed. The card at the slower speed shows clearly all the valve functions—cut-off, release, and exhaust closure, the card at the higher speed does not look as though it came from the same cylinder. The point of cut-off is not discernible, and there is nothing to indicate when the exhaust-valve opened; apparently the exhaust closed too early, but in fact did not close any earlier than in the card at slower speed. The high velocity of the piston rendered the ports insufficient to admit and exhaust the steam without excessive friction, which is shown by the difference in the appearance of the cards. The card taken at 33 miles per hour is most excellent—in fact, when the remarkable speed is taken into consideration, both are good.

*Harris Tabor*

## The Kom-kom Humbug.

In a statement recently made by the new president of the New York & New England, the following remarks were made about a mixture for doctoring poor coal:

"We have found out that Howard, entirely unknown to the company, had contracted with a Boston firm to have all the coal used by the company sprinkled with some patent stuff called 'kom-kom,' which was supposed to improve it in some way. The 'kom-kom' cost four cents a gallon and it took three gallons to sprinkle a ton of coal. Thus the company paid twelve cents on every ton of coal for stuff that was worthless. For this purpose alone Howard spent between $40,000 and $50,000. There is not a drop of 'kom-kom' used by the New York & New England road.

"An inspection of the coal in the bins showed that it was of the poorest quality and resulted in the rejection of several thousand tons that were ready for delivery. Yet the company was paying for good coal. The annual report showed that the cost of fuel had been twenty-six cents per train-mile, whereas the average for about fifty roads was only twenty cents. Between 'kom-kom' and poor coal, the New York & New England had a hard time of it."

## Three Men Asleep in the Cab.

When trainmen are overworked, it is very common for some of them to sleep considerable while running, but it is something unusual to find all the occupants of the cab asleep at once. This was what happened last month on a freight train on the Rome, Watertown & Ogdensburg, and the following is a dispatch describing the accident that resulted:

"A remarkable railroad wreck occurred at the Rome, Watertown & Ogdensburg junction, in this city, early Sunday morning. A freight train headed north stood on the main track. Another freight train came in from the south, running at the rate of twenty miles an hour. It smashed into the rear end of the standing freight, ploughing its way along with tremendous force, telescoping several cars and setting them on fire. There were three men in the cab of the moving locomotive, perfectly unconscious of what was going on about them. They were asleep, having been overcome by too many successive hours spent on the road. Two cars, one a caboose, were destroyed, the engine was badly injured and the bumpers on twenty-five cars were loosened."

We do not like the expression, "hard as fire and water can make it," used oftentimes in connection with the hardening of steel; it generally means that the steel is to be made coarse by overheating. It cannot be impressed upon the steelworker too often that his aim should be to refine the grain so that it will disappear when viewed by the unaided eye, the hardness will take care of itself. If it is not hard enough when refined by hardening at low heat, then the steel itself is too mild. Better take the steelmaker into your confidence and tell him what you want steel to do, then he will give you what will refine to a strong condition and harden just right for your purpose.—*Sparks.*


## Casting on Repairs—War Time Makeshifts.

*Editors:*

The question is asked by one of your correspondents if a piece can be successfully cast on a broken cylinder.

There is no difficulty about that if the metal is hot enough and enough allowed to run through the mold until the broken part of the cylinder is melted, which may be discovered by an iron rod run down through the cope so as to feel the surface of the broken part, noting the depth of the rod when run down to the broken cylinder before the metal is poured in, and the depth after the broken part is fused. I remember, when a boy in England, the oil cellar bolt-holes in brass driving-boxes on locomotive would wear out by the shake of the oil cellar, and the ends were recast on these boxes several times before the boxes were worn out; I also remember that during the war many cannon were brought to Richmond, Va., from the Norfolk Navy Yard that had their trunnions broke off before being abandoned by United States troops. At the Tredegar Iron Works new trunnions were cast on them—6x8-inch on 10-inch guns—and they did service to the end of the war.

I think Mr. Jas. E. Masters also cast teeth in large gear wheels at Richmond that had been broken out in service. These cannon were not rebored, only the trunnions turned up and mounted. I think electricity will play an important part in work of this kind before long.

I think I rifled some of the first cannon made in Richmond, Va., after the beginning of the war. The cannon were bolted on logs on the floor and a bar with tool in the end was attached to the bed of a planing machine, and by an inclined plane on which an arm slid up, the curve of rifle was given. This was one of the makeshifts of those troublous times. Jno. J. Bingley.

*Watertown, N. Y.*

## Bent Rods—"Burning on" a Patch—Lining Guides, etc.

*Editors*

Mr I. F. Wallace quotes his engine as bending right-side rod while pulling on a wreck; it is quite evident that the rod was sprung while passing the lower quarter. Possibly the engine was slipping and the back wheels took hold of the rail, which would have a tendency to allow the pins to close, the left side being at or near the center, and with a little lost motion there would be nothing to prevent the right pins from closing. If, as he says, the pins *were* in train (tram) and worked freely, I venture the assertion that the rods did not work free afterwards. The writer used to run an engine that had the same weakness.

A member of the Flat Wheel Club asks if a piece can be cast on a broken cylinder successfully. Of course it can, and a good job made of it. The days of putting a patch on a cylinder with top bolts have passed away on any well-regulated road. The process requires the handling of a large quantity of molten iron. A pattern of the broken piece is made and put in place, the sand rammed up, in and around the cylinder, the pattern taken out, and a stream of molten iron run through the mold and in contact with the fracture; of course, there must be an outlet to the iron it running through the mold heats and finally fuses the fractured edge, and when at the right heat the outlet is stopped up, when the mold fills up, and the job is complete. The above is about the substance of the operation. A molder could give a more detailed description of the process of *burning* in a piece, as it is called; but it is a cast-iron weld, and when well done, as they do it at the S. P. shops in Sacramento, Cal., it makes a good job, the joint being hard to detect after boring out.

About lining guides, Mr. Hitchcock and Mr. Dolbeer are both right. Mr. Hitchcock's methods are methodical and elaborate where plenty of time to do the work is at hand, but I don't see why they would give any better results than the method of Mr. Dolbeer. Mr. Hitchcock uses a line through the cylinders; now, to have this line represent the exact center of the cylinder as it should, depends a great deal on the man who puts the line through, as the same difficulty is met with as in culipering a piece of work; it is the sense of touch. We know the line exposes a minute surface and is hard to feel, more particularly in the back end of the cylinder, where as some do center from the back counterbore, the stuffing-box should be the point to work from when a line is used. I have found in practice that when the final adjustment of the line is made, a pine stick with an ordinary pin in it is better than inside calipers, as it is lighter and more sensitive.

A quick and good way to line guides when guides are planed or ground true, gland bushed, and rod turned, is to put in gland and bushing ring, put in piston and center it by liners in cylinder, hang lower guides so that the crosshead has a good bearing crosswise and in alignment with the engine across the frames; by moving the crosshead back and forth in the guides until the taper of the rod will enter crosshead without canting at either end of stroke; put on top guides and bolt them tight in their proper position. The crosshead must work free and not bind in the guides. The machinists can have their way in the shop, but the engine will have its way on the road. While we are speaking of guides, there is a painting hanging, or did hang, in the roundhouse timekeeper's office in Sacramento, that treats on hot guides. Will some of the S. P. boys tell us something about it, and what A. J. said?

There are a great many things in locomotive work in regard to close fitting of wearing parts that are giving better results by being a little loose in these days of push and hurry.

*Corry, Pa.* W. De Sanno.

## Where They "Burn on" Patches Successfully.

*Editors.*

In your April issue "A Member of Flat Wheel Club" asks if you have ever known of a patch being successfully cast in a cylinder which had been broken by some accident. Please inform the member or club that in the past fifteen years the Southern Pacific Railroad, at the Sacramento shops, have successfully cast, or more properly speaking, burned pieces in about seventy-five cylinders, some patches extending half the length of cylinder.

We have also drilled stud-holes in flange of cylinder through the seam of patch and there has not been a single failure up to the present time.

R. E. French,
Gen'l Foreman S. P. shops.
*West Oakland, Cal.*

## Hot Brasses—Why They Heat.

*Editors:*

The above subject will interest every engineer and fireman, for I do not think there is anything about a locomotive that will cause an engineer more worry and trouble than to throw the babbitt.

Most machinists know that a brass after it has been in service a while will bind on the pin from A to B—Fig. 1. It has been my practice to take a light chipping from A to B and finish with a bastard file. Although I knew that it was increasing the pressure on the remaining area, yet if lubrication was all right it had the effect of stopping a tendency to heat. The only feasible explanation I have seen or heard is given in Joshua Rose's "Modern Machine Shop Practice" He states that the constant vibration and pressure causes the

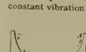



*Fig. 1.*

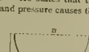



*Fig. 2.*

surface C, Fig. 2, to condense and stretch, causing the bore of the brass at D to close upon the pin and bind with undue friction, causing heating. That I believe is the cause of nine-tenths of hot brasses. Many practical men refuse to believe that a brass will heat through pounding, but the above condition is brought about in many cases by pounding. Ebor

*Oil City, Pa.*

## A Good Suggestion.

*Editors*

In considering the various so-called railroad problems of the day, one, of great importance, seems to have been almost entirely negected.

The progressive roads have made great strides in improvements of a certain class; the time made is faster, the roadbed smoother and safer, the motive-power heavier and the capacity of the cars greater. There has been improvement in the method of running trains, in the manner of lighting and heating cars, and in every line that would tend to promote the safety and comfort of the traveling public and cheapen the rates for shippers; but one feature in the method of management remains the same to-day as it was years ago, despite the fact that there seems to be plenty of room for improvement.

Think a minute and tell if you can of any improvement that has been made in the method of disciplining the men for infraction of the rules. There may have been an increase in the amount of discipline administered, but the method remains the same. In years gone by what was the means employed for punishing a man for disobedience of orders? Simply suspension without pay for a certain length of time.

What does this suspension mean? Simply enforced idleness; or, in other words, an unlimited opportunity to brood over and magnify what almost always seems to the man himself an injustice. When a man has been at work regularly every day for years and then is suddenly taken from his occupation and permitted, nay, compelled to waste fifteen or thirty days in idleness, he is naturally at a loss to know what to do with himself and so spends his time in drinking, gambling, or what is worse for the road, going around amongst his fellow men and dilating on the injustice of his sentence. Thus a man who while at work may be sober and well disposed, when deprived of this safeguard succumbs to temptation and is led into states of dissipation and discontent. Such is human nature, and every railroad man of experience can call to mind cases to confirm these statements. What an inconsistent thing it is to force a man into idleness for misbehavior, and by that very act give him every opportunity to commit further indiscretion.

Discipline we must have, but why should it be idleness. Surely there is another way, and now we think of it a very simple one. When a man has been found guilty of carelessness or misdemeanor reduce him for a time to a lower rank, but *keep him at work*. Do not let him remain idle. Give him no opportunity to brood over fancied wrongs.

For example, if he be a passenger engineer let him pull freight for a time, or put him on a run that is less desirable, and pays less money. If he be a brakeman treat him likewise, but do not force him into idleness, nor for a time entirely take away his means of support, thus compelling him to go into debt, for this of itself is demoralizing. After a period of longer hours and less pay he will learn the desired lesson, and then he may be reinstated in his old position.

In this way *idleness* and its attendant evils are avoided, the younger men who are temporarily placed in an advanced position learn something of the work connected therewith, and are in consequence better prepared when the inevitable changes of time necessitate their permanent advancement. Paul Synnestvedt.

*Chicago, Ill.*

## Air-Brake Care—Kinks and Points.

*Editors:*

In your February issue I made some statements that were questioned. I waited to see what was said about them and find that I must once more take a hand in the discussion. On page 53, in regard to drilling hole in feed-valve No. 21, it seems to be taken that it would connect reservoir and train-pipe pressures. The reservoir pressure is against the end of feed-valve and train-pipe pressure against the side. A hole in the side of the feed-valve would open inside of feed-valve to train-pipe pressure, and if reservoir pressure should get in it would close it. If valve is loose enough, hole is not needed, but if a new feed-valve is put in there is likely to be trouble from an unbalanced valve, and on this road the valves that best maintain regular reserve pressure have holes in them, and if valve should gum hole will be open, showing that air is continually rushing back and forth in it. A glance at the parts in brake-valve and the position feed-valve occupies will make it clear.

As to opening throttle on a modern passenger engine with driver brakes set, unless an inexperienced man he would hurt nothing, at least not as much as when the brakes went on, as I have timed engineers in such cases and never saw one shut off steam until after brakes were dead on, for it generally takes them about ten seconds to realize their position. I would like to get others' experience on this matter.

While on brake-valves, would like to find whether leather or rubber gaskets No. 22, plate D 8, are most liked. I use rubber and warm them up with the sprinkler hose when I wish to get them apart. How about scraping rotary-valve No. 13 and seat, and how long does it take? What is used to set the grain on seats after scraping?

I still claim a passenger train should not be started until brakes have been applied after auxiliaries are charged, as I have often watched at the first stop after a test under pressure has been made, and

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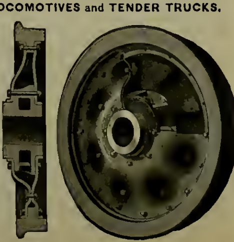

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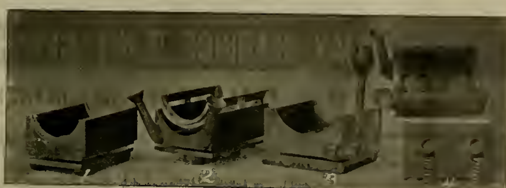

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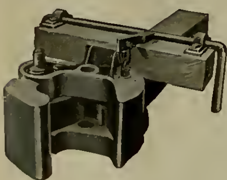
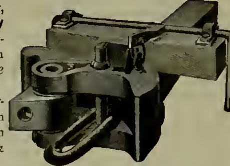


Is the Cheapest, Safest and Strongest Coupler, on account of its durability. The *only* Automatic Coupler that has a lateral swinging hook and couples with the link and pin proper, ***and pulls direct from the center at all times.***

This coupler has been in use on the Birmingham Division of the L. & N. R. R. seven months without a break. We take pleasure in referring to the Supt. Motive Power, L. & N. R. R., as to its merits.



For any information, photographs, models, or sample couplers, address **No. 310 FIFTH ST., LOUISVILLE, KY.**

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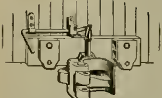

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**Only 4 Pieces.**

Tensile Strength (Fairbank's Test) 139,640. Drop Test, 700 lbs. hammer dropped 18 ft. 22 times failed to break the knuckle.

**ALL LOCKING PARTS ARE THE BEST OF STEEL.**

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# THE STANDARD COUPLER.

**DOWLING TYPE**

THREE PARTS, ALL INTERCHANGEABLE.

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ALL SIZES,

4 SHAPES.

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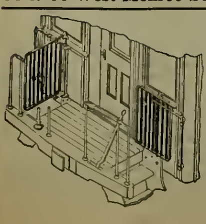

## BLOWN OFF THE CARS!

This cannot happen to passengers when cars are equipped with the

## WOOD PLATFORM GATE.

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Automatic Freight Car Coupler.

Locomotive and Car Axles, - - Coupling - - Links and Pins.

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# GOULD Coupler Co.

BUFFALO OFFICE AND WORKS,

AUSTIN ST.

M. C. B. Passenger Coupler Used in Place of Miller Hook WITHOUT CHANGE IN PLATFORM.

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Horizontal Punch, Made in 5 Sizes.

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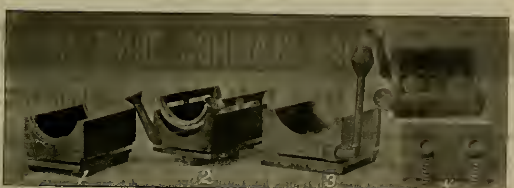

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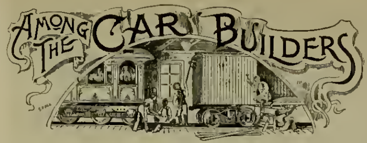
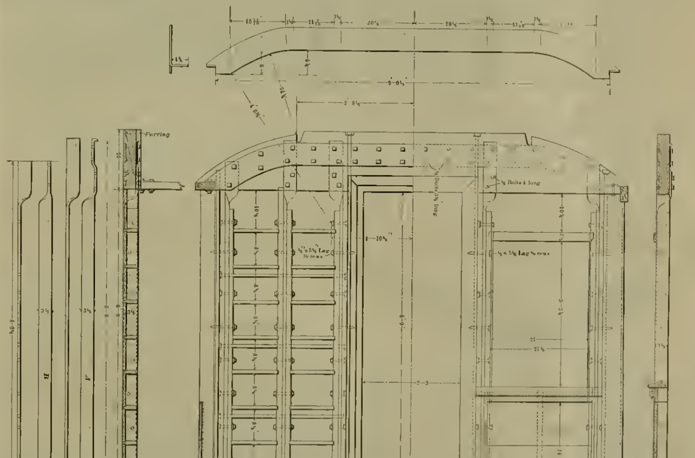



## A Very Strong Passenger Car.

The annexed engraving illustrates a method of composite construction adopted by the Lake Shore & Michigan Southern Railway for the purpose of strengthening passenger cars. The side-sills are reinforced on the inside by an 8 x ½-in. iron plate, extending 14 feet 10 inches back from end-sill, and being bent, forming an angle-iron, extending 8 inches onto end-sill, and having on the inside a piece of 2 x 7½-in. yellow or Norway pine, extending the full length of iron plate, flush with bottom of sill. The whole is securely bolted to side-sills by twenty-two ⅝ x 7¾-in. bolts, having heads let in flush in outside of end-sill, and secured by three bolts 9½ x ⅝-in. to end-sill, extending through end-sill, having head let in flush on outside of end-sill, with washers under both head and nuts, and ends of bolts riveted over on nuts. Between ends of iron plates, side-sills are reinforced by two ½ x 7½-in. yellow or Norway pine pieces, securely bolted to side-sill with twenty-eight ⅝ x 7¾-in. bolts, having washers under heads and nuts, and ends riveted over on nuts. These inside reinforcing pieces are mortised, gained and bored to receive bridging, bolsters and necessary tie-rods and bolts.

The end-sill consists of an inside and outside piece of white oak, with an 8 x ¾-in. wrought-iron plate between them. Outside pieces are of oak, and dressed on all sides to 4½ x 8¼ in., and mortised to receive platform sills, corner, door, and end-posts and end-studs; also gained out 3½ in. wide by ¼ in. deep at six places for receiving bottom of iron-end posts; and cut off at 45 deg. angle on each end, to receive bottom of corner post, and bored for necessary bolts and rods.

On the ends of the car six iron end-posts of ¾ x 3¼-in. iron are located, one close to door posts, one next to corner posts, and one half-way between the above. Posts to be put next to main end-posts, with an auxiliary post put on the other side, and the whole to be bolted together with five ⅝-inch bolts. Iron posts have ends twisted ¼ inch and extending to bottom of end-sill and to about 16 inches above bottom of end-plate, bottom end of post fitting into rabbet on inside of outside member of end-sill, and being secured by two ⅝-inch bolts, passing through entire end-sill in outer and intermediate posts, and by one ⅝-inch bolt through inner post, these bolts being also the ones which hold end-sill together. Top of posts lie flat on inside face of end-plate, and are offset to pass under and lip over a ¾ x 6-in. iron plate, extending from side-plate to side-plate. Outer posts secured by two ½-inch bolts through above tie-plate and end-plate, and intermediate and inside posts secured by two ½-inch bolts each through tie-plate and end-plate, and by two ½-inch bolts each, through end-plate alone. Cars built in this way have resisted tremendous blows without damaging the car. The plan adds so much to the safety of passengers in cases of accident that it deserves to be generally adopted in car construction.




Mr. William C. Baker, the well-known car-heater inventor, has lately patented an improvement on car heaters, consisting of an expansion vessel having a peculiar form of cock and funnel.

The Morris & Essex—long ago absorbed by the D., L. & W.—used to brand their stock M. E., and the car-hands promptly interpreted it "Methodist Episcopal."

Atchison, Topeka & Santa Fé R. R. have given the Hanrahan Refrigerator Car Co. an order for 250 cars. Barney & Smith, of Dayton, Ohio, are doing the building.

We are informed that the Long Island road have adopted the Smillie Coupler. The Lebanon Car Works are building 150 box cars for them, and the Middletown Works 250 gondolas.

## Car-Shop Management.

By Eugene Chamberlin.

Volumes might be written upon car-shop management, but, without entering into details, we will simply assert that, in a well-conducted shop, there should be "a place for everything, and everything in its place." Discipline should be perfect, and employés should be dealt with in a manner that they will readily understand that their advancement depends entirely upon their own exertions. Ability and strict impartiality should be the rule, and all promises made should be faithfully kept. The arrangement of machinery in every department should be such that, in the working of either metal or wood, it should approach completion by passing steadily in one direction, and, when finished, be as near as possible to the point required for use.

Men responsible for production of work should know what each machine can accomplish in a given period, when handled under the most favorable circumstances. The possession of such knowledge is valuable in arranging values for piece work, and for the prevention of trifling with a tool's capacity. The use of antediluvian machinery or tools is a serious draw-back. Templates of all work should be carefully made, properly lettered and classified, and kept in their respective pockets, that they may be readily obtained when required. All tools should be cared for in a room specially prepared for that purpose, so that in case of breakage or other mishap the work may continue without interruption, by the use of a duplicate tool, readily ob-

tained on the return of the one broken, which may be put in shape at convenience, and without the special attention and consequent delay to work upon which the party who breaks it is engaged. All manufactured stock should be classified and disposed of in a manner that will bring it readily at hand for use, and make it easy to inventory. Great care should be taken that an ample supply of manufactured stock, particularly standard parts, is always in readiness. The delay to work sometimes occasioned by men waiting for the preparation of material is very annoying, and becomes expensive as a labor item.

The economical handling, loading and unloading of heavy material, such as wheels, iron, coal, lumber, etc., in and about the shop, is an important factor. It will be found that a system of narrow-gauge surface tracks, with proper vehicles, and also the use of trolleys and other appliances, are valuable, and will result in a marked reduction of the cost of handling material. With regard to the work in repair and construction shops proper, satisfactory results have been obtained by assigning certain classes of work to groups of men specially qualified for each type of work, on the principle that in following one line of work they become in a measure expert, and are able to accomplish greater results. With this end in view, and that the work may arrive on the working tracks properly assembled, it will be found advantageous to locate a competent inspector at the head of shop yards, a part of his duties being to assign to designated tracks certain classes of work, such as roofs, sills, etc., etc. After these cars have passed through the shop finished, and before they leave the yard they may be again examined, with a view of determining if all work has been properly done. This, together with a system of accounting for the repairs done to each particular car, and by having entered upon such repair record the names of persons engaged in doing said work, precludes in a measure the possibility of any large amount of poor work leaving the shops, and, if defective work is discovered, certainly fastens the guilt upon the proper persons, and allows a remedy to be applied in the right direction.

It will be unnecessary at this time to enter into the merits or demerits of "piece work" on car repairs; much has been said upon this subject, and probably much more will be. In this age of progress, all things are possible, and if piece work is the true basis, why is it not possible to apply it to car repairs? To work such a system properly, a judicious compromise must be reached on the labor items for the renewal of parts on the multitude of cars of widely different construction, and the cost of inspection of such work will not counterbalance that which might reasonably be expected from day work.

In conclusion, the writer begs to say that he has not set forth in this article anything that invites criticism, and is fully aware that there is nothing new or startling in this method of conducting work on car repairs. It is only a plain matter-of-fact statement of how the business may be practically conducted with reasonably satisfactory results. This is written with a view that others engaged in the same occupation may see their way clear, to set forth the advantage occurring to them in handling the same class of work, but possibly in a very different manner, and probably with much better results in such case. We will be able to absorb information, if we cannot impart it, and the results might be beneficial to the service in which we are engaged.

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An improvement in the under-trussing of cars has been patented by Frederick R. Canda, inventor of the Canda Cattle Car. It consists of a combination of projections on the queen posts and collars on the truss rods, the purpose being to hold the trusses steady. It is one of these small improvements that does a great deal to keep a car from getting out of shape.

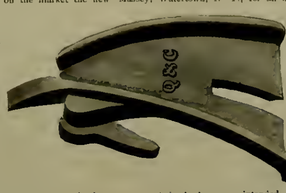
## Lehigh Valley Stock-Car.

The officers of the Lehigh Valley Railroad speak very favorably about the stock-car shown in the annexed engraving. The company have a great many of these cars in use. The special advantages claimed for this form of car are as follows: It is provided with a dead-air chamber in the top, which serves to retard the rays of the sun, and like a garret in a house make the car much cooler in warm weather, which is a very important factor in shipping cattle, sheep and hogs. Second, the stock is fed from the center of the car, the running-board consisting of a series of doors through which the food is let through the car and automatically distributes itself without further attention, and there is no liability of the food being wasted by running off from the sides of the car, like in other cars where the food is put up in its place close to the outer edge. Third, the convenience in watering is very great, as the tank on the end may be supplied with water from any convenient hydrant or hose and distributes itself all throughout the car, both upper and lower decks when used for hogs, and single decks for cattle. These troughs may be opened and closed by the attendant, who stands on the tank on end of car while operating the same. Fourth, the special advantage to be claimed over all other makes, is the fact, that the feeding and watering facilities in the car do not interfere in the least with the bracing of the car.

LEHIGH VALLEY STOCK-CAR.

## New Wrecking Frog.

The Q. & C. Company, of Chicago, have recently placed on the market the new form of wrecking frog shown herewith.

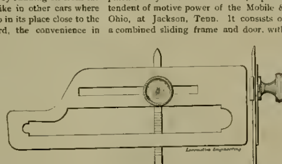


The same frog is used on either side of a derailed car; the slot in the frog fitting over the rail prevents any pushing away of the frog, crushing of ties, etc., and the heavy eccentric latch firmly grips the thin part of the rail to prevent the frog from slipping ahead, and is itself protected by the plate.

In this day of heavy equipment light, trappy wrecking frogs are of little or no use. These frogs weigh 350 a pair, and the makers guarantee them against injury by anything on wheels.

## Blackall's Tire Gauge.

The tool illustrated in the annexed engraving is the gauge used on the Delaware & Hudson for measuring the wear of tires. The device was gotten up by Mr. R. C. Blackall, the superintendent, and is simplicity personified. The recess at the end of the gauge goes over the flange and the straight surface rests on the face of the tire. The graduated slide is then slipped to the worn surface, and while in this position the thumb-screw is tightened. When the gauge is removed the graduated slide shows the amount the tire is worn beneath the original surface. The gauge is made of thin iron and can be carried conveniently in the pocket.



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An improved car door has been patented by Mr. M. T. Carson, superintendent of motive power of the Mobile & Ohio, at Jackson, Tenn. It consists of a combined sliding frame and door, with provision for holding the frame securely in place, and special mechanism for holding the door tight in the door opening of the car. The object of the invention is evidently the making of a car door that will be easily operated and at the same time be perfectly weather-tight.

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The Central Railroad & Banking Co. of Georgia are trying some of the Fox pressed steel trucks under tenders.

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A patent has been granted to A. P. Massey, Watertown, N. Y., for an improvement in brake gear, intended to make the load of a car vary the leverage of the brake. This would be a very important improvement if it should work satisfactorily. The means employed in the arrangement designed by Mr. Massey appear to be very simple and therefore promising of practical utility.

## New B. & O. Cars.

The new passenger coaches built by the Pullman Company for the Baltimore & Ohio Railroad, and run between New York, Cincinnati and St. Louis, are models of the car builder's art, combining all known appliances devised to secure the comfort and absolute safety of passengers. While the train will be virtually made up in Baltimore it is really to be an extension of the 9 A. M. daily Royal Blue Line Express from New York. The entire train is vestibuled, including postal and baggage cars, and fitted with Pullman's latest anti-telescoping device. The standard Pullman color, an olive brown, is used. If the cars were blue they would, in every sense, be Royal Blues, for they are built upon the same model, and look just as pretty, stanch and shapely. There is the familiar coat-of-arms which decorates the Royal Blues, except that the Maryland insignia only appears. The interior bears even more striking resemblance, the upholstery being in old gold velvet plush and the woodwork being of mahogany. The only notable departure from the interior designs of the Royal Blues is the absence of the smoking compartments, which are rendered unnecessary by reason of the fact that the forward coach of the train is assigned to smokers. Each car has separate toilet rooms for ladies and gentlemen and a lavatory. A porter, in addition to the one in the Pullman sleeper, will accompany each train.

One of the most striking improvements is the substitution of easy-sliding damask curtains for the tight-fitting slatted wooden blinds, which are the accompaniment of a double window, the upper section being of frosted glass. For each window there are also dust screens and dust deflectors, which provide a delightful draught of fresh air free from dust. The cars are heated by steam drawn from the locomotive, and also are provided with Baker's patent heater, for use in case the car should be detached from the locomotive, or in case the supply of steam from the engine should for any reason fail. The cars are heavily carpeted, have reversible seats, and are provided with an automatic device by which the conductor can signal the engineer. In short, every provision known to the car builder is made for the safety and comfort of passengers, and the high standard of the entire equipment is in keeping with the aim of the present Baltimore & Ohio management—to place at the service of its patrons the best facilities for their accommodation obtainable, and to attain the highest speed for its trains that is compatible with absolute safety.

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The poster pictures of "New and Old" locomotives recently sent out by us has attracted a great deal of attention, and the demand for them has been so great that another lot have been made. We will send one free to anyone who will put it up where railroad men can see it.

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We have received a prospectus for proving and introducing the Loeber air car, which has evidently been sent expecting that it would receive a notice. It is well worthy of mention. There is a picture in the front of an immense vessel, like the hull of a ship upside down, with big projections on the sides that are supposed to represent wings. The thing is represented to be flying in the air, with a city far away beneath it. When we look at the picture of the Loeber air car in this position, the refrain of an absurd song keeps coming to our mind, which began "When hogs begin to fly." The projectors of the car say that it will be made of steel, and some beneficial scheme has been imagined for making the car overcome the laws of gravity. Old Nature is hard to cheat, and we do not expect to see the Loeber car rise into the air until the time when hogs begin to fly.

### Some Freaks of Fate.

By John Alexander.

I am just back from a visit to old scenes, old chums, and old memories of my interesting experience on the western fringe of Uncle Sam's great gray blanket — the plains.

If some of you fellows who know more about writing than about running engines would only go out there for a year and keep your eyes and ears and brains open, and your mouths shut, you could come home and write us some true stories that would make fiction-grinders exceedingly weary.

The frontier attracts strong characters, men with the pioneer spirit, men who are willing to sacrifice something to gain an end; men with loves and men with hates. Bad men there are there, some of them hunted from Eastern communities, perhaps, but you will find no fools and mighty few weak faces—there's character in every feature you look at.

Every one is there for a purpose, to accomplish something; to get ahead in the world, to make a new start; perhaps to live down something or to get out of the rut cut by ancestors; some may only want to drink, and shout, and shoot, but even these do it with a vim—they mean it.

Of the many men who ran engines at the front on the Santa Fé with me, I recall few whose lives were purposeless; almost every one had a life-story.

If there is anything that I enjoy it's to sit down to a pipe and a life-story—told by the subject itself. How many I have listened to out there, and every one of them worthy the pen of a Kipling.

The population of the frontier is never all made up of men, and the women all have strong features, too—self-sacrifice, devotion, degradation or *something* is written on every face. There's no blanks in that lottery—there's no material there for homes of feeble-minded.

It isn't strange, either, when you come to think of it, fools never go anywhere, they are just born and raised. If they move it's because they are "took"—you never heard of a pioneer fool.

One of the strongest characters I ever knew was a runner out there by the name of Gunderson—Oscar Gunderson. He was of Swedish parentage, very light-complexioned, very large, and a splendid mechanic, as Swedes are apt to be when they try. Gunderson's name was, I suppose, properly entered on the company's time-book, but it never was in the nomenclature of the road. With the railroaders' gift for abbreviation and nickname, Gunderson soon came down to "Gun," his size, head, hand or heart furnished the prefix of "Big," and "Big Gun" he remains to-day, Big Gun among his friends, but simple Gun to me. I think I called him Gun from the start.

Gun ran himself as he did his engine, exercised the same care of himself, and always talked engine about his own anatomy, clothes, food and drink

His hat was always referred to as his "dome casing," his Brotherhood pin was the "number plate," his coat was the "jacket," his legs the "drivers," his hands the "pins," arms were "side-rods," stomach "firebox," and his mouth the "pop".

He invariably referred to a missing suspender button as a "broken spring hanger," to a limp as a "flat-wheel," he "fired up" when eating; he "took water" the same as the engine; and "oiled 'round" when he tasted whisky.

Gun knew all the slang and shop-talk of the road and used it—was even accused of inventing much of it—but his engine-talk was unique and inimitable.

We roomed together a whole winter, and often, after I had gone to bed, Gun would come in, and as he peeled off his clothes, he would deliver himself something as follows

"Say, John, you don't know who I met on the up trip? Well, sir, Dock Taggert. I was sailin' along up the main line near Bob's an' who should I see but Dock backed in on the sidin'—seemed kinder dilapitated, like he was runnin' on one side. I jest slammed on the wind and went over and shook. Dock looks pretty tough, John—must have been out surfacing track, ain't been wiped in Lord-knows-when, oiled a good 'eal but narry a wipe, jacket rusted and streaked, tire double flanged, valves blowin', packing down, don't seem to steam, maybe's had poor coal, or is all limed up. He's got to get through the back shop 'fore the old man 'll ever let him into the roundhouse. I set his packin' out and put him in a stall at the grays' corrall, hope he'll brace up. Dock's a mighty good workin' scrap if you could only get him to carryin' his water right; if he'd come down to three gauges he'd be a dandy, but this tryin' to run first section with a flutter in the stack all the time is no good—he must 'a flagged in."

Which being translated into English, would convey the information that Gun had seen one of the old ex-engineers in Bob Slatterly's saloon, had stopped and greeted him. Dock looked like he had walked, had drank, was dirty, coat had holes, soles of his shoes badly worn, wheezing, seemed hungry and lifeless, been eating poor food, and was in a general run-down condition Gun had "set out his packing" by feeding him and put him in a bed at the Grand Central Hotel—nicknamed the graybacks' corrall. Gun thought he would have to reform before the M. M would put him into active service. He was a good engineer, but drank too much, and, lastly, he was in so bad a condition that he could not get himself into headquarters but some one helped him by "flagging for him."

Gun was a bachelor; he came to us from the Pacific side, and told me once that he first went West on account of a woman, but—begging Mr. Kipling's pardon—that's another story.

"I don't think I'd care to double-crew my mill," Gun would say when the conversation turned to matrimony. "I've been raised to keep your own engine and take care of it, and pull what you could. In double-heading there is always a row as to who ought to go ahead and enjoy the scenery or stay behind and eat cinders."

I knew from the first that Gun had a story to tell if he'd only give it up, and, I fear, I often led up to it with a hope that he would tell it to me—but he never did.

My big friend sent a sum of money away every month, I supposed to some relative, until one day I picked up from the floor a folded paper, dirty from having been carried long in Gun's pocket, and found a receipt. It read:

"Mission, San Antonio, Jan. 1, 1878.

"Received of O. Gunderson, for Mabel Rogers, $40.00. Sister Theresa."

Ah, a little girl in the story, I thought, it's a sad story then. There's nothing so pure and beautiful and sweet and joyous as a little girl, yet when a little girl has a story it's almost always a sad story.

I gave Gun the paper, he thanked me, said he must look out better for those receipts and added that he was educating a bit of a girl out on the coast.

"Yours, Gun?" I asked kindly.

"No, John, she ain't, I'd give $5,000 if she was."

He looked at me straight with that clear blue eye, and I knew he told me the truth.

"How old is she?" I asked.

"I don't know—'bout five or six."

"Ever seen her?"

"No."

"Where did you get her?"

"Ain't had her."

"Tell me about her?"

"She was willed to me, John, kinder put in extra, but I can't tell you her story now, partly because I don't know it all myself, and partly because I won't — I won't even tell her."

I did not again refer to Gun's little girl, and soon other experience and other autobiographies crowded the story out of my mind.

One evening in the spring I sat by the open window enjoying the cool night breeze from off the mountains, when I heard Gun's cheery voice on the porch below. He was lecturing his fireman in his own unique way

"Well, Jim, if I ain't ashamed of you there ain't no one; coming into general headquarters with a flutter in the stack, so full that you can't whistle, air pump a-squealing 'count of water, smeared from stack to man-hole, head-light smoked and glimmery, don't know your own rights, kind o' running wildcat, without proper signals, imagining your first one with a regardless order.

"You want to blow out, man, and trim up, get your packing set out and carry less juice. You're worse than one of their slippin', dancing, three-legged no-good Grants. The next time I catch you at high-tide I'll scrap you, that's what I'll do, fire you into the scrap-pile.

"Why can't you use some judgment in your runnin'? Why can't you say, 'Why, here's the town of Whisky, I'm going to stop there and oil around,' sail right into town, put the air on steady and fine, bring her right down to the proper gait, throw her into full release so as to just stop right, shut off your squirt, drop a little oil on the worst points, ring your bell and sail on.

"But you, why you come into town forty miles an hour, jam on the emergency and while the passengers pick 'emselves out of the ends of the cars you go into the supply house and leave the injector on, an' then when you go to move you're too full to move without opening your cylinder-cocks and givin' yourself dead away.

"Now I'm goin' to Californ. next month and if you get so as you can tell when you've got enough liquor without waiting for it to break your injectors, I'll ask the old man to let you finger the plug on the Esmeralda whilst I'm gone. But I'm dambed if I don't feel as if you was like that measly old 19—jest fit to be jacked up and saw wood."

While Gun was in California I was taken home on a requisition from Mrs. A. and Oscar Gunderson and his little girl became a memory—a page in a book that I had partly read and lost, but not entirely forgotten.

Last month I took the west-bound express at Topeka, and spreading my grip, hat, coat and umbrella, out on the seats, so as to resemble an experienced English tourist, I fished up a Wheeling stoga and a book and went into the smoking-pen of the sleeper, and had it all to myself for half an hour.

The train stopped to give the thirsty tender a drink and a man came in to wash his hands. He had been riding on the engine.

After washing he stepped to the door of the "smokery," struck a match on the leg of his pants, held both hands around the end of his cigar while he lighted it, then waving the match to put it out, he threw it down and came in.

While he was absorbed in all this I took a glance at him. Six-foot-four if an inch, high cheek bones, yellow beard, clear blue eyes, white skin, and a hand about the size of a Cincinnati ham. I knew that face despite twelve years of turkey-tracks about the eyes.

"Gunderson, old man, how are you?" I said, offering my fin.

"Well, John Alexander, how in the name o' thunder did you get away out here on the main stem without orders?"

"Inspection car," said I, "how'd you get here?"

"Deadheading home, been out on special, a gilt-edged special, took her clean through to New York."

"You did!" I exclaimed, "why, how was that?"

"Went up special to a weddin', don't you see? Went up to see a new compound start off—prettiest sight I ever see—working smooth as grease, but I'm kinder dubious about repairs and general running. I'm anxious to see how the performance sheet looks at the end of the year, John."

"Who's been double-heading, Gun?"

"Why—why, my little girl, trimmest, neatest, slickest little mill you ever saw. Lord, but she was painted red and white and gold leaf, three brass bands on her stack, solid nickel trimming, all the latest improvements, corrugated firebox, high pressure, smoke-consumer, and sand jet—jest made a purpose for specials and pay car. But if she ain't got herself coupled on to a long fireboxed ten-wheeler, with a big lap and a Joy gear, you can put me down for clinker. Yes, sir, the baby is a heart-breaker on dress parade, and the ten-wheeler is a whale on business, and if they don't jump the track, you watch out for some express speed that will make the canals sick, see if they don't"

Without giving me time to say a word he was off again.

"You ought to have seen 'em start out, nary a slip, cutting off square as a die, small one ahead speaking her little piece chipper and fast on account of her smaller wheels, and the ten-wheeler barking bass, steady as a clock, with 180 on the gauge, a full throttle, and half a pipe of sand. You couldn't tell to save you whether the little one was pulling the big one or the big one shoving the little—never saw a relief train start out in such shape in my life"

Gunderson was evidently enthusiastic over the marriage of his little girl.

We talked over old times and the changes, and followed each other up to date with a great deal of mutual enjoyment, until the porter demanded the "smokery" for his bunk.

As we started for bed Gun laid his hand on my shoulder and said

"John, a good many years ago you asked me to tell you the story of my little girl. I refused then, for her sake. I'll tell you in the morning"

After a hearty breakfast and a good cigar Gunderson squared himself for the story. He shut his eyes for a few minutes as if to recall something, and then, speaking as if to himself, he said

"Well, sir, there wasn't a simmer anywhere, dampers all shut; you wouldn't a-suspected they was up to popping point, but the minute they got their orders and the con. put up his hand, so, up went—"

"Say," I interrupted. "I thought I was to have the story. I believe you told me about the wedding last night. The young couple started out well."

"Oh, yes, old man, I forgot, the story, well get on the next pit here," motioning to a seat next him, "and I'll give you the history of an old hook-motion, name of Oscar Gunderson, and a trim "Class G" made of solid silver from pilot to draft gear.

"You think I'm a Swede, well I ain't, I don't know what I am, but I guess I come nearer to being a Chinaman than anything else. My father was a sea captain and my mother found me on the China Sea—but they were both Swedes just the same I had two sisters older than myself, and in order to better our chances father removed to New York when I was less than five years old

"He soon secured work as captain on a steamer in the Cuban trade and died at sea when I was ten.

"I had a bent for machinery and tried the old machine shops of the Central road, but soon found myself firing

"I went to California shortly after the war on account of a woman—mostly my fault.

"Well, after running around there for some years, I struck a job on the Virginia & Truckee in '73.

"Virginia City and Carson and all the Nevada towns were doing a full rush business, turning every wheel they had, with three crews to a mill. Why, if you'd go down town in any one of them at night, and see the crowds around the gamblers and molls, you'd think hell was a-coming

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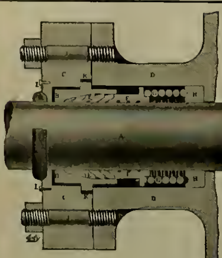

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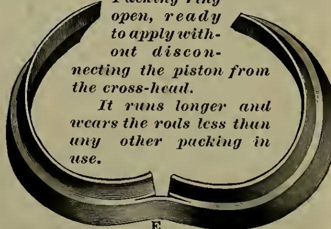


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forty-mile an hour, and that it wan't more than a car length away.

"Well, one morning I came into Virginia about breakfast time, and, with the rest of the crew, went up to the old California Chop-house for breakfast. This same chop-house was in a building about good enough for a stable these days, but it had a reputation then for steaks. All the gamblers eat there, and it's a safe rule to eat where the gamblers do in a frontier town if you want the best there is, regardless of price.

"It was early for the regular trade, and we had the dining-room mostly to ourselves for a few minutes, then there were four women folks came in and sat down at a table bearing a card, 'Reserved for Ladies.'

"Three of them were dressed loud, had signs out whereby any one could tell that they wouldn't be received into no Four Hundred, but one of them was a nice-looking, modestly dressed woman, had on half mourning if I remember. She had one of them sweet, strong faces, John, like the nun when I had my arm broke and was scalded, her sweet mouth kept mumblin' prayers but her fingers held an artery shut that was trying its damdest to pump Gun Gunderson's old heart dry—strong character, you bet.

"Well, that woman sat facing our table and kept looking at me; I couldn't see her without turning, but I knew she was looking. John, did you ever notice that you could *feel* the presence of some people; you knew they were near you without seeing them? Well, when that happens, don't forget to give that fellow due credit; for whoever it is, they have the strongest mind—the dominant one.

"I *had* to look around at that woman. I shall never forget how she looked; her hand was on the side of her face, her great, brown, tender eyes were staring right at me—she was reading my very soul. I let her read.

"I had been jacking up a gilly of a gafter who had referred to his mother as 'the old woman,' and I didn't let the four females disturb me. I meant to hold up a looking-glass for that young whelp to look into. I hate a man that don't love his mother.

"'Why,' says I, 'you miserable example of divine carelessness, do you know what that "old woman" mother has done for you, you drivellin' idiot, a thankin' God that you're alive and forgetting the very mother that raised you; if you could see the tears she has shed, if you could count the sleepless nights that she has put in, the heartaches, the pain, the privation that she has humbly, silently, even thankfully borne that you might simply live, you'd squander your last cent to make her life a joy from this day till her light goes out. A man that don't respect his mother is lost to all decency; a man who will hear her name belittled is a Judas, and a man that will call his mother "old woman" is a no-good, low-down, misbehaven whelp. Why, damn it, I'd fight a buzz-saw if it called my mother "old woman"—and she's been dead a long time; gone to that special, exalted, gilt-edged and glorious heaven for mothers. No one but mothers have a right to expect to go to a heaven, and the only question that'll be asked there is, "Have you been a mother?"

"Well, sir, them women clapped their hands; I looked around, and there were tears in the eyes of that one woman.

"She got up, came over to our table, laid a card by my plate, and said: 'I beg your pardon, but call on me, do.'

"I was completely knocked out, but told her I would, and she went out alone; the others finished their breakfast.

"She had no sooner gone than Cy Nash, my con., commenced to giggle—'Made a mash on the flyest woman in town,' he tittered, 'ain't a blood in town but what would give his head for your boots, old man, that's Mabel Verne—owns the Odeon dance hall and the Tontine in Carson.'

"I glanced at the card, and it did read, 'Miss Mabel Verne, 21 Flood avenue.'

"'Well, Flood avenue is no slouch of a street, the best folks live there,' I answered.

"'Yes, that's her private residence, and if you go there, and are let in, you'd be the first man ever seen around there. She's a curious critter, never rides or drives, or shows herself off at all; but you bet she sees that the rest of the stock show off. She's in it for money, I tell you.'

"I don't know how, but it made me kind o' heart-sick to think of the hell that woman must be in, for I knew by her looks that she had a heart and a brain, and that neither of them was in the Odeon or the Tontine dance-house.

"I thought the matter over, and didn't go to see her. The next trip, she sent a carriage for me.

"She met me at the door, and took my hat, and, as I dropped into an easy chair, I opened the ball to the effect that 'this here was a strange proceeding for a lady.'

"'Yes,' said she, sitting down square in front of me, 'it is; I felt as if I had found a true man when I first saw you, and I have asked you here to tell you a story, my story, and ask your help and advice. I am so earnest, so anxious to do thoroughly what I have undertaken, that I fear to overdo it; I need counsel, restraint; I can trust you. Won't you help me?'

"'If I can. What is it you want me to do, madam?'

"'First of all, keep a secret, and next, protect, or help protect, an innocent child.'

"'Suppose I help the child, and you don't tell me the secret?'

"'No, it concerns her, the child, sir; she is my child; I want her to grow up without knowing what her mother has done, or how she has lived and suffered, you wouldn't tell her that, would you?'

"'No, certainly not.'

"'Nor anyone else?'

"'No.'

"'You would judge her alone—forgetting her mother?'

"'Yes.'

"'Then I will tell you the story.'

"She got up and changed the window blinds, so that the light shone on my face, I guess she wanted to study the effect of her words.

"'I was born at Sacramento,' she began; 'my father was a well-to-do mechanic, and I his only child; I grew up pretty fair looking, and my parents spent about all they could make to complete my education, especially in music, of which I was fond. When I was eighteen years old I fell in love with a young man, the son of one of the rich merchants of San Francisco, where we had removed. Like many another foolish girl, I trusted too implicitly and believed too easily, and soon found myself in a humiliating position, but trusted to the honor of my lover to stand by me.

"'When I explained matters to him he seemed pleased, said he could fix that easy enough; we would get married at once and claim a secret marriage for some months past.

"'He arranged that I should meet him the next evening, and go to an old priest in an obscure parish and be married.

"'I stood long hours on a corner, half dead with fear, that night, for a lover that never came. He's dead now, got run over in Oakland yard, that very night, as he was running away from me, and as I waited and shivered under the stars and the fire of my own conscience.'

"'Did he stand on one track to get out of the way of another train and get struck?' I asked.

"'Yes,' looking at me close.

"'Did he have on a false moustache, and a good deal of money and securities in a satchel and everybody think at first he was a burglar?'

"'Yes, but how did you know that?'

"'Because I killed him.'

"'You!'

"'Yes. I ran an engine over him, couldn't make him hear or see me. He was the first man I ever killed; strange he should be *this* particular man.'

"'It's fate,' said the woman, rocking slowly back and forth, 'it's fate, but it seems I like you better now you were my avenger, that accident drove revenge out of my heart, caused me to let *him* be forgotten, and to live for my child. I have lived for her. I live to-day for her and I will continue to live for her.

"'My disgrace killed my mother and ruined my father. I swore I would be an honest woman, and I sought employment to earn a living for my babe and myself, but every avenue was closed to me. I washed and scrubbed while I was able to teach music splendidly, but I could get no chance. I made shirts for a pittance and daily refused, to me, fortunes, for dishonor. I have gone hungry and almost naked to pay for my baby's board, but I was hunted down at last.

"'One day, after many rebuffs in seeking employment, I went to the home of a sister of my child's father, and took the baby, told her who I was and asked her to help me to a chance to work. The good woman scarcely looked at me or the child; she said that had it not been for such as I poor Charles would have been alive, his blood was on my head, I ought to ask God to wash my blood-stained hands.

"'I went away from that house with my mind made up what to do. I would put my child in honest hands, and chain myself to the stake to suffer everlasting damnation for her sweet sake.

"'She is in the Mission San Antonio now, between three and four, a perfect little princess, she looks like me, and grows, oh, so lovely. If you could see her you'd love her.

"'I can't go to see her any more; she is old enough to remember. The last time I was there she demanded a papa.

"'I am making a great deal of money. Many of the rich men, whose Puritan wives and daughters refused me honest work, are squandering lots of their wealth in my houses. I am saving money, too, and propose as soon as I get a neat fortune together to go away to the ends of the earth, and have my little girl with me. I will raise her to know herself and to know mankind.'

"'And what do you want me to do, madam?'

"'I want you to be that child's guardian, the honest man through whom she will reach the outside of San Antonio and the world. Who will go between me and her until a happier time.'

"'I am only a rough engineer; the child will be raised to consider herself well off, perhaps rich.'

"'Adopt her. I will stay in the background, make her expenditures and her education what you like. I will trust you.'

"'I can't do that.'

"'You are single, your life is hard, I have money enough for us all. Let us go to the Sandwich Islands, anywhere, and commence life anew. The little one will know no other father, and all inquiry will be stopped.'

"'I couldn't think of it, my dear madam, it's too easy; it's like pulling jerkwater passenger—I like through freight.'

"Well, John, to make a long story short, the interview ended about here, and several more get to about the same place. There were a thousand things I could not help but admire in that woman, and I liked her better the more I knew her. But it wan't love, it was sort of an admiration for her love of the child and the nerve she displayed in its behalf. But I shrank from becoming her husband or companion, although I think she loved me, in the end, better than she ever did anybody.

"However, I finally agreed to look after the little one in case anything happened to her, the mother, and commenced then to send the money for her board and tuition, and the mother dropped out of all connection with the child or those having her in charge.

"The mother made her pile and got out of the business, and at my suggestion went down near Los Angeles and bought a nice country place, to start respectable before she took the little one home. She left money in Carson, subject to my check, for the little girl, and things slid along for a year or so all smooth enough.

"I was out on a snow bucking expedition one time the next winter, sleeping in cars, shanties or the engine, and I soon found myself all buggered up with the worse dose of rheumatiz you ever see. I had to get down to a lower altitude, and made for Sacramento in the spring. I paid the mission a year in advance, and with less than a hundred dollars of my own, struck out, hoping to dodge the twists that were in my bones.

"A hundred blind gaskets don't go far when you're sick, and the first thing I knew I was dead broke, couldn't pay my board, couldn't buy medicine, couldn't walk—nothing but think and suffer. I finally had to go to a hospital. Not one of the old gang ever came to see me. Old Gun was a dandy when he was making—and spending—a couple hundred a month; the rest of the time he was supposed to be dead.

"I might have died in the hospital, if fate hadn't decreed to send me relief. It suddenly dawned upon me that I was getting far better treatment than usual, had a special nurse, the best of food, flowers, etc., all labeled "From the boys."

"I found out, after I was well enough to take a sun bath on the porch, that a woman had sent all my luxuries, and that her purse had been opened for my relief. I knew who it was at once, and was anxious to get well and at work, so as not to live on one who was only too glad to do everything for me.

"A six months' wrastle with the twisters leaves a fellow stiff-jointed and oldish, and laying in bed takes the strength out of him. I took a notion to get out and go to work one day, and walked down to the shops—I was carried back, chuck full of 'em again.

"The doctor said I must go to Ojo Caliente, away down south, if I was to get well. John, if the Santa Fé road had a-been for sale for a cent then I couldn't a-bought a spike.

"At about the height of my ill-luck I got a letter from Mabel Verne—she had another name, but that don't matter—and she asked me again to come to her, to have a home, and care and devotion. It wasn't a love-sick letter, but it was one of them strong, tender, *fetching* letters. It was unselfish, it asked very little of me and offered a good deal.

"I thought over it all night, and decided at last to go. What better was I than this woman? Surely she was better educated, better bred. She had made one mistake, I had made many. She had no friends on earth, I didn't seem to have any either. I hadn't had a letter from either of my married sisters for six or eight years then. We could trust one another and have an object in life in the education of the child. I'd be no worse off than I was, anyway.

"The next morning I felt better. I got ready to leave, bid all my fellow flat-wheels good bye, and had a gig ordered to take me to the train—the doctor had given me two hundred dollars a short time before, 'from a lady friend.'

"As I sat waiting for the hack, they brought me a letter from home—a big one with a picture in it. It was from my youngest sister, and the picture was of her six-year boy, named for me—such a happy, sunny little Swede face you never see. 'He always talks of Uncle Oscar as a great and good man,' wrote Carrie, 'and says every day that he's going to do just like you. He will do nothing that we tell him Uncle Oscar would not like, and anything that he would. If you are as good as he thinks you are you are sure of heaven.'

"And I was even then going off to live with a woman who made a fortune out of Virginia City dance houses. I had a sort of a remorseful chill, and before I really knew just where I was I had got to Arizona, and from there went to the Santa Fé where you knew me.

"I wrote my benefactress an honest letter, and told her why I had not come, and in a

short time sent her the money she had put up for me; but it was returned again, and I sent it to the mission for my little girl.

"Well, while I was with you there I got a fare-thee-well letter, saying that when I got that Mabel Verne would be no more—same as dead—and that she had deposited forty thousand dollars in the Phœnix Bank for *your* little girl — *yours*, mind ye — and asked me to adopt her legally and tell her her mother was dead.

"John, I ain't heard of that woman from then till now. I thought she had got tired of waiting on me and got married, but I believe she is dead.

"I went to California, adopted the baby —a daisy too—and I've honestly tried to be a father to her.

"I got to making money in outside speculations, and had plenty, so I let her money accumulate at the Phœnix and paid her way myself.

"About four years ago I left the road for good, bought me a nice place just out of Oakland, and settled down to take a little comfort.

"Mabel, my daughter Mabel, for she called me papa, went to Germany nearly three years ago in charge of her music teacher, Sister Florence, to finish herself off. Ah, John, you o'rt to see her claw ivory. Before she went she called me into the mission parlor one day and almost got me into a snap; she wanted me to tell her all about her parents right then, and asked me if there wasn't some mystery about her birth, and the way she happened to be left in the mission all her life, her mother disappearing, and my adoption of her."

"What did you tell her, Gun?" I asked.

"Why, lied to her, of course, as any honorable man would have done. I told her that her father was an engineer, and a friend of mine, and that he was killed in an accident before she was born—that was all plausible enough.

"Then I told her that her mother was in poor health and had died just before I had adopted her, and had left a will giving her to me, and beside had left forty thousand dollars in the bank for her when she married or became of age.

"Well, John, cutting down short, she met a fellow over there, a New Yorker, that jest seemed to think she was made a-purpose for him, and about a year ago he wrote and asked me for my daughter—think of it. His petition was seconded by the baby herself, and recommended by Sister Florence.

"They came home six months ago, and the baby got ready for dress parade, and Sister Florence and I went down to New York and seen 'em off; but here's where old Fate gets in his work again. That rascal of an O. B. Sanderson—I didn't notice the name before — was my own nephew, the very young cuss whose picture kept me from marryin' the baby's mother. I never tumbled till I ran across his mother, she was my sister Carrie.

"John, I don't care a Continental cuss how good he was, the baby was good enough for him—too good—I just said nothing and watched the signals. You or't to a seen me a-givin' the bride away. Then, when it was all over and I was childless, I give the bride a check for forty-seven thousand and a fraction, kissed her, and lit out for home—and here I am.

"But I ain't satisfied now, and just as quick as I get back, I'm a going running again, then, when I get so old I can't see more'n a car length, I'm going to ask for a steam-pump to run. I'm a going to die a railroading."

"Have you ever made any inquiries about the mother, Gun?" I asked.

"No, not much, it's so long now 'taint no use, I guess that her light's gone out."

"What would you do if she was to turn up?"

"Well, I don't know; I guess I'd keep still and see what she done."

"Suppose, Gun, that she showed up now, loved you more than ever for what you have done, and renewed her old proposal? You know it's leap year."

"Well, old man, if an angel flew down out of the sky and give me a second-hand pair of wings, and ordered me to put 'em on and follow her, I guess I wouldn't refuse to go out. Time was, though, when I'd a held out for new, gold-mounted ones or nothing; but that won't come, John; but you just or't to a been to the consolidation, it was just simply—well, pulling the president's special would be just like hauling gravel train to it."

The train stopped suddenly here, and Gun said he was going ahead to get acquainted with the water-boiler, and I took out my note-book and jotted down a few points.

After the train got into motion again, I was reading over my notes, when, without looking, I thought Gunderson had come back, and I moved along in the seat to give him room, but a black dress sat down beside me.

We had been sitting with our backs to a curtain between the first berth and a state-room. The lady came from the state-room.

"Pardon me, sir," she said; "I want to finish that story. I have heard it all; I am Sister Florence, music teacher to Mr. Gunderson's daughter; he does not know that I am on this train.

"Mr. Gunderson did not tell you that the Phœnix Bank failed some months ago, and that the fortune of his adopted child was lost. He never told her, and she does not know it to-day ——"

"He said he paid her the full amount," I interrupted.

"Very true. He did. But he paid it out of his own pocket. Sold his farm, put up all his securities, and borrowed seven hundred dollars to make the sum complete. That is the reason he is going to run an engine again. He does not know that I am aware of this, so don't mention it to him."

"Gun is a man," said I, "a great, big-hearted, true man!"

"He is a nobleman!" said the nun, arising and going back into the state-room.

Half an hour later Gunderson came back, took a seat beside me, and commenced to talk.

"Say, John, that's the hardest riding old pelter I ever see, about three inches of slack between engine and tank, pounding like a stamp-mill and ——," looking over his shoulder, then at me, "John, I could a swore there was some one standing right there, I *felt* 'em."

"It seems to me they or't to keep up their engines here in pretty good shape. They've got bad water, and so much boiler-work that they have to have new flues before the machinery gets worn much. But, Lord, they don't seem ——" he looked over his shoulder again, quickly, then settled in his seat to resume, when the door of the state-room opened softly and a pair of hands covered Gun's eyes—the nun's hands.

"Guess who it is Gun?" said I, and noticed that he was very pale.

"It's Mabel," said he, putting up his hands and taking both of hers, "no one but her ever made me feel like that."

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Mr. Charles M. Raymond, a young man who had the good sense to learn the details of iron-rolling right at the rolls, after coming out of college, has been placed in charge of the Cambria Iron Company's new 26-in. billet mill, at Johnstown, Pa. Few young men of twenty-two get a chance like this.

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At a point in New Brunswick we lately examined a locomotive built by a firm in Manchester which is almost an exact copy of the old form of Baldwin straight-boiler eight-wheel engines. English builders seldom make cast iron wheels of any kind, but this engine has cast iron driving wheel centers and chilled wheels in truck and tender. The boiler is of steel, and is evidently too hard, for one of the sheets blew out, and the metal is said to be so hard that it could be tempered. The fire-box sheets are also said to be very hard and given to cracking, although the water used makes no incrustation to cause overheating.

## When Does it Pay to Destroy a Locomotive.

By A. Doibeer.

The question of what is the profitable age that a locomotive can be maintained to, is one over which opinions differ. There are railroads that are prominent and profitable that have locomotives in service that are twenty-five years old. There are other roads that have destroyed engines that were less than twelve years old.

We must bear in mind that the condition of a locomotive rather than its age should be the pivot upon which rests the proposition of whether it is policy to consign it to the scrap pile, or by repairs continue it in service.

We must bear in mind that the capacity of rolling stock has increased two-fold within the past fifteen or twenty years. Twenty years ago we stood in the yard of a prominent railroad, and saw a train of new cars, each loaded with fifteen tons of coal. There have for several years past been many cars with double that load passing over the road. Many car builders claimed and still claim that this load is excessive, but still the capacity is increasing.

So with locomotives. We remember when a locomotive of 60,000 lbs weight, with cylinders 16x24, was considered large. To-day few freight engines are built of less than 100,000 lbs. weight and with cylinders less than 19x24, while many are in use of 120,000 lbs. weight and 20x24 cylinders.

We speak of this simply to illustrate that the advancement and changes of railroads and their equipment will to a great extent enter into the question of economy of maintaining engines that were built fifteen or twenty years ago. The Pennsylvania Railroad fifteen years ago began the process of destruction of its old power, yet, last year, we saw upon this road an engine that was over twenty years old. We recognized it at once as an old-time acquaintance. This engine, while not so heavy as one of the modern type, was equipped with 20x24 cylinders. This road, which, we believe, was the pioneer in the destruction of old power, was using engines older than many newer ones which had years before been destroyed.

You cannot consider this question from a motive-power standpoint exclusively, but let us see how it stands as far as that department is concerned.

Let us take an engine that has been in active service hauling freight for twelve years past. This engine comes to shop and you look it over, and find the engine will have to receive new firebox and one flue-sheet, new cab, cylinders, tender-cistern, and tires. At same time you will apply air-pump and driver-brakes, and very likely apply some new driving-axles. This engine will cost for these repairs $3,000. While these repairs are going on you watch things carefully. The boiler is swung out of frames, and after flues are out and inside of boiler is cleaned, you find things you do not like. Your boiler-maker calls your attention to the fact that one sheet in the boiler looks bad, thin in some places, and in another, narrow, longitudinal grooves worn in sheet. However, you feel that the boiler is safe after it stands the hydraulic pressure. Your firebox is put in, and you look with some pride upon the work that has been done, but that boiler-maker of yours will probably spoil your good feeling, which is enough to commend him for doing a good job, by remarking. "Yes, it's a good job, but that throat-sheet—" Then he will wag his head. "Well, what's the matter with that—isn't that all right?" "Yes, it is all right for a while," is his answer, "but it is only going to be a short time before that will have to be renewed." You leave the boiler and go over into the blacksmith-shop, where one of the frames is being straightened, and you find them interviewing a crack that had developed by getting the frame hot. You have this remedied by welding, and instruct them to bring in the other frame and examine that. And so you go. Whichever way you turn the engine is showing weakness that was never dreamed of while in service, and you wonder whether your $3,000 estimate is going to hold out. Time goes on and the engine goes into service. We will say that it is satisfactory, and you are getting good service, and it runs without mishap for a year, or perhaps eighteen months, when the engine comes to shop for repairs. About the time this engine was turned out of shop a new engine was bought and put on the road. This engine comes into shop for repairs at same time. You look over the expenses during the past year, and you will find the engine which you had repaired so thoroughly, has cost a great deal more than the new one for running repairs. You give both engines the repairs they need, and find the cost of the new one $250, while upon the other engine you are lucky if it does not reach $1,000 or $1,200.

Now, let me ask my mechanical friends if we have stretched that little fable any? It don't happen to be a fable, it is a fact based upon actual experience. The next year when your engines come to the shop you will find that the one engine will cost about $600, the other will cost you at least $1,200.

We have been asked to prepare a table with estimated cost of repairs for eight (8) years to an engine that is twelve (12) years old and to one that is new. Below is the estimate. We invite criticism of it, fairly, fully and freely.

| | Eng. No. 1 (Old). | Interest. | Eng. No. 2 (New) | Interest |
|---|---|---|---|---|
| Value as scrap. | $800 | | | |
| Cost of repairs | 3,000 | | | |
| | $3,800 | | $9,000 | |
| First year | 1,000 | $100 | 250 | $450 00 |
| Second year | 1,200 | 240 | 600 | 462 50 |
| Third year | 1,500 | 300 | 1,000 | 492 50 |
| Fourth year | 3,000 | 375 | 1,400 | 542 50 |
| Fifth year | 2,000 | 525 | 1,500 | 642 50 |
| Sixth year | 2,000 | 625 | 1,600 | 707 50 |
| Seventh year | 2,500 | 725 | 1,800 | 787 50 |
| Eighth year | 2,500 | 850 | 2,000 | 877 50 |
| Total | $19,500 | $3,830 | $19,550 | $4,952 50 |

You find by this estimate that you have now one locomotive on your hands at the end of eight years that has, including its price, cost you $19,550. The older engine has cost you $18,700 for repairs alone. Had you sold the older engine eight years before you would have realized at least $800 for it, so that practically you have one engine eight years old and one twenty years old that, as far as your department is concerned, have cost you about the same. We have not lost sight of the fact that at the outset the company have invested $9,000, and that the interest of this amount during the eight years would amount to considerable, say $4,952 50, as against $3,830, the interest on cost of repairs to the old engine. Neither have we lost sight of the fact that your new engine has been hauling upon an average four more cars per train than the older engine. We are not prepared to say what the value of this additional service would amount to, but it would certainly be far in excess of amount of interest on the money invested.

It would be folly to say that an engine should run a certain number of years and then be destroyed, for some engines at fifteen years of age are worth more than others at eight. The condition and worth of the individual engines must decide that, but we do believe that many roads are maintaining engines that it would be economy to destroy. At the same time we wonder whether some engines are not destroyed that it would be economy to repair.

*Rochester, N. Y.*

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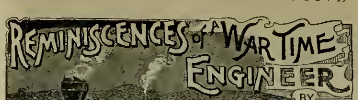
Mr. Daniel Kiley, 12 Cooper street, Brooklyn, N. Y., has recently patented an improvement on balance valves. He provides a check-valve in the top of the slide-valve cavity, and another on the balance plate, these to relieve the engine of the pumping action when running down hill, and to prevent excessive wear on the strips and seat.




## Wrecking Under Difficulties.

Some time during the summer of 1864, while employed as engineer of the government wrecking train, and while laying over at Kingston, Ga., Colonel W. W. Wright, the military superintendent, came to me and wanted to know how many soldiers I would want, as guard, to go with me on the engine to find engine 44, John Maloney, engineer. This engine had been started from Kingston with a commissary train of supplies for Resaca. After leaving Kingston and passing Adairsville and Calhoun, nothing had been heard from her for several hours; so long that the superintendent had become anxious about the fate of the train.

I said to Colonel Wright that I was ready to go after the train, but did not want any guard of soldiers. That if, as he feared, there were guerrillas in the vicinity, they would be more likely to fire into a guard of soldiers than to fire on civilians. The Colonel was anxious to go with us, and I furnished him a civilian's suit, and we started, with orders to run to Resaca, regardless of all south-bound trains.

Arriving at Adairsville, we found Captain Dan Callahan with a company of the Third Indiana Cavalry, who informed us that he was almost sure there was a company of Carter's Bushwackers somewhere in the neighborhood, and that he feared they had captured the train. Between Adairsville and Calhoun the county road and the W. & A. R. R. runs parallel for some distance. Here we were jogging along about ten or twelve miles an hour, when I saw a squad of horseman approaching us. I slowed down, expecting to see them unsling their carbines or draw their revolvers and fire on us. Colonel Wright was sitting on the fireman's seat, the fireman standing in the tank, his arms resting on the tank-box; I was sitting on my seat and leaning out of the cab window; none of us made any move to duck or dodge so long as they let their carbines and revolvers remain as they were.

When close enough to be heard, the officer at the head of the squad hailed me with the remark that we could jog along, as what we were looking for was in the ditch near Doctor ——'s barn, but they were afraid to tackle the train, as it had too strong a guard for them, but that they would get some of us yet.

After leaving them, we ran along, keeping a good look-out for the track ahead. We passed Calhoun without stopping, and soon came upon a flagman who informed us that the engine had been blown off the track with a torpedo. This was made of cast iron, something like a jug, about ten inches in diameter by twelve inches high; the top had a plug screwed in it; through the plug there was a quarter-inch hole, for the purpose of putting a steel rod, on the end of which they placed a percussion cap, which rested on a nipple cast on the bottom of the bomb. This machine held about six or eight pounds of powder, and for the purpose for which it was invented was a success.

To place one in position for business, a hole was dug under the rails of the track, and the machine buried. The top of the steel rod touched the bottom of the rail, so that as soon as the weight of the engine struck it the pressure on the rod exploded the cap.

In the case of the "44," Maloney stated that the front of the engine was lifted into the air so high that she almost stood straight up. When we arrived at the wreck, we found the engine laying on her side down the bank, in Doctor ——'s barnyard, as the Guerrilla Captain had informed us. On the left of the road, going north, stood a large two-story white frame house belonging to Doctor ——.

I often wondered why it had not shared the fate of most such houses—been burned, being as it was directly in the track of our army, but I afterward learned that the old Doctor was a strong Union man.

After messages had been sent both ways we did what we could to clear the track, and the dispatcher started some trains North. The first to arrive was loaded with the Eleventh Indiana Infantry, going home on veteran furlough. Soon after their arrival some one told the soldiers that the train had been wrecked by the inmates of the house, and that the house ought to be burned. The inmates consisted of two little girls and their mother, none of whom were capable of wrecking the train. In those days soldiers did not need much urging to take vengeance on anything they thought would cripple the "Johnnies." So it was but a short time until the dwelling was in flames, in spite of the earnest protest of Colonel Wright and myself. Much of the furniture was saved, as were all the out-buildings. The government has since paid for the house, it being proven that the owner was loyal to the government. Captain Callahan and the squad of Carter's men had a lively brush the same day near Adairsville, the "Yank" getting the best of the "Johnnie."

Captain Callahan was before and after the war an engineer on the O. & M. R. R., running out of Seymour, Indiana. The trainmen of the railroads, especially the engineers and conductors, were well represented, and made good officers in the army. I could name a long list of them who did good service during the disturbance.

### The Old Timers.

I think the "General," of which Mr. Wesley writes, was not brought down to the main line. If she had been I would remember her. Until the government began sending engines from the North the principal make of engines in the service was Rogers, Moore & Richardson, a very few Danforth & Cooke and one or two Tredgar engines. The first engines sent south by the government were the Hercules and Jupiter, from the L. M. C. & X., eight-wheelers; there were two Niles ten-wheelers, from the three C.'s, the Bellefontaine, from the B. Line. They also sent several Memphis and Charleston engines to Chattanooga.

Nearly every builder in the country at that time had a government contract, Baldwin, Rogers, Cooke, Hinkley, Mason, Norris and the Fairbanks, Taunton. The Norris had defective boilers, and the Hinkleys would not make steam. I have seen a corporal's guard escorting engineers and firemen from their quarters to a Hinkley or a Norris engine, and in two instances knew engineers preferring imprisonment in the stockade to running Norris engines, the boilers of which had no stays in their domes.

The cut of the old Nashville depot and surroundings looks very natural. The piles of wood, the crossing-watchman's shanty and the old boiler, the row of engines and tenders appear like old friends. The U. S. on the rear of the tanks looks very natural, also the balloon stacks of the engines. About the time that picture was taken, John C. Maginis was general engine dispatcher, Harry Elliott was master mechanic, and the present master mechanic, James Cullen, of the N. C. & St. L., was foreman of the government shops at Nashville; at Stephenson, Ala., Asa Daniels, and at Chattanooga, Steve Hobbs, were the engine dispatchers for the N. C. & St. Louis; Ford was at Knoxville. Mr. Ford, previous to his being employed by the government, was master mechanic of the Michigan Central. He was suspended by A. S. Sweet, who was the party who placed the "Last Straw" on the back of the camel, the breaking of which hurried the organization of the old brotherhood of the footboard, of which W. D. Robinson was the founder.

James H Hevey

## McAdam Junction.

There are a good many towns in different parts of this country that have been created by railroads, and not a few others that depend principally on railroad men for existence, but we have never seen or heard of a place created and so thoroughly dependent upon railroads as McAdam Junction, N. B. When a traveler going from Boston to the maritime provinces of Canada has made up his mind from the scene outside the car window that he is not ambitious to be a land owner in northeastern Maine he enters New Brunswick and finds out that the poverty of the land keeps increasing. The climax appears to be reached about six miles across the line, where we find McAdam Junction.

A native brakeman whose acquaintance I made, indicated the condition of things without attempting a description.

"There appears to be a good crop of stones in this country," remarked the writer.

"Yes," said the brakeman, rather proudly. "I have fifty acres of land near here, and you can go over the whole of it without stepping off a stone."

It was in this region that a young man from New Jersey got married and was trying to make a living by farming. "Why, George," exclaimed his father, who had gone on a visit, "I never expected that a son of mine would ever settle in a place like this."

"I am not so bad off as you think," answered the son, "I don't own the land."

McAdam Junction, the Petrea of New Brunswick, is known to the world as the headquarters of the mechanical department of the New Brunswick Railway, now a part of the Canadian Pacific. No carriage road or even pathway goes to the town, and there is not a human habitation within twenty miles of the place on one side and six miles on the other. All the men in the place are engaged in railroad work except two storekeepers.

The shops at this point are required to do the work on all the rolling stock employed on about 700 miles of track. The shops are not well provided with appliances or conveniences for doing work, but "how to make the best of it" is the prevailing motto, and its influence effects wonders. Mr. George A. Haggerty, the master mechanic in charge here, is well known to many of our readers, for he has been on several roads in the United States. Mr. Haggerty holds a peculiar position in McAdam Junction, for he appears to be chief magistrate as well as master mechanic. We know of no other potentate so powerful in his domain. When he went to McAdam Junction there were eight saloons in the place. There are not any drinking places there now. There is no crime in the place, because, as George puts it, when any fellow comes in who does not want to obey the law we send him away.

The greater part of the locomotives that have headquarters at McAdam Junction are of odd makes, shapes and dimensions, owing to the New Brunswick Railway having absorbed numerous small roads. This makes repairs expensive, but good management keeps down the cost remarkably well. The machine tools are nearly all of English make, and are not nearly so powerful to take cuts as modern American tools. A fire destroyed the shops some years ago and all the tools had to be rebuilt by Mr. Haggerty. The work was done in excellent shape, and the repairs of engines and cars kept going at the same time. Only those who have gone through an experience of this kind can understand the difficulties to be encountered.

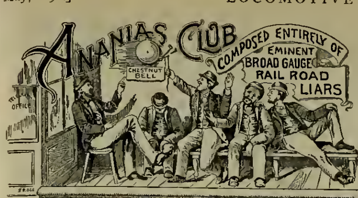
A very large volume of work is turned out of these shops, and it is due in a great measure to the orderly and systematic way in which everything is done. Many of the shops in Canada lead a visitor to think that an article of faith among those in charge is that no scrap heap is necessary so long as a shop is not full of litter. The shops at McAdam Junction are a notable contrast to the results of this policy. There appears to be a place for everything and everything in its place, while the scrap heap is the place for parts that are on the way to cupola or forge. His surroundings and the way that his business is conducted leads a visitor to the conclusion that, in spite of his being king of his city, Mr. Haggerty is greater than the place he fills.

## Cost of Cheap Cast Iron Wheels.

A correspondent lately asked us how it was possible to sell cast iron wheels for $8 each. In searching for the information we found in our note-book a communication, several years old, from a company making wheels, which says: "The average cost of charcoal pig iron used in casting car wheels is $26.50 a ton, from which four wheels can be cast. Old car wheels to the extent of 25 per cent. can be used, which proportion at $19 a ton, the present price, would bring the cost of the metal, unmelted—three-quarters charcoal pig iron, one-quarter old car wheels—to $24.62½ per ton. The item of labor in this amount is 90 per cent. of the whole. The labor, therefore, on the metal for one wheel, unmelted, would be one-quarter of 90 per cent. this cost of $24.62½, or $6.16, and this the wheel manufacturer pays out before the materials come to his mills. Then the items are as follows for one wheel Cost for melting, core drying, etc., 20 cents; sand, molds and cores, flour and facing, 15 cents; foundry labor of molding and casting, 85 cents; outside work, unloading pig iron, coal, etc., 10 cents; repairs, wear and tear, taxes, insurance, motive power and delivery charges consume 40 cents more, and the cost is $7.86, leaving the company just 14 cents profit on each wheel."

This does not indicate that there is much temptation for capitalists to embark in the business of making cast iron wheels.

George E. Bell, West Somerville, Mass., has received a patent for what is called a "smoke conveyer" for locomotives. The smoke conveyer is an arrangement of pipes that extends the smokestack to the back end of the train. This is one of the most persistent inventions of our acquaintance, and has kept bobbing up periodically ever since people began to complain of annoyance from smoke and cinders.




## After the Wrong Crew.

"I heered a good one on old Kernal Ricker," said the old timer, as the Boies wheel-man stopped at the end of a "whopper." "It's a good 'un," smiled the old timer, "just like the Kernal.

"You know how he will stop and talk to a feller on a train, or on the grade; he's always huntin' for p'ints about the road from the ground up.

"Well, jest after he went to the Iron Mountain, they say he took a ride over one of the Southern branches on the regular train—sorter half *incog.*, you know.

"Well, things was not runnin' the smoothest, delays were grevious, and fact o' the matter was it wan't much like railroadin'; real railroadin'.

"The longer the Kernal set in that car the madder he got—you know that when he turns loose a kussin', old Cappen Kidd ain't nowheres.

"Well, they was a long wait and a lot of poundin' of couplers, and slakkin' ahead an' slakkin' back, an' hollerin' and swinging lamps before a start was made.

"Jest as the train started a feller in blue clothes and cap come in, shut the stove door, sort o' authority-like, and set down behind the door—the Kernal riz up and went and set down by him.

"'What'en the blue-blazes is the matter out there?' he ast.

"'Cuddent find a small pin for one of them pattent shakkle-bars,' sais the man.

"'Whyinthe h——l don't you keep pins in the baggage car?' ast the Kernal, sassy-like.

"'Because, tain't my bizziness to——'

"'That's it, that's it tain't your bizziness, hey. You fellers are gettin' so all-fired dam partickler about what you do that there's no gittin' along with ye. Look at that lamp,' sais the Kernal, pointin' to a smoky lantern by the stove. 'Jest take an' look at it; when did you clean that lamp?'

"'That ain't my lamp, sir,' sais the man, kinder scared like, 'that belongs to the conductor.'

"'Well, dam a hind man that can't keep *both* lamps clean, you ain't cut out for this kinder work, you'd better go back farmin',' sais the Kernal, gettin' madder. 'No, no, don't commence to tell me who you air or how long ye've bin here. When you git in you'd better quit, and that dodrotted, lazy, no good, blunderin' jackass with a conductor's sign on him, wants to do better train runnin' than this, or by the bald-headed, jumped-up——'

"'Ah, my friend,' said the man, 'how about your soul?'

"The Kernal riz up to get a good full breath to scorch that feller up, when he noticed a red band on the man's cap which said 'Salvation Army.'"

## A Windy Division.

"Yes, it blows sometimes on the Mohawk division," acquiesced Nat Sawyer, on hearing one of the engineers in the New York Central roundhouse tell that trainmen in that part of the country frequently had their beards carried away by the wind.

"I'll admit," continued Nat, "that the wind is often fresh up that way, but if you want to meet with wind that is out of the common you must go up the Harlem division. Since the timber grew up in the more exposed parts it is not so bad as it used to be, but I tell you the wind screams there at times. Why, it used to be common for the wind to blow the packing out of the engines' stuffing-boxes."

"That's true," said Pete Gibson, "I've often seen the engines come in that way."

"Do you remember, Nat, about Tom Blank burning the old 93 owing to the wind?" asked Pete.

"Yes, of course I do."

"Let's hear the story," called out half a dozen voices.

"It was this way," said Pete, "Tom was out with the 93 hauling a heavy freight train and a terrible storm came on. Something like a cyclone or some of these Western storms. Well, Tom came out of it with the crown sheet of 93 down. I don't know just how the thing happened, but I heard Tom's explanation to the old man.

"Tom was ordered up to the office, and the old man said sharp like 'Blank, what have you got to say for yourself about burning that engine?'

"'Well, sir,' said Blank, 'it was the wind.'

"'The wind? How could the wind burn an engine?'

"'If you did not see that storm, Mr. Buchanan, you don't know what wind can do. Why, sir, that wind blew the water off my crown sheet!'

"'Blew the water off your crown sheet, and went through a thick lagging and a ⅜ iron sheet?'

"'No, sir; you don't understand. Just where the thing happened we were in a deep cut, and the wind blew so all-fired hard down my stack that it just forced its way down the nozzles through the steam-pipes and right on to the crown sheet like a blast. I could not make out why the engine stopped, but I happened to try the water at that time, and a puff of pure air came out of the gauge-cock. I shut the throttle quick, but it was too late.'

"'That was a most extraordinary experience you had, Blank,' remarked the old man. 'I am glad you showed so much presence of mind. You deserve promotion for that. You can begin running a wheelbarrow to-morrow.'"

## A Double-Headed Joke.

"A long time ago,' said the conductor, "a long time ago, back in the early seventies, I was running a train on the St. Paul. I had in my crew a loud-mouthed young fellow named Ed. Peterson, he had more gall than a book-agent, a little given to bragging, but a good brakeman—and would fight if you said there was another better.

"Some of the boys got their heads together and put up a job on Ed. I knew it but said nothing—the other brakemen and a couple of operators did the work. The plan was to send Ed. a dispatch, on the West trip Saturday, ordering him to come to Milwaukee to run an extra stock-train—Ed. was dead anxious to run a train, but there were a dozen older men. When he got to a certain station, part way over the division, deadheading on passenger toward Milwaukee—and a train—another message was to be delivered to him telling him to stop there and take Bill Westbury's crew West. When he got into the caboose the other brakemen proposed to have fun with him.

"The scheme worked fine, Ed. got the message all O.K. and immediately swelled up two sizes; he came to me and said, 'Old man, I thought you was lying when you said you put in a good word for me ahead of these wax figgers. Put her there,' then he handed me a message that read

"'Come to Milwaukee on No. 2 prepared to run a special stock-train through to Prairie du Chien. J. C. G.'

"J. C. Gault was superintendent there.

"Ed. telegraphed to his father, who lived at a small place about half over the road, to get him to watch and bring his best suit down to No. 2, and took the passenger train East, the proudest man in seven States.

"For some reason or other Ed. could not be found at the station where the stop-message was to be given him, and once by it the operator dare not use the wire to head him off, so he just held his breath, got his resignation ready and waited developments; and old Ed. got to Milwaukee none the wiser for the joke.

"When J. C. G. got to his office he found an impatient brakeman awaiting him.

"'What can I do for you, sir?' asked the official.

"'I'm here on your order, sir; Collins (our trainmaster), don't know what your arrangements are.'

"'My order, said Gault. 'My order, let's see. What's your name?'

"'Peterson.'

"'Peterson, Peterson, lets see the order.'

"The old man read the message over two or three times.

"'Bill Westbury, hey. I see. Mr. Peterson, I guess that the boys have put up a job on you and me, and I guess it wouldn't be very hard to find out who it was and fire 'em. But two can play at the same game. Now *we* will put up a job and see where the laugh comes in. You *can* take a stock-train out to-night just as this message says, and you can keep it all fall; as long as the rush lasts.'

"'There are a dozen men ahead of you and they are at the bottom of this joke—they won't feel so funny. Then I will have Collins send a message to all operators asking them to find out, privately, who forged my signature to certain orders. They will surely tell the trainman and none of 'em will dare say 'boo'—and, mind you, you keep still and we will watch the fun.'

"Ed. got a new blue suit and a nickel-plated lantern and put on style till about holidays. The boys were awful broke up over it, but nary a one of us dared to 'peep.' It was the best job I ever seen put up—for the victim."

## A Dangerous Curve.

"It is sometimes amusing to hear the excuses invented by engineers," remarked F. A. Casey, turning to draw the attention of Lauder.

"You remember old Dick Brown who used to run the boat train on your road?"

"No, that was before my time," said Lauder.

"Well it does not matter. Dick was an ingenious man—a sort of natural mechanic, and he was always tinkering with some new attachment for his engine. His inventions never amounted to anything, and his only success was in explaining why he was not a rich man through the value of his inventions. He was also very fertile in explaining away things that ought not to have happened.

"One day he invented an improved style of pump-packing, and put it into the stuffing-box of his left-hand pump. He watched it a little after starting and it seemed to be going all right. It did not keep going all right, however, for when he got to Providence he found the bushing cut to pieces and the plunger broken.

"On getting back to Boston he was ordered by the master mechanic to explain the cause of the accident.

"'It was the Providence curve that did it,' Dick calmly explained.

"'How could a curve cut out the bushing and break the pump plunger?' queried the master mechanic.

"'That's easily explained,' said Dick, 'and being a practical as well as a scientific man you will readily see it.

"'You know that sharp curve at Providence. Well, I was a little late, and was trying to save some time and took the curve rather rapid. The twist she gave on that curve just bent that pump plunger like a dog's leg and before we got in all the damage was done. It seems to me that something ought to be done to ease that curve.'

"The explanation was accepted as satisfactory."

## Not a Protectionist.

One of the great Western roads recently got out a new form of agreement for tie contractors, that provides that "All ties shall be of sound oak, not less than twelve inches in diameter, free from sap, have two sides flattened by edge tools to present an eight inch face and be taken out of the wind"—meaning the twist.

One old country merchant, who had always been depended upon to furnish some thousands of ties each winter, wrote to the tie inspector, as follows.

"Your contract received and returned herewith unsigned, I want you to understand that I ain't no millionaire and don't propose to build sheds to take your dam ties in out of the wind—the wind never hurt 'em before. I think this provision has been made to freeze me out of the contract, but I want you to understand that I'll go to the president with it. You ain't the St. Paul road, young feller. I suppose you will want 'em painted and varnished yet."

## An Australian Spark Arrester.

Charles Cooper, of Guilford, Western Australia, has recently patented in the United States, a spark-arrester for locomotives. It consists essentially of the old balloon-top stack so well-known in this country, with a spark-chamber between the lining and outside of the stack. He adds pipes leading from the spark-chamber to two tanks of water carried at the sides of the smoke-box, where the sparks are deposited and quenched, as in several spark-arresters patented in this country where the quenching-water is carried in a tank in the bottom of the smoke-box.

The Australian patentee appears to think that he has got something valuable, for the spark-arrester is patented in South Australia, Victoria, New South Wales, New Zealand, Queensland, England and the United States.

Railroad companies are objects of many curious suits for damages, but one of the most far-fetched suits that we have heard about lately is one presented by David Jacobs, of Seymour, Ind. He has sued the Pennsylvania Railway Company for $10,000 for being sunstruck while waiting for a load of brick, on a hot day of August last, while a freight train cleared a local crossing.

Our British friends pay a rather high price for the exclusion which they say travelers enjoy in a compartment-car. The small compartment, excluded from intercourse with the rest of the train, offers an opportunity for outrage, robbery and murder, which ruffians and thieves avail themselves of. Last month an outrage was attempted on a young lady in a compartment-carriage on an English railway, which has roused the press to demand the abolition of the compartment system. Several railways are running trains with cars built on the American plan, and every outrage committed in a compartment-car helps to drive in the wedge that will force the old-style carriage out of service.

## Railway Supply Men's Dinner.

A number of well-known gentlemen in New York connected with the railway machinery and supply trade arranged to have a dinner together, and it was held at Delmonico's, New York, on the evening of April 22d. Mr. William Toothe, of the Nathan Manufacturing Co., and Mr. C. A. Moore, of Manning, Maxwell & Moore, did the principal part of the work in getting the supply men together.

About 150 gentlemen were present at the dinner. General Greeley had been chosen chairman. He welcomed the guests with a few well-chosen remarks, in which he spoke of the pleasure and profit to be derived from men in similar business meeting at the festive board.

In the course of the evening there were numerous toasts responded to, some of the speeches being very humorous and amusing. Among the toasts brought in for response were "The Press as a Promoter of Business Enterprise," replied to by Mr. Joseph Eccleseine, of the *Railway World*; "Sympathy and Goodfellowship in Competitive Business," replied to by Mr. C. A. Moore, of Manning, Maxwell & Moore; "Steam Power, the Developer of Civilization," by Capt. H. G. Tarr, Worthington Co.; "The Press as an Exponent of Inventive Genius," by Angus Sinclair, *Locomotive Engineering*; "The Electrical Age of Machinery," by David Dodd, National Lock Washer Co.

During the evening Mr. C. S. Bushnell, who is a splendid singer, favored the company with a number of songs. Great enthusiasm was aroused by Mr. C. A. Moore telling that to the liberality and public spirit of Mr. Bushnell's father was due the building of Ericsson's Monitor, as he had from his own means supplied the necessary funds, after the plans were rejected by the Naval Department.

General Green, of Brooklyn, amused the company with several recitations and humorous stories. Mrs. Shaw, the famous whistler, entertained the meeting with several selections. Before the close Mr. C. A. Moore proposed that a permanent organization of the railway machinery and supply trade be formed, and the motion was carried amid great enthusiasm. General Greeley was elected President for the first year.

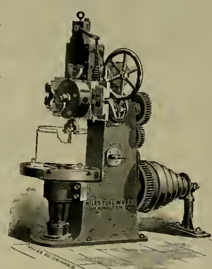
## Meeting of American Railway Association.

The annual meeting of the American Railway Association was held in New York last month. This association is composed of railroad managers, or representatives sent by the managers. They discuss all topics that are of general interest to railroad companies. President Haines, in his inaugural address, took the subject of car-couplers and gave a very exhaustive history of the car-coupler for freight cars. The work done by railroad companies through the Master Car Builders' Association was described and commended. The efforts of State Legislatures to force safety couplers into use was also related with great minuteness, and it was shown that all these efforts were in the direction of confusion. He considered that railroad companies are making satisfactory progress in the introduction of automatic safety couplers and he argued against legislative interference. Compulsory legislation would be unjust to railroad companies and might lead to new complications that would delay the good work of applying safe couplers upon all cars. No one was more anxious than himself to stop the accidents due to the coupling of cars, but he wanted the business to be managed by practical men who understood all the requirements.

Among the subjects under consideration by this association were the advisability of adopting the 24-o'clock system, freight car changes and safety appliances. No action of any consequence was taken on either of these subjects.

## Combined Turret Boring and Turning Machine.

The illustration represents a turret machine recently brought out by the Niles Tool Works, of Hamilton, O., for general boring and turning of small work, and for the special duty of turning piston rings for locomotives or other steam engines, the turret principle being employed



to bring into successive action the different tools necessary to complete such rings.

The turret saddle is mounted upon a substantial cross-rail fixed to a vertical slide in the column. The table is supported on a heavy spindle with large bearings, and receives motion through bevel gearing from a cone having five steps for a 4-inch belt. Cone is strongly backgeared, thus affording ten changes of speed for the table.

Four feeds by power are provided, the change from roughing to finishing cut being made instantly by means of a small lever projecting from side of column. Quick hand adjustments to facilitate setting are also provided.

In the illustration a casting for piston rings is shown in outline secured to the table, while the turret carries three special tools for finishing the rings without stopping.

It will be seen that the machine has remarkable advantages for performing such work in duplication. When once set, the different tools can be made to perform their respective duties again and again cutting up casting after casting into rings, and the work when done will be characterized by a degree of uniformity altogether beyond the reach of lathe or other ordinary methods.

By means of a taper dowel, the turret is secured over center of table for boring with double-ended cutters and for general chucking work.

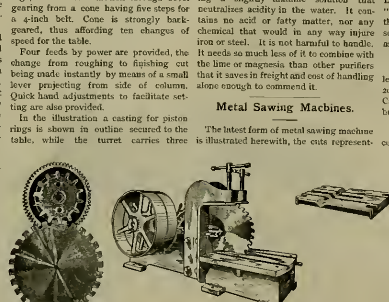
The machine will swing 31 inches in diameter, the table being 30 inches, and has a clearance under overhang of column of 18 inches, this height always being available for work, as the vertical slide allows an adjustment of the cutting tool to suit.

## A New Water Purifier.

The American Fluoride Co., New York, are hearing of very satisfactory results from the use of fluoride, which they are supplying as a feed-water purifier. It has long been known that a preparation could be made from fluorine which would precipitate lime and magnesia, but the cost of the material was so great that it could not be used. Prof. C. A. Doremus, of New York, a well-known chemist, lately succeeded in preparing a compound of fluorine which can be produced cheap, and this is the water purifier now handled by the company named. It is a white crystalline powder, dry, free from water, which means that the purchaser does not pay for water at a dollar or more the gallon when buying a scale preventer, but gets full weight of chemical for every pound. It can be kept in wood or paper indefinitely without deterioration or melting. It dissolves readily in cold or hot water, forming a slightly alkaline solution that neutralizes acidity in the water. It contains no acid or fatty matter, nor any chemical that would in any way injure iron or steel. It is not harmful to handle. It needs so much less of it to combine with the lime or magnesia than other purifiers that it saves in freight and cost of handling alone enough to commend it.

## Metal Sawing Machines.

The latest form of metal sawing machine is illustrated herewith, the cuts representing the Bryant system of metal saws, both in the portable and power form, together with specimens of work and detail of method of driving the saws.



The portable machine is especially designed for cutting of rails, being operated by two men, a sixty-pound rail has been cut off in three minutes with it.

The power machine is designed for machine shop work, cutting heavy pieces. Metal sawing is not practiced so extensively in American shops as in those in Europe, the main trouble being in general want of confidence in the process, brought about by extensive experiments with rotary saws driven from the arbor, like wood saws.

The Bryant saw is driven by a gear meshing into the teeth of the saw itself, and is therefore driven in direct line with the cutting point.

The teeth are really small planer tools in form, and each one takes out a chip as if driven alone, the speed of the saws being limited to seven turns per minute—20 to 25 feet.

The portable machines have been in use for some time on the Lehigh Valley road. They are being introduced by the Q. & C. Company, of Chicago.

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One of our most valued correspondents recently witnessed a number of tests of the Smith fire-kindling device for locomotives, in the shops of the C. R. I. & P., at Chicago, and reports that in each instance a full fire of coal was ignited in from 10 to 14 minutes and the engine put in steam, from cold water, in from 45 to 55 minutes. This invention is an oil-burning device with an inexpensive plant, it entirely prevents smoking-up of cabs and brass fittings; has enough air blast of its own to create a good draft: does away with the use of wood and the danger of fires from it; insures the absence of spikes and nails to stick and burn off grates and reduces the number of men required to fire-up and care of engines. The neat, cleanly and efficient service gotten out of this improvement will commend it to any man in charge of motive power.

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The Boston & Albany Car Department are covering a number of milk cars, also several passenger coaches with the Lee Composite Manufacturing Company's "Permanence Brand" of roofing, which they claim effects a saving over tin of some fourteen dollars per car in first cost and will not require painting.

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President Haskell of the Mahoning Valley Railroad, has just let the contract for 200 coal gondolas to be built by the Erie Car Co., under Buffalo, Rochester & Pittsburgh specifications.

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The D. & R. G. has advanced the pay of conductors and brakemen. These men now receive the largest pay for the service performed of any in this country.

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The New York Railway Club, under the efficient presidency of Robt. C. Blackall, is rapidly growing in popularity, meetings being well attended and discussions full and interesting. It is the purpose of the club to raise for the Grant Monument Fund five hundred to one thousand dollars. This is to be done by voluntary contributions. The treasurer reports fifteen hundred dollars in the treasury as a club fund.

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The Lukens Iron & Steel Co., Coatesville, Pa., have added to their list of customers the following roads: The Chicago & Northwestern, Central Vermont, Illinois Central, Ohio & Mississippi. This steel has long occupied an enviable position in the marine field and bids fair to become as well known in the railroad field.

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Mr. John Fagin, master mechanic of the Atchison, Topeka & Santa Fé at Atchison, has resigned. He has been with the company for twenty years.

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The Roberts spring dummy hose coupler is gaining some ground, and the makers report some orders and many inquiries.

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The New York, Ontario & Western will be placing orders soon for considerable additional equipment.

Master Car Builder E. D. Bronner, of the Michigan Central, has during the month turned out of the shops at West Detroit, six handsome passenger cars, elegantly finished and very substantially built. A notable feature of these cars is the end framing which is constructed on a plan similar to the Lake Shore passenger car illustrated in this issue of LOCOMOTIVE ENGINEERING. The Michigan Central was the first railroad company to adopt this strong style of composite end framing, and it was worked out by Mr. Robert Miller, now general superintendent. The private car of President Ledyard, framed in this way, once took the shock of a very bad tail collision with very little damage.

A new engine has just been turned out of the Lackawanna shops in Utica, and is of the class known as culm burners. One of its principal features is a combustion chamber in the firebox, which, it is figured, will protect the flues to a great extent. The cylinders are 18 x 24 inches, and the drive wheels 5 feet 4 inches in diameter. The cab is finished in black walnut and mahogany, and the entire engine is fitted with all the modern and most approved conveniences. It is equipped with air-brakes, air-whistle to be used instead of the bell cord, and the bell will be rung by air pressure.—*Buffalo Courier*.

The Chicago, Burlington & Quincy are adding very rapidly to their freight-car equipment, for they have now given out new orders for 2,000 cars, just as the last cars of a big order have been delivered. The new cars are all furnished with the latest improvements in car construction, including Westinghouse air-brakes, steel brake-beams and M. C. B. couplers. All cars for this road now have the trucks made with rigid centers. Swing center trucks were formerly standard, but the great expense of repairs led to the change.

The Ohio Falls Car Co., Jefferson, Ind., are building two combination and baggage cars for the Minneapolis & St. Louis, and four passenger cars for the Evansville & Terre Haute. They have lately delivered ten suburban coaches for the Chicago & Grand Trunk. They are building fifty Jenkins patent poultry cars and a train of cars for a show company.

The Rogers Locomotive Works have received an order from the Chicago, Burlington & Quincy for fifty locomotives. Of this number twenty-five are 10-wheelers, twenty-five moguls, class "H," with 60-inch boilers and standard Burlington dimensions, and with Westinghouse air-pump and brake arrangement.

The St. Charles Car Co. are building some passenger cars for the Des Moines & Northwestern. They have just finished some unusually handsome coaches for the St. Louis & San Francisco. They are finished in mahogany and have all the best appliances for promoting comfort and safety.

The Rhode Island Locomotive Works are building some engines for the Saltair Railroad of Salt Lake City. The Wabash recently placed with these works an order for twenty-five, including twelve 8-wheel passenger, eight 10-wheel freight and five 6-wheel switching engines.

The Schenectady Locomotive Works are unusually busy. They have not yet begun to deliver the engines of the New York Central order of 100, and they now have orders from the Chicago & Alton, the Cleveland, Cincinnati, Chicago & St. Louis.

The Lafayette Car Works, which have been in the hands of a receiver for some months, were sold lately to a local syndicate for $39,500.

An order has been given to the Pennsylvania car shops at Port Wayne, Ind., to build 100 of the large furniture cars used by the company.

The Pennsylvania gave out contracts last month for 1,500 standard gondola cars.


(45) K. C., Kansas City, asks:

How is the connection made between the dry-pipe and the front-head? *A.*—By a ground joint held against the sheet by the flange of the T-pipe.

(46) Geo. E. Rhoads, Westtown, Pa., writes:

1. Did the knuckle of the Hien coupler open to the left? *A.*—Yes. 2. Are the Hien coupler interests consolidated with the Janney? *A.*—Yes. 3. Who was the inventor of the Belpaire firebox? *A.*—An engineer of that name in Belgium.

(47) G. W. P., Kansas City, writes:

I am making a model locomotive, and want to know how the firebox is put in a locomotive. If they rivet it together outside, I don't see how they get it in, and if riveted inside, how do they hold the rivets? *A.*—When the firebox has straight sides it is usually put in from the bottom; but where the crown sheet is wider than the mud-ring the box is put in through the end and the back-head put in afterward.

(48) R. Chase, Alleghany, Pa., writes.

Your article on "Electric Motors against Locomotives," has caused much discussion. Several of your readers would like to know what relation the expense for coal bears to the total cost of operating an electric railway? *A.*—In an address delivered by President Huntley, of the National Electric Light Association, he made a statement saying that the cost of coal was only about 10 per cent. of operating expenses of an electric railway.

(49) J. F., Selma, Ala., asks:

1. Will not shortening the eccentric blades on an indirect engine increase the lead, and on a direct decrease the lead? *A.*—No; shortening the blade will only make the valve travel out of the center of the seat; if it increased the lead opening on one end, it would decrease it on the other. Advancing the eccentric will increase the lead. 2. What is meant by the linear advance of the eccentric? *A.*—Linear means "in line with" or "in the same line," and linear advance of an eccentric means moving the eccentric ahead on the axle, *toward* the eccentric-rod connection. 3. If, on passing the forward center, the piston should strike the front cylinder-head, would it not be proper to insert a liner in the back end of the main straps? *A.*—It would do no good to put a liner behind the brass unless it made the rod shorter; take out one in front of brass and put it behind—anything that will shorten the rod.

(50) G. W. P., Little Rock, Ark., writes.

I often see the expression "co-efficient of friction," used in mechanical papers, and I am not sure what it means. I have tried to pump several of our learned engineers, foreman, etc., to get some light on the subject, but they are all like one who said that he knew but lacked the power of language to explain it. Do you possess the necessary gift of the gab? *A.*—The co-efficient of friction is the proportion of the weight of a body that is necessary to overcome the resistance to movement. Thus, if you put a block of iron weighing, say, 5 pounds, on a flat surface, and attach a string to it, the amount of the pull required to move the block will give the co-efficient of friction. If a pull of 1 pound moves the block, the co-efficient of friction is $\frac{1}{5}$. A similar expression, very familiar to railroad men, is the "co-efficient of adhesion." This is the proportion of the weight on driving-wheels required to make them slip. This depends upon the condition of the rails, and it varies from $\frac{1}{4}$ to $\frac{1}{10}$ of the weight resting on the wheels. An engine having 80,000 pounds on the drivers may have a turning power of 20,000 pounds applied to the driving-wheels without slipping. When the rails are in bad shape, a turning power of 8,000 pounds may slip the wheels.

(51) R. J. Ross, Boston, Mass., writes:

I have heard it said that "A Modern Samson," the monster locomotive seen on the front page of your February paper, is equal to a simple engine with $24 \times 28$ in. cylinders. Several of your readers would like to know what pull an engine of that sort can make on the drawbar and the horse-power that could be exerted when running at twenty miles an hour. *A.*—The tractive power, as the force that a locomotive can exert on the drawbar is called, is figured by a very easy rule which is found in all engineering hand-books. Those wanting to learn how to figure the power of a locomotive should not be frightened at the rule because it is expressed by letters or algebraically, thus

$$T = \frac{d^2 \; L \; p}{D}$$

meaning, T traction equal to $d^2$, the square of the diameter of one cylinder in inches, multiplied by L, length of stroke in inches, and multiplied by $p$, the average pressure on the piston, in pounds per square inch. These are divided by D, the diameter of the driving-wheels in inches, and the answer shows the number of pounds that the engine can exert on the drawbar. When applied to the Erie engine referred to in the question, we have $d^2$ equal to $24 \times 24 = 576$. This multiplied by 28, the length of the stroke, makes 16,128. Next multiplier is $p$, which represents the average pressure per square inch of piston. As the boiler pressure is 200 pounds, we can take 90 per cent. as the cylinder pressure, which gives 180 pounds. We have now $16{,}128 \times 180 = 2{,}903{,}040$. This is divided by 50, the diameter of the driving-wheels, and we have 58,060 pounds as the pulling force the engine can exert. To find the horse-power developed at twenty miles an hour, we have first to find the average cylinder pressure. From indicator diagrams taken from the other engines, we are safe to assume that this one will give an average in the cylinders of half the boiler pressure when making 136 revolutions per minute and cutting off at half stroke. This is 100 pounds. We now find the area of the piston, which is 452.39. The two pistons make 904.78 square inches, which is multiplied by 100, the steam pressure in pounds, and gives 90,478 pounds of force exerted on the crank-pins. This is exerted through twice the stroke during each revolution and is $28 \times 2 = 56$ in. or $4\frac{2}{3}$ ft. The speed is 136 revolutions per minute, so we have 90,478 lbs. $\times 4\frac{2}{3}$ ft. $\times 136$, equal to 57,423,369. This is divided by 33,000, the number of foot-pounds in a horse-power, and gives 1,740 as the horse-power exerted.

The time-honored adage that "It's an ill wind that blows nobody good" finds another illustration in a use for boiler scale, which has heretofore been regarded as an unmitigated evil. Mr. John Player, superintendent of machinery of the Atchison, Topeka & Santa Fé Railway at Topeka, Kan., has found a way of using this scale to good advantage in making floors for the shops. It is spread over the floor and then hammered down solid, and then thoroughly soaked with water. On becoming thoroughly dry it forms a floor as solid as could be obtained by a good grade of cement floor. It can be very cheaply made and readily repaired, and affords a means of usefully disposing of a material supposed to be utterly worthless.—*Railway Review*.

The Pittsburgh Locomotive Works are building for the Pittsburgh & Lake Erie five locomotives, two of which will be for fast passenger service. Mr. Wightman, superintendent of these works, is said to be working on the plans of a compound locomotive of a tandem design. He thinks that a tandem arrangement of cylinders will give the most compact means of developing the great power likely to be called for in the near future.

The order given out during last month of fifty locomotives for the Cleveland, Cincinnati, Chicago & St. Louis, excited much pleasant anticipation among leading builders. It carried comfort to three establishments, Richmond getting thirty engines, Schenectady ten and Brooks ten. There is a tendency among people to congratulate the Richmond people, as the plums that fall in that direction are not generally very large.

The Green Bay, Winona & St. Paul Railroad shows a performance sheet for the locomotives that reflects credit on Master Mechanic Fenwick. That region is hard on locomotives in winter, yet, the engines in March were operated at a cost of 16.86 cents per mile. Of this about half went for fuel. Repairs cost only 2.82 cents per mile.

An announcement has been made that the *Railway Age* and *Northwestern Railroader* will publish daily reports of the Master Car Builders' and Master Mechanics' Conventions at Saratoga, in June next. This has been done for several years by the *Northwestern Railroader*, and the reports have been very popular.

On March 28th, the Empire Line Express ran from Oneida to De Witt, 21.37 miles, in 17 minutes and 40 seconds, the average speed having been 73.69 miles per hour. The engine that made the run was one of Mr. Buchanan's 8-wheel 19 x 24-inch engines, with driving-wheels 78 inches diameter.

The Lima Iron Works, says the *Age of Steel*, are now completing one of the smallest locomotives ever built for practical purposes. It will be used by a fruit company in the orange groves of Florida. The total weight of the engine complete, including the cab, is about 6,000 lbs.

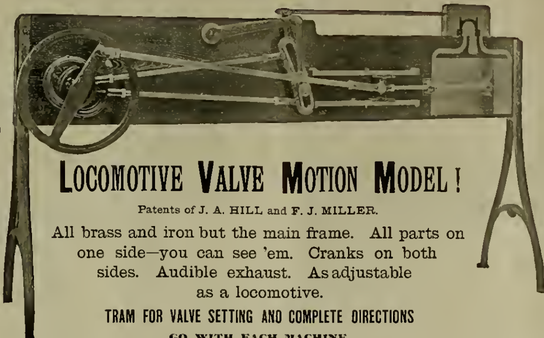
The Midvale Steel Company have contracted with Manning, Maxwell & Moore, New York, for a 20-ton Shaw electric crane of the kind illustrated in LOCOMOTIVE ENGINEERING last month.

Contracts have been given out for the building of the New York Central shops at Depew, which we illustrated two months ago, and the work is being pushed vigorously.

The C. & W. M. have ordered four new ten-wheelers from the Rhode Island Works.

The B., R. & P. have ordered four compounds from Baldwin's.

# FOR YOUR LODGE ROOM!



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IMPROVED FOR 1892.

## LOCOMOTIVE VALVE MOTION MODEL!

Patents of J. A. HILL and F. J. MILLER.

All brass and iron but the main frame. All parts on one side—you can see 'em. Cranks on both sides. Audible exhaust. As adjustable as a locomotive.

**TRAM FOR VALVE SETTING AND COMPLETE DIRECTIONS GO WITH EACH MACHINE.**

**Half size of 17 x 24 Engine.—A Machine, not a Toy.**

ESPECIALLY USEFUL IN M. M.'S OFFICE WHEN EXAMINING FIREMEN FOR PROMOTION.

**PEDRICK & AYER, MAKERS, PHILADELPHIA, PA.**

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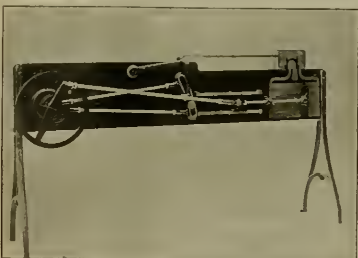
## Useful Things for Enginemen and Machinists that can be had for a Little Overtime.

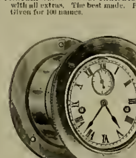
THESE are no job lots that we have got cheap, but every identical thing in the list is new and the latest and best, *and will be shipped direct to you from the maker*—just as though you had sent *them* the cash. Every subscription must be accompanied by $2. When a club is received and the premium mentioned that is wanted, we will order it sent direct to you from the maker—and we will always pay the mail or express, no premium shall cost you an extra cent on any pretext. We want you to work. In sending your club write each name, town, box and street plainly, and state when paper should commence. Send the money with the list, and give the name and number of the premium you want. Renewals just as good as new names.



**Premium No. 1. Valve Motion Model.**

Built by Pedrick & Ayer. *Improved for 1892.* Half the actual size of a 17 x 24 locomotive. Just as adjustable as a locomotive. Tram for setting valve furnished, and complete directions for setting valves, eccentrics, finding exact dead centers, etc., go with each machine. No wood but the main frame—a machine not a toy! Everything visible from one side. Just the thing for lodge rooms. Crank on back as well as front. Patented audible exhaust, you can watch something else and hear the exhaust. More can be learned from this practical machine than from anything else. *No lodge room complete without it.* It is worth $60. We will give it for 85 subscribers for 1 year. In case you can't fill out the complete club of 85, we will accept 70 names and $18.00 cash extra, 60 names and $23.00 extra; 50 names and $25.00 extra, 40 names and $30.00 extra; or, 30 names and $39.50 extra.

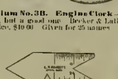
**Premium No. 2. Tabor Indicator.**—In case, with all extras. The best made. Price, $85.00. Given for 100 names.



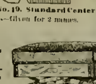
**Premium No. 3B. Engine Clock.**—Not Jeweled, but a good one. Becker & Lathrop make. Price, $10.00. Given for 25 names.

**Premium No. 3. Howard Jeweled Chronometer.** Price, $40. Given for 60 names.

**Premium No. 3 A. Seth Thomas Jeweled Engine Clock.** The best they make. Price, $37.50. Given for 50 names.

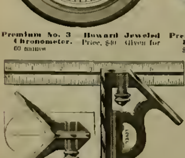


**Premium No. 19. Standard Center Gauge.**—Given for 2 names.

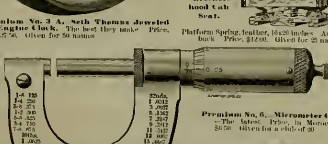


**Premium No. 33. Brotherhood Cab Seat.**

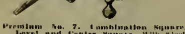
Platform Spring, leather, 16x20 inches. Adjustable back. Price, $12.00. Given for 25 names.



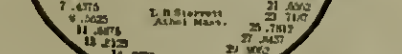
**Premium No. 7. Combination Square, Level and Center Square.**—With 6-inch scale. Given for 8 names. With 12-inch scale for 12 names.



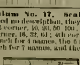
**Premium No. 6. Micrometer Caliper.**—The latest. Price, in Morocco case, $6.50. Given for a club of 20.



**Premium No. 17. Scales.**—These fine scales need no description, they are divided as follows: 1st corner, 10, 20, 50, 100; 2d corner, 12, 24, 48; 3d corner, 16, 32, 64; 4th corner, 14, 28. We send the 3-inch for 4 names, the 6 inch for 5 names, the 12 inch for 7 names, and the 24 inch for 12 names.

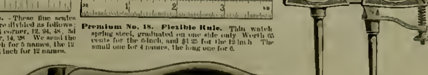


**Premium No. 18. Flexible Rule.** Thin watch spring steel, graduated on one side only. Worth 65 cents for the 6-inch, and $1.25 for the 12-inch. The small one for 4 names, the long one for 6.



**Premium No. 8.**

**Small, Fine Square.** 2 blades. Fine tool. Given for 10 names.



**Premium No. 5.—Combination Tool.**—Handiest tool in your box. Black are worth $1.25. Given for 6 names. Nickel, $1.50. Given for 7 names.

**Premium No. 20. Trammel Points.** Adjustable, with extra Pencil holder. Given for 13 names.

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**We offer the following Books, which we consider good and well worth the money. They are grouped according to price.**

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MODERN LOCOMOTIVE CONSTRUCTION. By J. G. A. Meyer. This is the latest exhaustive book on the locomotive, every piece being shown by drawings and rules given for determining strains and designing the machine to meet them. About 1,000 engravings.

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HASWELL'S. A standard work much like Trautwine's, same size and style. One of the best authorities on strength of materials, etc. Contains many useful tables. Same price.

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ALEXANDER'S READY REFERENCE. This is one of the deservedly popular little books. It contains plain directions for the many distresses of a locomotive: what to do to man and to engine in case of accident. Illustrated by plates.

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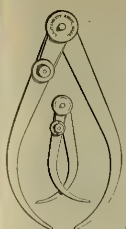
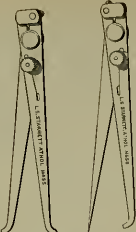
**Fifty Cent Books.—For 2 names.**

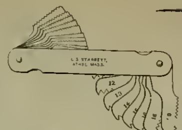
PROGRESSIVE EXAMINATIONS OF LOCOMOTIVE ENGINEERS AND FIREMEN. By John A. Hill. Between five and six hundred questions and answers on practical questions on locomotive firing and running, proposing a new plan of examination of enginemen. Adopted by several roads as standard. Has 17 colored plates, showing color and position of all signals carried by trains or engines. 1891.



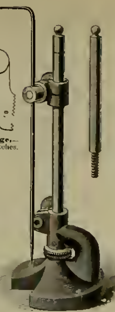

**Premium No. 21.—Lock-Joint Calipers.**—The 4-inch size we give for 4 names, the 8-inch for 6, the 12-inch for 8, and the 18-inch for 13 names. You can have either inside or outside.




**Premium No. 22.—Hermaphrodite Calipers.**—6-inch, patent lock nut. We send it for 5 names.

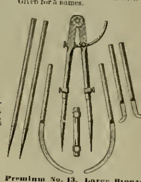



**Premium No. 16.—Screw Pitch Gauge.**—Will fit a nut as well as a bolt. 20 pitches. Given for 5 names.



**Premium No. 12. Starrett's Surface Gauge.** A good one 8 inch size sent for 10 names, the 12-inch for 18

**Premium No. 15.—Double Plumb and Level.**—18-inch. Given for 8 names



**Premium No. 13. Large Bronze Dividers and Calipers.**—The best one there is. Given for 15 names

**Premium No. 28.—Ideal Outside Calipers.** Heavy spring, patent nut and washer. The 2½ and 3-inch will be sent for 5 names, the 4 and 5-inch sizes for 6 names, and the 6-inch for 7

**Premium No. 29.—Ideal Inside Calipers.** Same style as the 28 The 3-inch given for 5 names, the 4 and 5 for 6, and the 6-inch for 7.

**Premium No. 40. Drawing Set.**—K. & E. Price, $4 50. Given for 12 names.

**Premium No. 41.—Drawing Set.**—K & E. Price, $8 50 Given for 20 names

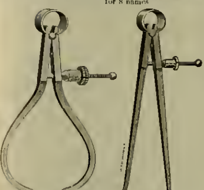
**Premium No. 42.—Drawing Set.** K & E Price, $12 75. Given for 24 names.

**Premium No. 43.—Drawing Set.**—K & E Price, $20.25. Given for 38 names.

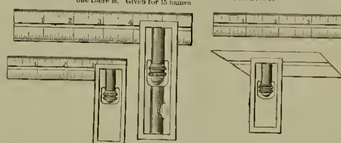
**Premium No. 100. Westinghouse Engineer's Brake and Equalizing Discharge Valve.**—Full size, with case cut away so as to expose all valves Indispensable in a lodge-room Not a model—an actual valve. Given for 40 names.

**Premium No. 101. Westinghouse Quick Action Triple Valve.**—Full size, case cut away so as to show movement of every piece The actual valve Your lodge-room ought to have one Given for 20 names.

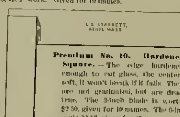
**Premium No. 102.—A Fine Gauge Lamp.** Solid stand, heavy globe, plain or painted Brass cap and base Neatest lamp out Cost $30 a dozen at wholesale. We will send you one for a club of 10.



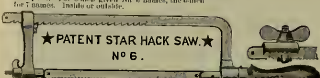
**Premium No. 23.—Fay's Patent Spring Nut Calipers.**—4 or 5-inch given for 6 names, the 6-inch for 7 names. Inside or outside.



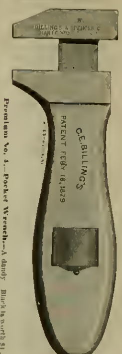
**Premium No. 9. Double, Sliding Head Square.**—With 2 blades, one for finishing Hex work. Given for 10 names.



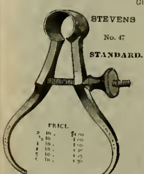

**Premium No. 10. Hardened Square.**—The edge hardened enough to cut glass, the centers soft, it won't break if it falls They are not graduated, but are dead true. The 3-inch blade is worth $2 50, given for 10 names. The 6-in costs $4 50, given for 15 names



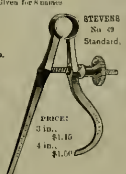

**Premium No. 21. Hack Saw Frame,** and a dozen Saws —Nickel-plated. Given for 8 names




**Premium No. 4.—Pocket Wrench.**—A dandy Black is worth $1. Nickel, $1 25; given for 5 names given for 6 names



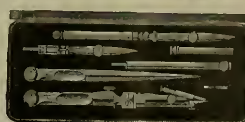

**Premium No. 25** is furnished in 6 sizes, prices as above The 2, 2½ and 3-inch will be given for 5 yearly subscriptions each The 4 and 5-inch for 6 each, and the 6-inch for 7



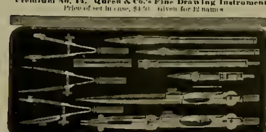

**Premium No. 26. Key-hole Calipers.** The 3 inch for 6 yearly subscribers, and the 4-inch for 7


**Premium No. 27. Inside Calipers.** 5-inch, given for 6 names for a year


**Premium No. 31. Spring Dividers with Thumb Attachment and Patent Washer.** The 2 or 3½ inch for 6 subscriptions, the 4 or 5 for 7, the 6 for 8

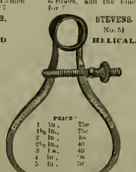


**Premium No. 14. Queen & Co.'s Fine Drawing Instruments.** Price of set in case, $4 50 Given for 12 names



**Premium No. 45. Queen & Co.'s Case of Instruments.** Price $14 50 Given for 25 names


**Premium No. 30. Standard Spring Dividers.** The 2 and 3½-inch for 5 subscriptions, the 4 and 5-inch for 6, and the 6-inch for 7




**Premium No. 32. Helical Coil Calipers.** Something extra nice The two smallest sizes are gold plated, and are used as watch charms We will send either of them for 4 yearly subscriptions We will give any size of the larger plain steel for 3 yearly subscriptions

**Premium No. 11.—Inclinometer.** A very fine tool, worth $5 Given for 20 names

**Premium No. 14. Level and Plumb.** 6-inch Given for 7 names

**Premium No. 16.—Q. & Co.'s Extra Fine Set Drawing Instruments.** Price $30. Given for 35 names.

# LOCOMOTIVE ENGINEERING.

A Practical Journal of Railway Motive Power and Rolling Stock.

VOL. V, No. 6. NEW YORK, JUNE, 1892. PRICE, 20 Cts. Monthly. $2 00 per Year.



## Compound Locomotive for Grade of 575 Per Mile.

The peculiar looking locomotive shown herewith was designed for logging service on the Sinnemahoning Valley Railroad of Pennsylvania, which has grades of 575 feet per mile, with curvature of 40 degrees. The engine is to be used on stringer track, the cross-ties being placed 20 feet apart, and the rails laid upon log stringers between the cross-ties. The maximum weight allowable upon each pair of stringers is 35 to 40 tons. A locomotive exceeding that weight must therefore have a wheelbase exceeding 20 feet to avoid overloading the stringers. With so long a wheelbase, a locomotive of the ordinary type would be too rigid to work upon the sharp curves.

The "Edward T. Johnson" has 12 driving wheels, arranged in two six-wheeled swiveling trucks, the firebox being between the trucks. Each truck is driven by Vauclain compound cylinders, the two trucks, of course, working simultaneously. Live steam is communicated to the cylinders by means of a thoroughly jacketed steam-pipe on the engineer's side of the locomotive, and the exhaust steam is conveyed to the stack through a similarly jacketed exhaust-pipe on the fireman's side of the locomotive. The steam connections from the fixed steam-pipes to the swivelling truck are made by means of Moran patent flexible joints. The principal dimensions are as follows:

Gauge, 4 feet 8½ inches.

Fuel, soft coal.

Cylinders, H. P., 9½x18; L. P., 16x18.

Driving wheels, 40 inches diameter on the tread.

Wheelbase of each truck, 7 feet 6 inches; total wheelbase, 27 feet 6 inches.

Boiler, 50 inches diameter, wagon-top form of ½-inch and $\frac{9}{16}$-inch steel, with butt joints and double welt strips.

Fire-box 66 inches long, 47½ inches wide, 59½ inches deep at front, 40 inches deep at back.

Crown sheet supported by radial staybolts 1⅛ inch diameter.

The water is carried in a rear tank, similar to an ordinary tender tank (capacity, 900 gallons) and in two side tanks holding 1,600 gallons; aggregate, 2,500 gallons.

Coal capacity, 4 tons.

Weight in working order about 150,000 pounds, equally divided between two trucks.

Steam and exhaust-pipes covered with magnesia sectional lagging and jacketed.

Piston-rods and valve-stems fitted with U. S. metallic packing.

Steam-brake on all wheels, LeChatelier pressure brake to act upon both sets of cylinders.

Water supplied by two No. 8 Monitor injectors.

The locomotive is said to be doing satisfactory work upon the Sinnemahoning Valley Railroad, but no special tests of its capacity have been made up to this time. This engine does the same work as that performed by some geared engines employed on the same line.

Eight-Cylinder Tree-Climber.

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On the St. Louis & San Francisco road they use the regulation bulletin notice of engine performance. Following the engineer's name there is a blank space left large enough to contain the letters A. B. C. D.; these represent waste, coal, engine oil and cylinder oil respectively, and are only placed after the name when that engine and engineer have used more than the average amount of the stores designated. Below the sheet these words stand out boldly: "Letters A. B. C. D. denote poor record of engineer and engine." Just as quick as a man finds his name he sees at a glance just how he stands with the average runner of his own road—he isn't compared with the best. Some of the men have all the titles, others have none.

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In the Boston & Maine shops, at Boston, they have in use a simple arrangement which materially increases the capacity of the driving wheel lathes. It is well known that when a heavy cut is attempted on most wheel lathes there is a tendency to chatter. This is due in some measure to the small bearing work set in centers has on the lathe. To prevent chattering they have an arrangement of two pillars, one of which goes beneath each of the axle journals, bearing part of the weight. A strong clasp encircles the journal and makes the work so unyielding that any cut a tool is capable of making can be done without causing the least disturbance.

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The Jersey Central's compound 385, recently swung a Royal Blue train over a mile in 39¼ seconds—this is the fastest time on record, that we know of. If this speed could be maintained between New York and Washington it would reduce the time, without stops, to two hours and a half. The fastest regular time is five hours.

## A Novel Engine Board.

Superintendent of Motive Power James R. Groves, of the St. L. & S. F., has in his office at Springfield, Mo., an engine record board out of the usual run.

Instead of the engine numbers being arranged in rows they are arranged on lines representing the road itself, with all branches, shops and roundhouses.

These lines are arranged like a map of the road, the mileage of divisions is marked on it, the principal towns located, etc.

There are three lines on the map, the upper one is a blue line, the center one a heavy line in gold leaf and the lower one a white line. On each of these lines there are many little brads on which to hang small brass tags which show the engine number and a symbol for its class.

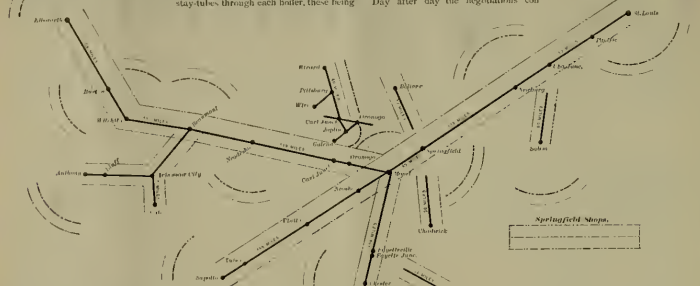
Engines in first-class condition are always represented on the blue line, those in good working condition, not more than two-thirds worn out, on the gold line, and those in bad condition on the white line.

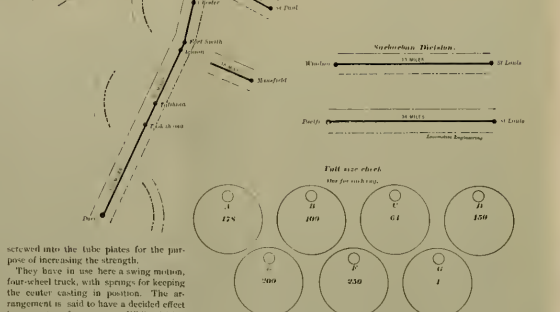
At each place where there is a roundhouse it is shown by an arc of a circle and there are three rows of pegs for every stall in the shops.

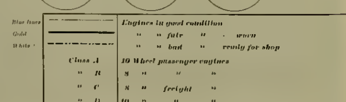
Traveling Engineer M. Savage takes care of the board and changes the number tags whenever changes are made.

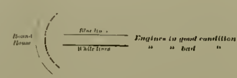
Our engraving gives a pretty fair idea of the arrangement of the board, which is about three feet square, and locked under a glass door, and the details show checks and symbol system.

The arrangement of the engine numbers in this way shows at a glance the distribution of power on the road, and is the neatest thing of the kind we have seen.




## Canadian Pacific Shops.

During a recent visit to the Canadian Pacific shops at Montreal, I found them unusually busy with repair work of locomotives. They are making several permanent improvements in the shops, one being the putting in of an air compressor to supply pressure all over the establishment for power purposes.

They are working 550 men in the locomotive works alone. Last year they built twenty-five new locomotives in the Montreal shops, rebuilt ten others, and effected heavy repairs upon about eighty engines. Their method of building is very good, and the work is carried on nearly as systematically as it is done in regular building shops. The railroad companies in Canada follow the English practice of building their own motive power. In the Canadian Pacific shops they are at present building some ten-wheel express engines with cylinders 18 x 24 inches, driving wheels 62 inches outside diameter, and a boiler with 1,290 square feet of heating surface. The boiler is straight, and has the firebox secured by radial stays. They are using stay-bolts one inch thick round the fireboxes and find that there is very little trouble with broken stay-bolts since this size was adopted. The boilers are particularly well braced, and every care is evidently rendered to secure safety. They use eight stay-tubes through each boiler, these being screwed into the tube plates for the purpose of increasing the strength.

They have in use here a swing motion, four-wheel truck, with springs for keeping the center casting in position. The arrangement is said to have a decided effect in preventing flange wear. While visiting here I failed to meet Mr. Preston, superintendent of motive power, but was shown everything by Mr. R. Atkinson, the general foreman, who deserves great credit for the condition of the shops and the way the work is carried on. A. S.

## The Great Northern Order for Locomotives.

Great excitement prevailed in New York for a few days last month among the leading locomotive builders of the country. Mr. Jas. J. Hill, president of the Great Northern, intimated that he would contract for a large number of locomotives and rumor gave it out that the order might reach into the hundreds. There is an exciting uncertainty in bargaining with Mr. Hill, for on more than one occasion he is said to have raised high hopes of an immense order and negotiated half the night to pull down prices to the lowest notch, then finished up by ordering one or two engines.

The builder representatives duly met Mr. Hill in New York, and at once he opened an onslaught to break prices. The builders have got tired of making locomotives for glory, and on this occasion they stood firm. Mr. Hill threatened to buy his locomotives in Scotland, and no doubt would have done it if the plan would have saved a dollar. But our builders knew that owing to their superior methods of manufacture, they could construct locomotives cheaper than the builders in Glasgow, and the 35 per cent. *ad valorem* duty on the importation of locomotives into this country was certain to render the bringing of locomotives from Scotland an expensive luxury.

Day after day the negotiations continued. All sorts of rumors were in the air. One hour it was reported that the deal was off and that no locomotives would be ordered at this time, then the wise men of Gotham were ready to tell all about a general break in prices and a spreading round of an order for 200 locomotives. The facts were, however, that the road could no longer get along without the engines, and the builders had grown wise by experience and were determined to obtain a living profit on the work, or build no locomotives. The outcome was that fifty-six locomotives were ordered, fifty of them going to Brooks and six to Baldwin's. The fifty engines are consolidations, with cylinders 19x26 inches and a working weight of about 130,000 pounds.

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Among the many inventions patented monthly we look in vain for a good flue cleaner for locomotives. The flues of a locomotive are so difficult to reach with the ordinary rod and brush that a better means of removing the soot and cinders is badly needed. Would not a sectional flue cleaner, to be operated by power from a flexible shaft, or a steam cleaner, be a good thing?

## "The Moon Extension."

The Denver & Rio Grande has a branch eight miles long, from Hecla, Col., to the Calumet iron mines, with a maximum grade of 407 feet per mile.

This track runs through the rugged Box Cañon, is very crooked, and often clings to the side of the gorge away above the stream below. The men on the road long ago nicknamed it "The Moon Extension."

It is, we believe, the heaviest grade in the country operated by an ordinary road locomotive

The track is 3-foot gauge, laid with 52-pound steel, and the engine is a consolidation pattern, with 16 x 22 cylinders and 36-inch wheels, the boiler is 52 inches in diameter; total weight of engine, 60,000 pounds, with tender, 100,000 pounds, and having a total length of 44 ft. 11½ inches—considerable engine for a 36-inch track.

Three empty gondola cars and a "pasteboard" caboose are sufficient load on this grade, but the engine brings down all the loads that are ready, seldom more than twelve, however.

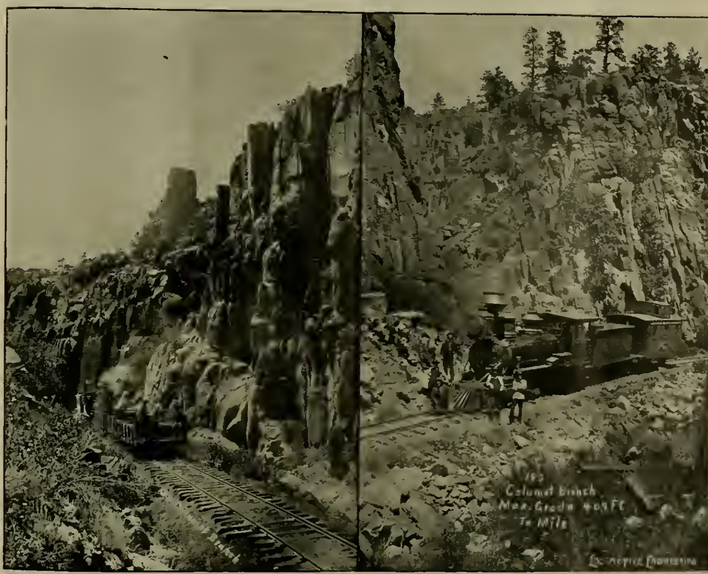
Every wheel on this road has an air-brake hold of it, and on this grade they don't let go to recharge; straight air is used, and the water-brake on the engine is in constant operation.

The artist insisted on looking down the grade at the engine in each instance here, which makes the incline appear less than it really is.

The writer has himself run a locomotive over this track, but not for a regular diet. A. W Leonardson was the runner in charge of engine "408" when these pictures were taken.

Perhaps there has been more sensational articles written about the wonderful feat of ascending and descending this mountain ladder than about any other piece of track in America. Some ten years ago the company forbid the carrying of passengers on this line under any pretext whatever, but that don't keep the imaginative reporter from telling how "the engineer stood like a statue holding the throttle reversed, with the steam and water oozing out of the chests from over-pressure, and the water-brakes throwing a stream of sparks from every wheel, while the train rushed from the mines, perched like an eyrie ont he mountain crest, to the main line along the torrent-dashed waters of the Arkansas below." The "rush" is about six miles per hour.

The operation of this branch shows nerve and skill all the way through, from the civil engineer who picked out the path to the locomotive engineer who daily (excuse the road expression) "keeps his eye on the gun."




"The Moon Extension," Denver & Rio Grande Railway. Grade, 407 Feet.

The Atchison, Topeka & Santa Fé are increasing the capacity of the repair shops at Argentine, Kan. The intention is to put in a plant there that will do the work that is beyond the capacity of the over-crowded shops at Topeka. The latter shops are badly adapted for carrying on work on a large scale, and it is the intention of the management to relieve them of the work that cannot be done to good advantage.

We are in receipt of a large number of letters telling about engines that slipped without steam. All of them explain the apparent paradox as being caused by bent axles.

## Locomotive-Running Among the Bush-whackers.

By Old Soldier.

In 1862 I went to Nashville, Tenn., with General Buell's army. At that time, the only railroad in the Army of the Cumberland that was opened was the L. & N. R. R.

At that time I was wagon-master of the post of Nashville, and the Army of the Cumberland had a good number of worked-down horses and mules. Captain Stevens, of California, was acting quarter-master, he had a civilian by the name of Henry Little as an assistant, with the title of Superintendent, who had charge of all wagon-masters and all mechanics of the post. He had ordered me to go out in the country and rent all the pasture land I could get, so as to pasture crippled and overworked horses and mules to recruit them up. I think, in all, I rented about 6,000 acres; we had about 3,000 head; so Mr. Little put me in charge of the pastures. About that time Captain Stevens took sick and died. I do not remember how long he lay sick, but as things did not go to suit me I quit.

Being a machinist and engineer, I went down to the Nashville & Chattanooga shops T. W. Smith was master mechanic, he gave me work in the shops on some old scrap heaps to get them ready for the road. The track at that time was the old English U rail. Mr. John Mackenzie, now superintendent of motive power of the Nickel Plate road was an apprentice in the shop, and his father was working journeyman-work as a machinist.

The Confederates had torn up the rails as they retreated south and had bent some of them.

I think the Ninth Michigan Regiment of sappers and miners built up the road. When they got out to Mill Creek bridge we had just finished up a little old Harkness engine called the "J. Edgar Thompson." The M. M sent me out with her with a load of bridge timber. I think we finished the bridge, or nearly did so, in one week. I wanted to lay off one trip, and I got an engineer by the name of Mart Quinn to make a trip for me. Mart was a Nashville man, and had been running for the Confederates Well, Mart made the trip out with the "J. Edgar Thompson," but she never came back.

Mart came back in about two months the hardest looking citizen you ever saw. He had pretty hard work to get away from the Johnnies, but they did parole him and let him come to Nashville That parole meant for him never to run again or to go into the Yankee army, for any man caught the second time with a parole would be put to death, so Mart was stricken from the ranks of the engineers at his special request.

His engine had been captured right opposite Capt. Richard McCann's property Dick at this time was captain of a Confederate company. Before the war he was a passenger conductor on the Nashville & Chattanooga road, but you can see, dear reader, what a grand mistake he made in capturing a locomotive and burning her up with his own fence rails. That same locomotive belonged to his enemies, who were twice as strong as he was. Revenge is sweet to the Yank, and we had it.

Before 12 o'clock that night one regiment was ordered out to burn Richard McCann's house down I think it was the Nineteenth Illinois Infantry.

I was the engineer ordered to haul them out. I had an old inside-connected called "Slatter." I think she was got for the Pittsburgh & Fort Wayne road, anyhow she was an old-time Mason engine. My fireman's name was, I think, on that particular night Pat Crosby

The colonel got on the engine with the fireman and myself. The night was very dark, and when we got to within about two miles of Dick's residence we could see his camp-fire about one and a half miles on the right side of the road. I do not think he had more than 50 or 75 men, while we had about 700 or 800, but of course we did not know how many men he did have, and our colonel was expecting them to attack us while on the train.

I think he as well as myself became a little nervous I am sure that at one time he thought we were right into a trap, as he could see Richard's men on the move. He caught me by the shoulder, and asked me in loud tones

"Can you not stop that d—d noise the engine is making?"

"What noise?" I asked.

"That noise coming out of the stack"

I was pulling up a pretty good grade, and going around a curve into Antioch. I told him

"Yes, sir, I can stop that noise if you want it stopped"

"Well, stop it at once"

Well, you know all I had to do to stop was simply to shut off and it stopped.

Immediately the colonel stepped from the gangway to my foot-board and laid his hand on my shoulder and said

"Why, the train has stopped."

"Well, the noise is stopped," I answered

"D—n it, can't the train move without that noise?"

"No!"

"Well," he says, "put out that headlight and let her go"

Say, boys, we did not need any fancy cushions to sit on, we just stood up on our little foot-board ready to dodge bullets—and, I assure you, we had many a one to dodge Well, we arrived and stopped in front of Dick McCann's house. I asked the colonel to let me go with him, so he did I asked him what his orders were, and he told me they were to get the folks out of the house and burn up the house and contents, not even allowing Mrs McCann to take her wardrobe out.

I says, "Colonel, that is pretty hard."

He surrounded the house with his men, and he and I went up on the gallery at the front door and rapped. It was then about 11 P. M. Mrs. McCann came to the door herself As soon as she saw who it was she said in a very pleasant voice

"Good evening, Colonel." The colonel says

"Good evening, Mrs. McCann."

He then pulled out a large government envelope and says, "Mrs McCann, I have called on you on very unpleasant business"

She says, "I expected you, and I told and begged Richard not to capture that engine and burn it up, for the Yankees would have revenge soon, but I did not expect it so soon," but like a brave woman she says

"Colonel, do your duty as a soldier should, but let me save my wardrobe, as it is not much, but I never expect to get any more."

I looked at the colonel, and saw big tears standing in his eyes.

I said, "Colonel, please let me have some of your men, and give us five or ten minutes before you apply the torch" The men in front could hear all we said, and responded just as soon as the colonel gave his consent, which was five minutes.

I told Mrs. McCann to tell us quick what she wanted to save, and we hustled it out lively. Inside of six minutes that house was one solid mass of flame

As soon as the colonel was satisfied, we all boarded the train and started back to Nashville

Poor Dick had to stand on the hill and see his hard-earned money go up in flames and smoke. Perhaps you will laugh at the idea of a passenger conductor having hard-earned money in the good old days before the war, but everybody said that Dick was honest

Well, we will drop Dick for a while. Colonel McCullom, the colonel of the Ninth Michigan, was an indefatigable worker. He pushed the road through to Murfreesboro, thirty miles from Nashville.

Of course, if your refer to the history of the war you will see that we fought for every inch of the ground, and we fought one of the hardest battles ever fought before we got to Murfreesboro—that was the battle of Stone River The Yanks got there, then we got to running regular trains to that point Brice Custer (a brother of General Custer), Hi. Keys, George Richardson, Bill Russell, Daniel McGee and myself ran them We kept this run about three or four months General Rosecrans was in command of the Army of the Cumberland. I believe General Sherman relieved him before we left Murfreesboro. Well do I remember when we left A little incident happened to Hi. Keys before we left.

I was lying at Murfreesboro one night, when Hi. Keys came in on extra and had orders to come right back to Nashville. He commenced joking me about getting out ahead of me I tell you, boys, I never felt sad about anybody getting ahead of me going out, for in those days it was safer to stay inside of the lines.

Well, he got out in about one hour's time About two hours afterwards I was called to get ready and go. Well, I started out. My fireman's name was Mike Campbell. When Mike got aboard, I asked him how he felt. He said he felt just as if something was about to happen I laughed at him and away we went.

We got within nineteen miles of Nashville, on the Knowland pike, when I saw Hi.'s red lights. I called Mike's attention to them. "Didn't I tell you, we had better look out, for that train is captured," says he At that time we carried with us forty or fifty soldiers as a guard on each train

I pulled up to the red lights, and halloed —but got no answer. I got off my engine and went up to the caboose and found it empty. I heard Hi.'s engine blowing off steam through the safety-valve. I called the captain of the guard and told him something was wrong in front of the train. It had been raining hard and the ground was very muddy. I asked the captain to take half his men and go one side and I would go up the other side.

He said "No," very quickly. I said, "All right, you stay and guard this train, and I and my fireman will go." So Mike and I started up each on a side—of course we were unarmed, and I thought if we were captured they would parole us and let us go—but it would not have been so, for Dick McCann and Gen. Forrest sent me word the very next day that if ever they caught me they would kill me, for hauling the troops out that burnt Dick's house.

Now you see what a generous railroad man he was after what I had done for him. I guess if I had heard this one day sooner I would not have gone up to that train.

Well, as it was I did go, and Mike also. We did not find, nor see, nor hear of any rebels, nor did we see old Hi. nor his fireman, nor any Yanks, all were gone, and the poor old engine was laid over on her side, trucks badly damaged and one cylinder broken. This engine was an old Roger engine, called after the M. M., "T. W. Smith"

On looking around, we could see where old Hi. and his fireman had made tracks through the mud and ran to Lavene, about two miles away. It was a telegraph station.

Hi telegraphed to Nashville, and said that the Rebs had a battery planted on the Knoxville pike, and had fired into him and knocked the engine off the track. Well, poor old Hi thought this was so, but it was not, Mr. Editor, the Rebs had a better thing than the trouble of placing a battery to knock an engine off the track. It was simply a bomb-shell, as we found out afterwards. It was placed there by one man. He slipped out a tie and dug a hole, then placed in the bomb, and laid the end of the rail on the cap. As soon as the engine struck it, it exploded and knocked her off the track The bomb was made like a jug I think it would hold about a peck of powder and slugs.

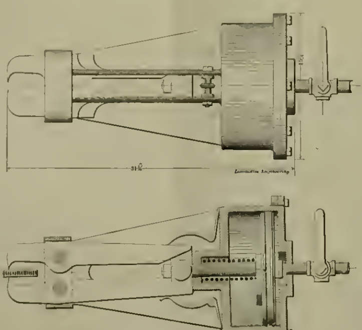
*[To be continued.]*

The B. & O. are getting ready for the World's Fair business, and are fast adding new engines to the passenger equipment. They have put into service some forty engines within two months. There are now employed out of Chicago some of the big 19x24 American engines with $6\frac{1}{2}$-foot drivers. Engines of this class are those that do the dizzy act in hauling the Royal Blue trains between Philadelphia and Washington.

## Baird's Stay-Bolt Cutter.

We hereby illustrate a novel form of stay-bolt cutter in use in the shops of the Atchison, Topeka and Santa Fé, and invented by the boiler shop foreman, Mr. Archie Baird. Those interested will readily understand the machine by examining the engravings. It is a set of beveled shears operated by a piston and having sufficient power to cut a stay-bolt. It does the work very expeditiously. The medium of power may be air, steam or water, but the former is best suited for ordinary shops. The device takes very little room, being 32 inches long and 15 inches diameter, and is suspended by a clevis at the center of gravity so that it can easily be handled by one man. The piston is connected to a V-shaped crosshead, which operates the shears. The leverage is three to one and the piston receiving a pressure of nine tons imparts a shearing power of 27 tons. The cutting edges of the shears are so made that in operating the machine for cutting stay-bolts all that the operator has to do is to simply let the shears come up as close to the boiler as the shears will allow it, and after the bolt is cut off it leaves just enough protruding to make a good head of a bolt after it has been hammered up. There is attached to the piston a rubber washer and coil spring, which render the machine noiseless, prevents any pound, and acts as a cushion while returning the piston to its normal position. There are also plate springs at each side which return the blades to the normal position when the bolt has been cut off.

This machine can cut off an average of 1,000 bolts, $1\frac{1}{4}$-inch diameter, per hour. It makes a neat, clean, shear cut, allowing an equal amount of each head to be riveted over afterwards, and does this without the injury to bolt and thread, so common with the hand process. After cutting over 50,000 stay-bolts the cutting edges of the shears are as sharp as when they were first applied.




BAIRD'S STAY-BOLT CUTTER.

## The Memphis Bridge.

One of the greatest bridges in the world was last month opened across the Mississippi by the Kansas City & Memphis Railway, at Memphis, Tenn, being the only bridge across this river below St. Louis. It is the largest truss bridge in this country and is the third largest in the world. The eastern end of the bridge is located on a high bluff near the point from which De Soto is said to have first viewed the Mississippi. The first span is a cantilever anchor arm, 226 feet high. Then there is the main span of $794\frac{1}{2}$ feet, and then two more large spans aggregating 2,597 feet and terminating in 2,300 feet of plate girder viaduct, making a total length of nearly a mile and a half. The bridge weighs 9,500 tons The main posts are 80 feet high and weigh 30 tons each. It is entirely of steel and some of the plates used are said to have been the largest ever rolled in the United States. We have condensed these facts from an illustrated article in the *Engineering Record*.

It is surprising to witness the hopefulness there is among inventors relating to bumper-brakes. That was the first of continuous brake tried for controlling railroad trains, and it has been brought out in a variety of forms that follow closely on the number of car-couplers. No form of bumper-brake ever worked satisfactorily, and every inventor of bumper-brakes appears to have wasted his time; yet others keep coming up like sheep to the slaughter. A month ago a patent was granted to William B. Guernsey, Norwich, N. Y., for an automatic compression-brake, for which no less than thirty-five separate claims are made. The principal novelty of the brake is that it has more mechanism than most of those that went before it

## Some Tests of Hollow Stay-Bolts.

The Falls Hollow Stay-Bolt Company recently submitted some of their bolts to severe tests in order to demonstrate the fact that there were no welds of any kind in them.

That they are made of good material is shown in the picture below, which was reproduced direct from the photograph; in each case where the bolt is partly broken it was first "nicked" deeply to insure a break.

The central piece is one of many that we saw drifted until they split. In each case there was a distinct tear of the metal and no appearance of a weld.

There are makes of hollow bolts that are welded up of half round stock or of two common gas-pipes one placed within the other and welded there; this last is a dangerous thing when a bad weld occurs as the outer tube has the thread and is fast to the sheet while the inner one has nothing to hold it; when the outer skin breaks the inside tube pulls out like a telescope.

With high pressures, hollow stays or drilled stays are an insurance of notice in case of rupture, the drilled stay will tell of the bolt broken next to the outer sheet—where most of them do break—but the bolt with a hole clear through it will inform on a case of treason anywhere from the fire-box to the shell.


About the most fertile of car-coupler inventors is Mr. Lucien Barnes, of Syracuse, N. Y. He was the inventor of several couplers that are now in the market under other names, notably the Gould. Last month patents were granted him for still another coupler of the M. C. B. standard type.

On the railroads of Jamaica the train men get about the smallest wages paid for similar service. The conductors get from six to ten dollars a week, and the engineers from ten to fifteen. One of the curious who ran a 10-wheel Rogers engine there on a 176-foot grade, while building the division, got the magnificent salary of fifteen dollars per week; when the road was completed he was promoted to running a regular passenger train and his pay was fixed at ten dollars and fifty cents per week. Jamaica is an English colony and the management of the road is English. It is too bad that this road can't be forced to pay its responsible men, the engineers, decent living wages.

A "Circumstance"—Forty Head of Cattle Killed.

The Toledo, St. Louis & Kansas City, of which Mr. John Orton is master mechanic, have lately erected very good shops at Frankfort, Ind., for locomotive and car repairs. The shops are substantially built of brick, and are arranged on the parallel plan. The equipment of tools is very good, and the tools are said to be admirably arranged for doing work with least possible movement of material.

We have lately heard numerous highly favorable reports from master mechanics about the Leach sanding device for locomotives. Those who are using the invention appear to be finding new virtues in it all the time. Several of those who have the sander in service say that it saves enough tires in six months to more than pay for the outlay of applying it. The saving of sand is also no small item. It appears to fulfill the double purpose of providing sand at the right time and place, and at the same time using less than half the quantity distributed by the common sand-box.

## An Old Hay-burning Locomotive.

The above heading does not mean that the curious old locomotive shown attained eminence by setting fire to the hay on the right of way. She obtained in early days her energy for train-pulling by burning hay in the firebox. She is to be seen in the Canadian Pacific yard at McAdam Junction, N. B. The engine was built by the Portland Locomotive Works, in 1856, for the Portland, Saco & Portsmouth road, and was one of the first outside-connected engines built at Portland. The cylinders are 13x20 inches, and driving-wheels 60 inches diameter. The steam-chest is horizontal and the cylinders inclined and riveted to the smokebox, which is wrought iron. The throttle-valve is in the smokebox and is of the old D pattern.

The engine came into the possession of the New Brunswick Railway by consolidation of the road for which she was built. She is fitted up for sawing wood and is still used for that purpose. The mate of this engine was thoroughly overhauled three years ago and sold to the Chigneto Ship Railway Co. for construction purposes.


A Laboring Man.

A cylinder-casing formed of one piece of pressed steel has been patented by E. W. Mackenzie Hughes, of Chicago. The intention is to make the casing by the Fox process.

## Indicating the Engine on the Fastest Train in the World.

By Angus Sinclair.

DESIRE FOR HIGH SPEED.

The desire that people have to transfer themselves from one place to another with the least possible loss of time will always keep up a keen popular interest in rapid means of transportation. The mind flies round the world fast as the electric flash and the means of making the body keep pace with the mind at that kind of speed is what would satisfy the extremist demand for rapid transit. Something very much less than this will have to suffice even with electricity as a means of propulsion, but meanwhile the people want to know to what extent their progress through space is likely to be accelerated in the near future. It was for the purpose of being able to obtain some accurate information on this subject that the writer lately made a power test of a locomotive pulling the fastest train in the world.

The resistances to movement encountered by railroad trains at the higher speeds and the amount of power required to move trains at high velocities have excited great diversity of opinion among the men who ought to be best capable of settling these problems. The subject is certainly not well understood, or there would be less uncertainty about how fast it is possible to run trains. For years a mile a minute has been regarded as the outside limit at which a railroad train could be run, but performances have lately demonstrated that the locomotives coming into use on our first-class lines are capable of exceeding by one-half the old accepted limit of forced velocity. There are probably as many locomotives in the country to-day that could be urged, under favorable circumstances, to attain a speed of ninety miles an hour as there were engines fifteen years ago capable of maintaining on a level track a speed of sixty miles an hour.

THE EMPIRE STATE EXPRESS.

There is at present in this country a popular demand for faster trains between the principal cities. This demand was inevitable with the improvement in railroad structures that rendered fast traveling safe, but it has been very much stimulated by the remarkable success of the Empire State Express run by the New York Central Railroad Company. This train is the fastest in the world. The running time between New York and Buffalo, a distance of 439½ miles, is 8 hours and 40 minutes, calling for an average speed of 52½ miles an hour. A peculiarity about this train is, that it is the most punctual in arriving at its destination of any long-distance train in the country. If any delays occur they are nearly always made up, and on one occasion lately 31 minutes were made up on one division

Through the courtesy of Mr. William Buchanan, superintendent of motive power of the New York Central, the designer of the locomotives that run these fast trains so successfully, the writer was privileged to make a test of one of the engines The work consisted in making a record of the water and coal used in two runs from New York to Albany, and the taking of indicator diagrams to show the working of the steam in the cylinders and supply data for estimating the horse-power developed.

LOCOMOTIVE 870

The engine tested was No 870, with cylinders 19 x 24 inches diameter, driving wheels 78 inches diameter, and having a boiler with 1,821⅝ square feet of heating surface and carrying steam at 170 pounds pressure The engine which is of the eight wheel type, was illustrated in the February number of LOCOMOTIVE ENGINEERING, and was built at the Schenectady Locomotive Works There is nothing peculiar about the engine except that she has an exceptionally large boiler and has steam passages sufficiently large to permit the steam to get in and out with little wire-drawing or obstruction The engine is equipped in excellent style for convenience in operating She has Richardson balanced valves, Jerome metallic packing, Nathan light-feed lubricators, and piped lubricators to the principal bearing

ATTACHING THE INDICATOR

As a connection for the indicator openings were drilled into the counter bores at the ends of the cylinders, and connecting pipes led to the top of the steam chest where the indicator was set Motion from the cross-head was taken by a Brumbo pulley secured to a swinging bar fulcrumed on the running-board This is a fairly good method of reducing the cross-head motion for ordinary locomotive speeds, but it is not adapted for the shocks that are inevitable when a train is running faster than sixty miles an hour. The indications were taken with a Tabor indicator, having a five-inch drum and a spring with a scale of 100 pounds to the inch. The indicator is all that could be desired for high speed purposes A Crosby revolution counter was used which gave an accurate record at the highest speeds

THE RECORD.

The mechanical department of the New York Central have devoted a great deal of attention lately to keeping close water and fuel records, which enabled me to obtain the benefit of men accustomed to taking records and appliances that had been found satisfactory. The speed counter was operated by Mr P T Lonergen, chief draughtsman of the mechanical department and he also noted the steam pressure and position of levers. The water and coal record was taken by Mr. Wm J McDonald, an engineer who has much experience of that special work.

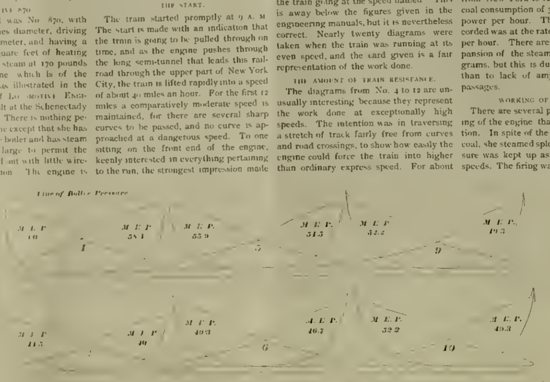
THE TRAIN

The train consisted as usual of four coaches weighing, with estimated load, 340,000 pounds The engine and tender in working order weigh 200,000 pounds, so that a total weight of 270 tons had to be kept in motion

In watching the preparations for the start to make a run of 143 miles without stopping, there was nothing unusual to be noted. Engineer Buchanan appeared to devote anxious attention to having all the bearings carefully oiled, and the fireman had the long 8-foot firebox well loaded with a clear-burning fire The coal on the tender had a very unpromising look, for most of it would have passed through a 1-inch mesh, but it proved better than it looked.

THE START.

The train started promptly at 9 A. M The start is made with an indication that the train is going to be pulled through on time, and as the engine pushes through the long semi-tunnel that leads this railroad through the upper part of New York City, the train is lifted rapidly into a speed of about 40 miles an hour. For the first 12 miles a comparatively moderate speed is maintained, for there are several sharp curves to be passed, and no curve is approached at a dangerous speed. To one sitting on the front end of the engine, keenly interested in everything pertaining to the run, the strongest impression made was the careful manner in which the train was handled.




*Tabor Indicator, Scale 100*

THE ROUTE.

This route offers exceptional opportunities for fast running, because the railroad follows the bank of the Hudson River and there are no track crossings at grade and few road crossings. The streets of the numerous villages are well protected and the track is almost a true level A speed of a mile a minute could probably be maintained safely all along the route after leaving the Grand Central Station, but they do not operate the train in this way. At a few sharp curves the engineer reduces the speed sufficiently to permit the train to go round without shock and then the few seconds of time lost are made up by faster running on the straight track

THE POWER REQUIRED TO PULL THE TRAIN.

During the time that the engine was first lifting the train into speed diagram No 1 was taken. It shows a mean cylinder pressure of 59 pounds. According to this the power exerted on the rails to move the train is 6,553 pounds, or 24 pounds per ton The speed is 37 miles an hour, which could be maintained on about half the expenditure of power represented by the diagram. The balance, of course, is expended in accelerating the speed. When a speed of nearly 60 miles an hour was reached, the engine settled down to steady running, neither accelerating the velocity or letting it decrease. Card No. 2 represents the work done in this way and measures the power required to keep this weight of train running at a mile a minute. The average cylinder pressure is 40.7 pounds, representing a total traction force of 4,520 pounds without making deductions for interval friction. If we deduct 10 per cent. for friction, it leaves 15 pounds per ton to keep the train going at the speed named This is away below the figures given in the engineering manuals, but it is nevertheless correct. Nearly twenty diagrams were taken when the train was running at its even speed, and the card given is a fair representation of the work done.

THE AMOUNT OF TRAIN RESISTANCE.

The diagrams from No. 4 to 12 are unusually interesting because they represent the work done at exceptionally high speeds. The intention was in traversing a stretch of track fairly free from curves and road crossings, to show how easily the engine could force the train into higher than ordinary express speed. For about 20 miles the speed was maintained at about 70 miles an hour, and it probably ran up to 80 miles, for diagram No 11 was taken when the engine was making 340 revolutions per minute, which is within a few feet of 79 miles an hour. Cards 4 and 5 were taken shortly after water had been scooped up and when the engine was working into speed Cards 6, 7 and 8 represent the work of keeping the train running 70 miles an hour. They were taken three miles apart when the speed was almost uniform. The average cylinder pressure for the three cards is 47.6 pounds Deducting 10 per cent. again for friction, this leaves 17 6 pounds per ton as the power exerted in keeping the train up to a velocity of 70 miles per hour. Cards 9 and 10 show an increase of area due to the opening of the throttle, and by the aid of a slight descending grade it worked up the speed to about 79 miles an hour, when diagram No. 11 was taken. This is a phenomenally good diagram for the number of revolutions and a piston speed of 1 360 feet per minute. The back pressure is unusually small for this speed, and the compression is not beyond what is necessary to insure smooth running. This result is due in a great measure to the large steam ports.

THE DIAGRAMS.

The diagrams represent the steam distribution as it goes on in the ordinary working of the locomotive. Some of them show bad reduction in initial pressure due to throttling. The evil of this can be appreciated from a study of diagrams 2 and 11. In the former, 31.4 pounds of water are exhausted for each horse-power developed, and in the latter the water consumption per horse-power is 21 pounds. Throughout the trip 7 pounds of water were evaporated per pound of coal As near as I can estimate, the work of pulling the train from New York to Albany was done on a coal consumption of 3½ pounds per horse-power per hour. The highest power recorded was at the rate of 1,120 horse-power per hour. There are traces of initial expansion of the steam in most of the diagrams, but this is due to throttling rather than to lack of ample steam pipes and passages.

WORKING OF THE ENGINE.

There are several points about the working of the engine that are worthy of mention. In spite of the slack character of the coal, she steamed splendidly, and the pressure was kept up as easily at the higher speeds. The firing was very skillfully done. There was very little jar to the engine, and she rode like a coach, and passed the sharpest curves very smoothly. When running close on 80 miles an hour the machinery worked as smoothly as at the lower speeds, and no trace was to be perceived of hammer-blow or other disturbance due to the heavy weights swinging round at a great velocity.

Annexed are a few leading dimensions of the engine

Size of cylinders, 19 x 24 inches

Driving-wheels, 78 inches diameter.

Steam ports, 18 x 1¼ inches.

Exhaust port, 18 x 2¾ inches.

Bridges, 1⅛ inch thick.

Eccentric throw, 5¼ inches

Valve travel, 5½ inches.

Outside lap, 1 in.

Inside lap, $\frac{1}{64}$ inch each side.

Driving-axle journals, 8½ x 10½ inches.

Engine truck journals, 6 x 10 inches

Tender journals, 4½ x 8 inches.

Crank pins, 5½ x 5½ inches.

Side rods, channeled, 4½ x 3½ inches.

Boiler material, steel, $\frac{9}{16}$ inch thick

Firebox, 96 inches long, 40⅞ inches wide.

Tubes, 268, 2 inches outside diameter, 12 feet long

Heating surface of tubes, 1,670.7 sq feet.

Heating surface of firebox, 150 8 sq feet.

Grate area, 27 3 sq. feet.

PARTICULARS OF INDICATOR DIAGRAM.

| No. of Diagram | Throttle opening | Reverse lever notch | Point of cut off | Boiler pressure | Revolutions per minute | Speed in miles per hour | Indicated horse-power |
|---|---|---|---|---|---|---|---|
| 1 | ¼ | 18 | 8½ | 160 | 160 | 37.1 | 648 3 |
| 2 | ¼ | 18 | 8½ | 165 | 260 | 60.8 | 728 |
| 3 | ⅛ | 18 | 8½ | 170 | 190 | 44 | 551 |
| 4 | ⅛ | 18 | 8½ | 170 | 250 | 58 | 891 |
| 5 | ¼ | 18 | 8½ | 160 | 260 | 60 | 900 |
| 6 | ¾ | 19 | 7¼ | 160 | 298 | 69 | 983 |
| 7 | ¾ | 19 | 7¼ | 160 | 304 | 70.5 | 977 |
| 8 | ¾ | 19 | 7¼ | 165 | 296 | 68.6 | 972 |
| 9 | ¾ | 19 | 7¼ | 165 | 300 | 69.6 | 1,045 |
| 10 | ½ | 19 | 7¼ | 170 | 304 | 70 5 | 1,059 |
| 11 | ½ | 19 | 7¼ | 165 | 340 | 78 9 | 1,120 |
| 12 | ½ | 19 | 7¼ | 165 | 310 | 71 9 | 1,026 |

## How to Fix Up a Headlight.

By C. B. Conger.

Some of the young men who have fired a good engine with a headlight in first-class order, which was looked after by an engineer that was an expert in the business, get a great shock when they are promoted and get an engine ready to fall to pieces. The headlight on her in generally in bad shape, wick burned short, a leaky oil tank, air passages around the burner and wick-tube full of dirt and pieces of crust off the wick, reflector smoked up and top of case filled with soot.

It is quite a trick to put it in good shape to give you good service.

In the first place empty the oil tank, rinse it out with a little clean oil, see that the oil-pipe between wick-tube and oil-tank is open and clean of sediment; if it leaks around the shaft of the little cog-wheel that turns the wick up, put some candle-wick packing in the nut and don't screw it up too tight. If the oil-tank leaks, now is the time to get it soldered, the pipe to let air in the top of the oil-tank should be high enough so oil won't splash out; an air hole as large as a small needle is large enough if kept open, a large air hole lets the oil slop up around a loose wick.

A knit or felt wick is the handiest to put in as they are made the right size, if you have to make one of cotton flannel, get some one to show you if you don't know how, as it is something that can not be well described. Put it in smooth and even, tie it at the bottom around the wick-holder with fine linen thread with a small knot so it will not crowd the wick against the other side of the wick-tube. After getting the wick in so it can be raised or lowered easily, run it clear down and burn off the top even with the top of the wick-tube, with a small flat piece of red-hot iron; then fill the tank with oil. See that *all* the holes and air spaces about the burner and the air hole up inside the wick are wide open and perfectly clean; the supply of air inside and outside the flame must be adjusted or it will smoke. If the flame strikes the chimney, too much air comes up inside the flame around the button, if it runs up straight and close to the button, there is not enough inside. A new headlight has a slide at the bottom of the inside tube to shut off the supply of air when necessary; if this slide is gone, get a cork large enough to fill the hole and cut big notches in its edge to let a sufficient supply of air past it.

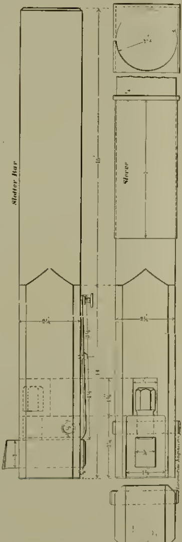
See that the springs on top of the reflector are bent so as to hold the chimney square with the burner, and keep it from striking the edge of the hole in the reflector when running. Then use oil and fresh lampblack to clean the reflector. Old lampblack often has dirt and grit in it on account of the package being open on the engine for months, and it will scratch your reflector. Do not use any tripoli, whiting, or patent polish, the silver coating is thin enough without scouring it off. If you use alcohol to mix the lampblack with, it is better than oil, as it evaporates and leaves the silver clean. When the reflector is done, clean out the case, get all the soot out of the opening in the top, so the draught will not be interfered with; wipe the case out clean, get some quick-drying white paint, with which paint the inside of the projecting ring the glass is set in. The reason for this is, pure white is a good reflector of light. If the headlight has the number of the engine in the sides of the case, paint the outside of the reflector, sides, and back of the case also. It is an advantage to tip the top of the headlight away from the stack a little and put a wedge under the bottom, so it will throw more of the light on the track, where you want it, and not up in the air. When the flame is the right height and burning properly, the middle of the flame should come level with the little prick punch mark that is exactly in the middle of the back end of the reflector, then the light is in the focus of the reflector. If you suspect the oil you use is poor or has water in it, empty the oil-tank once in a while, as the water all settles in the oil pipe at the bottom of the wick and keeps the oil out.

It will take half a day to do all this work, and do it right the first time you try it, *but it pays to do it well*. A good headlight may save your job for you the first time you head into a siding with a full train and show you cars, when the siding was said to be "all clear." This is a long item on this subject, there is some more of it on page 5, March number, 1889, Locomotive Engineer.

## Improved Slotter Bar.

Illustration is made herewith of a very handy slotter bar designed by W. E. Ormond, a machinist in the E. T. V. & G. shops at Atlanta, Ga.

The writer recently saw one of these




Slotter Bar.

bars at work there, and was much impressed with the handiness of the tool. This particular bar was 29 inches long, 15 inches of the upper end being turned round and fitted into a split box that clamped it in any position, the lower part being of 2-inch square steel stock, the bottom is slotted out and a tool holder hinged into it, the sizes being given on the plate. Behind the tool block there is an adjustable spring that holds the tool firmly against the set screw bearing, yet allows it to swing clear on the up or return stroke.

The bar saves a great deal of setting, and requires only the cheapest and easiest made tools.

On another page, in Mr. Tabor's article, will be found an indicator card taken from a Baldwin compound locomotive running 91.7 miles per hour—the fastest on record.

## A Texan Narrow Gauge.

The Houston, East & West Texas system of narrow gauge line reaches from Houston, Tex., northwest to Shreveport, La., and taps a large lumber and agricultural district.

This road is one of the few old-fashioned narrow gauges. It has pretty good sized cars and they carry a standard gauge load all right, but their largest locomotive has only a 13-inch cylinder, and the majority of them are 12x16-inch.

There are in operation some 232 miles of the yard-wide track, and their passenger trains make over one hundred stops in this distance.

Our old friend E. A. Campbell has charge of the motive power, and seems to be wringing a good deal out of it without putting much in. It is almost useless to ask for anything on a narrow gauge—"Wait till after we widen out," is the usual form of delay.

One thing they have got, the best I saw in the South, and that is a diamond stack for wood-burners. It is smaller than the usual balloon affair, and seems to be especially efficient in a cotton-carrying country, and the fire claims of the road are practically *nil*.

The shops are mere sheds, not worth mentioning, and while all the new machinery is first-class there is not much of it, and a whole lot of old stuff.

Campbell is one of the happiest of men, however, has more friends than the Governor, and knows how to show a railroader all the shops in the city as well as his own.

This little road was built by a shrewd old Frenchman, Paul Bremond, who also built the H. & T. C. road. Bremond was an eccentric old fellow, a confirmed spiritualist; he claimed that a spirit appeared to him once and said "Paul, arise, go thou and build railroads—but don't try to manage any of them."

Paul arose and built the H & T. C. and sold out at a large profit, and the road prospered. Then Paul arose again and built the narrow gauge, and tried to run it—and that appears to be the matter with it now.

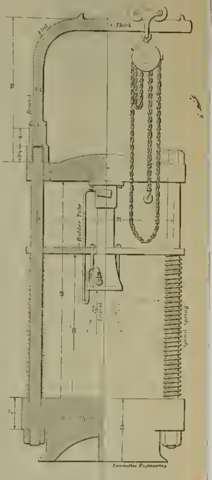
J. A. H.

We have heard reports lately that several railroad companies having large shops are contemplating the adding to their establishments a foundry for making malleable iron castings. Malleable iron is coming so much into use for railroad rolling stock purposes that it seems natural for railroad managers to conclude that they ought to make the castings themselves, just as they make their other castings. We have reason to believe that establishing plant for making malleable iron castings is likely to prove an expensive way of obtaining the desired product. The running of a malleable iron foundry requires not only special skill in management and workmen, but it requires special selections of iron. It might be well for those intending to go into this business to inquire into the experience of others who have added malleable iron foundries to manufacturing establishment. The makers of agricultural implements have in some instances started malleable iron foundries in connection with their works, and we understand that in every case the cost of castings is greater and less satisfactory then it was to purchase from those who make malleable iron casting a specialty.

A praiseworthy arrangement has been arrived at between all the French railway companies. In future every employé, of no matter what line, will be entitled to a return free pass once a year to any station in France, and his family living with him to passes at one-quarter the usual passenger rates. This understanding will, therefore, allow railway employés to spend their yearly holiday in their own home, or wherever else they may choose, at little or no expense.

## Cheap Hydraulic Press.

The press shown was designed by Mr. E. E. Davis, master mechanic of the Boston & Maine shops, at Boston, and is used for pressing in driving box brasses and for the numerous other jobs about a machine




Handy Press.

shop where steady pressure is much preferable to blows. As will be seen the apparatus consists essentially of a hydraulic jack set in a frame and special springs to return the head to the normal position.

An improvement in car heaters has lately been patented by William C. Baker of Baker Heater fame. The improvement is designed to use steam from the locomotive as the heating medium for a perfected system of hot-water circulation. He has also patented an improved form of safety vent for steam apparatus, which appears to overcome the shortcomings that have usually been found in giving relief to the Baker heater.

Concerning the question of long locomotive mileage which has been exciting some of our readers, a correspondent in New Orleans makes a plea for an engine on the Louisville & Nashville, which he considers deserving of the confectionery. The engine doubles a run of 180 miles every day of the year, making over 120,000 miles annually.

To be ready for the variety of cars that will be running all over the country during the World's Fair, the Chesapeake & Ohio people have prepared a drawing, showing the maximum dimensions of cars that will pass through their tunnels. Blue prints will be furnished to all connecting lines or others desiring them.

The New York, Providence & Boston are in the market for six locomotives. The chances are that the Rhode Island Locomotive Works will secure the contract. These works have lately secured an order from the Ohio & Mississippi for fifteen ten-wheel engines with cylinders 20x24 inches, and five six-wheel switchers.

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## Steel vs Iron for Fireboxes.

The following letter, written by the American agents of the Low Moor Co., appeared in a recent issue of the *Railway Age*:

"An article in the May number of LOCOMOTIVE ENGINEERING, concerning an order recently given for Low Moor fireboxes opens up an interesting question for discussion. The writer of that article seems to have overlooked some important considerations. Twenty years ago Low Moor iron was almost invariably used for this purpose, and there are engines in service to-day that have Low Moor fireboxes and boilers that have been in use twenty years or more and are still in good order.

"Steel superseded Low Moor iron because it was cheaper and ... service. This ... filled ...

... on roads ... pits and corrodes ... Low Moor iron does not crack, and it withstands the effects of the bad water in a way that steel never has and never will.

"As to failures of iron plates caused by blisters and laminations, that is entirely a question of proper welding. Low Moor iron is a clean, sound metal, and being properly welded, very seldom shows either of these failures. The possibility of such defects is more than offset by the tendency of steel plates to crack and blister.

"If the writer of the article referred to will read Dr. Dudley's report read at the meeting of the American Institute of Mining Engineers in regard to the tests made by him at Altoona on steel plates, he will see that the conclusion which the Pennsylvania people have come to is, that the trouble with steel plates, aside from their tendency to crack, is blisters caused by slag and gas bubbles which it is impossible to prevent.

"The master mechanics who used Low Moor plates twenty years ago and have gone through the steel age are the ones who are coming back to this material to get them out of the troubles which the use of steel has brought them into. The superintendent of motive power referred to in the article is one of these men, and one who stands among the very highest in his profession. So far from being twenty years behind the times, he is in line with the movement which bids fair to replace steel with Low Moor iron almost universally on the roads which are obliged to use bad water."

It is rather a late day to revive the discussion of the causes that led to the general substitution of steel for the iron plates formerly used in fireboxes, but the memory of persons interested may be refreshed by a review of the facts. It is natural that the agents for Low Moor iron should consider that the change to steel was a mistake, and that their interests and aspirations should magnify the prospects of a return to iron, but there are few disinterested persons likely to see the question in the light that favors employing iron again. The experience with the different kinds of material for fireboxes has been too conclusive in favor of steel.

No question relating to railroad machinery received more investigation from the Railway Master Mechanics' Association than the "material best suited for boilers and fireboxes." A convention seldom passed during the first ten years after the association was formed without this question being reported on or discussed. For years iron as a material for fireboxes had many friends, but they gradually grew less until their voices ceased to be heard. They were all compelled to yield to the inevitable and adopt the use of steel, because iron was notoriously given to failure through laminations and blisters. One of the latest reports on material for boilers and fireboxes says:

"As steel of a low grade has so firmly established itself in favor, and is almost universally used for the firebox sheets of coal-burning locomotives, we do not consider it necessary to prevent the relative merits of steel, iron and copper, but we may safely conclude that steel is the best. Steel of a low grade seems to meet all the requirements, if we except its tendency to crack in the side sheets of the firebox. This tendency is not confined to steel, but reports show that iron has the same tendency in an equal if not greater degree, besides its liability to blister from imperfect welding in the process of manufacture, or in other words, from its not being homogeneous."

As the manufacturers of steel plates obtained year by year increased experience in their business, an article was produced which was much more reliable for fireboxes than the steel used in the first few years after it was introduced. The best quality of sheets were, however, given to cracking round the stay-bolts when the inside became incrusted with scale, and this character of failure has continued to be a source of complaint against steel. Some men are very ready ... magnitude of ... ii ...

... ted to abide ... of experience, especially ... owners, and this class of men have flown at sundry times from the evils of cracking steel sheets and bought new experience with iron sheets that cracked and blistered and laminated. Six or seven years ago the troubles with iron had become so dim that the master mechanics of several roads began using iron, and the movement was heralded far and wide by the iron sheet interests. The movement was of remarkably short duration. While investigating at that time the experience of various roads with iron and steel for fireboxes, the writer received a great many letters from master mechanics which were practically unanimous in favor of steel.

The following is an extract from a letter received from Mr. William Buchanan, superintendent of motive power of the New York Central: "My experience thus far has been entirely satisfactory in the use of steel, and I consider it in every way superior to iron for both boiler and firebox. Very frequently while using iron we would lose about one out of every three plates in flanging, resulting from the looseness of the metal, and the boiler would need patching; and a so-called new boiler would be patched after completion. Another objection to iron for fireboxes was that the sheets would become blistered, and after not more than three months' service would have to be patched. Since using steel there has only been one or two instances where the metal blistered. Another advantage of steel over iron is that the metal does not draw in working, but retains about its original thickness. It is also less given to the dangerous practice of grooving inside."

The criticism Dr. Dudley made on steel plate in his report to the Institute of Mining Engineers is no doubt true. Steel is far from being perfect, especially the cheaper brands that some roads are short-sighted enough to purchase. But the Pennsylvania Railroad Company, which Dr. Dudley represents, do not propose going back to iron because steel is defective. There are sufficient records belonging to that company to keep them informed of what they would experience if they were to fly from the lesser evil into the vortex of the greater. If we could hear of any material likely to give better results than steel for fireboxes, we should be glad to advocate its use. Iron gives no such promise. It has been weighed and found wanting. Iron is superior to steel for stay-bolts and many other purposes, but for firebox sheets it is not a success. If any master mechanic is inclined to coquet with iron for fireboxes, we would advise him, "Don't!"

## Good Joint Inspection System.

A number of the railroads running into Buffalo, Cleveland and other interchange points are delivering and receiving cars under a joint inspection agreement prepared by Mr. A. M. Waitt, assistant general master car builder of the Lake Shore.

A joint foreman is engaged, whose duty it is to see that all cars are carefully and impartially inspected. The foreman has the authority to decide all disputes, but appeals may be made to an executive committee appointed by the roads interested. The decision of this committee is final.

All cars are received if safe to run, and defect cards given by the joint foreman.

When trains are delivered on receiving tracks, no loaded cars are sent back. If they require repairs, they are attended to by the receiving road and a defect card given. If a loaded car cannot be put in safe condition, the load is transferred at the expense of the delivering company and the car returned. All action ... cars must be ... d ...

... the ... responsible for ... connected with the inspection, oiling and light repairs of all cars.

The joint foreman is governed by the M.C.B. rules, and special interpretations of them or special rules issued by the executive committee.

Each road accepts its own cars with certain old defects without defect card, provided the defects have not been caused by derailment, wreck, or unusually rough handling. The acceptable old defects are: running boards defective; roof boards loose or missing; end or side finish loose or missing; end or side sheathing loose; ends or sides bulged (not broken); corner plates cracked; truck or body bolster broken; spring planks broken, truck springs broken; draft springs broken, brake-shoes worn out; journal bearings worn out (in accordance with M. C. B. rules); center plates broken; center plate bolts broken; truck truss-rods broken or missing; body truss-rods broken or missing; center pins broken or missing; oil-box covers broken or missing; spread trucks; loose dead blocks; cars low on trucks, where wheels come in contact with intermediate timbers; side bearings and bolts broken.

## Train Resistances.

There ought to be no great difficulty in ascertaining with some degree of accuracy the measure of the resistances encountered by railroad trains at various speeds, yet there is no measurable quantity in engineering about which there is so much uncertainty. The article published on another page, giving particulars of tests made on the New York Central's famous Empire State Express, gives figures of the train resistance that are greatly at variance with the results that would be obtained by calculating the resistance according to the rules laid down in engineering manuals. Many years ago D. K. Clark proposed a formula for calculating train resistances, which was accepted without question and is still used. According to this rule there is a resistance of eight pounds per ton to movement, and then that the resistance increases with speed at the rate of the square of the velocity in miles per hour divided by 171. American engineers modified this to read six pounds per ton for the constant resistance and accepting the remainder of the rule; so that in our engineering text-books we find the rule for finding the train resistance on a level, straight track to be

$$\frac{V^2}{171}+6=R$$

That is, V representing miles per hour and R resistance per ton. The rule plainly stated is: Square the velocity in miles per hour, divide this by 171, add 6 to the quotient, the result being the resistance at the rails in pounds per ton.

In the run referred to a speed of seventy miles an hour was maintained for some miles and several diagrams were taken when the locomotive was doing the work of maintaining the speed without loss or gain. The power developed showed that the entire resistance of the train and locomotive at that speed was 17.6 pounds per ton. In the discussions that come up periodically about what the ultimate speed of railroad trains will be, arguments are advanced that after a speed of sixty miles an hour is passed a point is soon reached where the locomotive will absorb the whole power developed in moving itself. Figures to prove this are always given, based on the text-book rule. According to this rule the resistance per ton at 70 miles an hour is over 34 pounds. If this were true there is not a locomotive in the country that would keep three cars running at 70 miles an hour.

The fact is that the ... ity does ...

... used to ... trying to find ac... ... data to calculate from. Its existence was evidently due to the desire of mathematicians to establish formulæ for everything. In this case the formula was established without the necessary data upon which to build correctly.

A number of American railroad companies have used dynamometer cars for years in which excellent provision was made for keeping an accurate record of train resistances. These go to prove, not only that the resistance does not increase in proportion to the square of the speed, but that the resistance varies greatly according to the load per axle. On a Western railroad a great many records were made some years ago on the resistance of different kinds of freight trains, with the view of finding out how many cars certain locomotives ought to haul. A train of loaded freight cars weighing 940 tons gave an average resistance of $5\frac{1}{2}$ when running twenty miles an hour on the level. A train of empty freight cars weighing 340 tons showed a resistance of 12 pounds per ton when running twenty miles on level track. A passenger train weighing 363 tons gave $7\frac{1}{2}$ pounds per ton resistance at a speed of thirty miles an hour. The records respecting train resistance of the roads having dynamometer cars agree substantially with those which we publish in our article on the Empire State Express.

## The Mechanical Conventions.

The railroad mechanical conventions which meet at Saratoga this month promise to be as interesting and as profitable as any meetings of the kind ever held. Both the Master Car Builders' and the Master Mechanics' Associations have programmes of business that will keep the members in close session if each association is to get done in the three days usually devoted to each convention. The arrangement of bringing the meetings closer together, which goes first into effect at the approaching meetings, promises to have a good effect upon both conventions. Persons who wish to attend both meetings may do so by spending about one week at Saratoga. From the talk that was heard when the proposal to reduce the time between the conventions was under consideration, we should believe that the greatest part of the superintendents of motive power who have been in the habit of attending the Master Car Builders' Convention only will remain over and give their counsel to the master mechanics. We understand that the managers of several of our largest railroad systems are encouraging their mechanical men to attend these conventions. This is a move in the direction of encouraging enlightenment, and we doubt not that the companies following this policy will be the gainers.

There are eleven subjects to be reported upon by Committees of the Master Car Builders' Association and nine by Committees of the Master Mechanics. This means a great deal of work. If the conventions take vigorous hold at once and deal with the most important questions, letting minor ones pass, there may be time for the reading of all the reports and full discussions of points where members are in the position to add valuable information. But there will be no time to waste on trifling talk. Much depends upon the presiding officer for pushing the business along fast enough to insure dispatch and not too fast to stifle the discussion of important subjects. Both the associations are fortunate in having good presiding officers, and we have no doubt that both will perform their duties so that the conventions will be the best ever held.

## Big Driving-Wheels.

The railroad companies that have most experience with the running of fast trains are inclining toward unusually large driving-wheels for the high-speed locomotives. The Pennsylvania Company are building at Altoona a two-cylinder compound locomotive that will have driving-wheels seven feet in diameter, and the New York Central people are putting wheels of the same size under one of their engines in the West Albany shops. This is not the first time that this size of driving-wheel has been used on American locomotives. Nearly half a century ago there was a tendency on American railroads to use locomotives with very large driving-wheels, but the fashion was short-lived. Several railroads in New England had engines with driving-wheels six feet diameter and upwards. Some of the lines now constituting the New York Central tried the same practice, and the Camden & Amboy was noted for the large wheels of its "flyers."

There were several causes which made large-wheeled locomotives unpopular in those days. The track was not adapted for particularly high speed, there were no means of controlling trains so that they could be stopped quickly, and no signal system to insure notice when stations were not clear of trains. These circumstances made the running of particularly fast trains unsafe. Besides that, the engines were by no means efficient, for there was not sufficient boiler or cylinder capacity behind the wheels to produce the power required. Consequently the engines were slow in starting and of little use on a hill. That made them unpopular. The modern big-wheel engines are different. They have very large boilers that supply steam freely and cylinder capacity to turn the wheels rapidly on moderate grades. The prospects are that the big wheels have now come to stay and that they will soon appear in increasing numbers.

We lately examined a steel casting in the Cambria Iron and Steel Works that weighed fifteen tons.

We understand that the Committee of the Railway Master Mechanics' Association investigating the subject of exhaust pipes, nozzles and steam passages have not been able to finish experiments they expected to carry out, and that in consequence an unfinished report will be presented. This Committee has already done a great deal of original investigation that is calculated to be highly valuable to railroad companies, and we look with interest to the discoveries they have made during the year. Strangely enough, most of the members of the Committee have been on roads where single nozzles are almost exclusively used and their recommendations refer mostly to this kind of nozzle. The single nozzle is in a small minority, and it is highly desirable to obtain accurate information upon double nozzles and the best way to place them for an open stack. It would also be interesting to see some accurate comparisons of the steaming and coal-consuming properties of single and double nozzles tried on the same engines. A great deal has been spoken and written upon the subject of nozzles, but it is one that will still profitably bear investigation. There is nothing about the engine that affects the coal consumption so intimately and nothing in which a trifling change produces such important effects.

## NEW BOOKS.

RECORD OF SCIENTIFIC PROGRESS. By Robert Grimshaw, M. E. Cassell Publishing Co., New York.

This book gives in convenient form a brief outline of the scientific progress of the past year. The improvements on railroads and in all departments of the mechanic arts appear to be fairly complete and concise. The book will be convenient for persons having to refer to the material progress of the past year.

VALVE-GEARS FOR STEAM ENGINES. By Cecil H. Peabody. John Wiley & Sons, New York. Price, $2.50.

This book has been written by a professor of the Massachusetts Institute of Technology for the use of engineering students. We imagine that the students who profit by this work will need to be well advanced in mathematics, for the author appears to talk in algebraic formulæ. The subjects treated are plain slide-valves, shifting eccentrics, link motions, radial valve-gears, double valve-gears, and drop cut-off valve-gears. The book is about as interesting as a chapter of Euclid and is prepared much in the same style.

LIABILITY OF RAILROADS FOR PERSONAL INJURY TO EMPLOYÉS. By Addison J. Penn. Published by Geo. H. Smith & Co., Cedar Rapids, Ia.

This is a small hand-book written by a member of the Iowa bar, giving a plain condensation of the laws and decisions in every State of the Union on the liability of railroad companies for personal injury to employés. It gives in convenient form a great deal of information that railroad men ought to know. Incidentally it gives evidence of the miserable diversity of laws in the different States respecting liability for injury and the necessity for radical reforms.

ELEMENTARY LESSONS IN HEAT. By S. E. Tillman, Professor of Chemistry, United States Military Academy. John Wiley & Sons, New York. Price, $1.50.

This book was written for the use of students of the Military Academy, and it is best adapted for a text-book on the subject treated. It contains, however, the information in very concise form, which will be found valuable for anyone studying the various phenomena of heat. The subjects treated are thermometry, dilation of bodies, calorometry, production and condensation of vapor, change of state, hygrometry, conduction, radiation, thermo-dynamics, terrestrial temperatures, aerial motors, and aqueous motors. Engineers will find the chapter on thermo-dynamics of much value and interest.

## PERSONALS.

Mr. E. O. Hill, who was for years superintendent of motive power of the Erie, died last month at Port Jervis, N. Y.

Mr. Herbert Wallis, mechanical superintendent of the Grand Trunk Railway, has gone to Europe for a two months' visit.

Mr. W. R. Morris has been appointed foreman in charge of cars and locomotives of the Chesapeake & Ohio at Ashland, Ky.

Mr. W. T. Smith, master mechanic of the Chesapeake & Ohio at Lexington, has had his jurisdiction extended over the Big Sandy division.

Mr. Edward Gibbs has been promoted to be general engine dispatcher and road foreman of engines of the Manhattan Elevated Railroad.

Mr. John G. Thomas has been appointed assistant superintendent of motive power and rolling stock of the Port Reading Railroad.

Mr. H. M. Curry has been appointed assistant road foreman of engines of the Northern Pacific. He has been for several years an engineer on the road.

Mr. James Nute has been promoted to be engine dispatcher of the Boston & Maine at Northampton, Mass. Mr. Nute has been for years an engineer on the road.

Mr. J. T. Lord, for some time general foreman of the Northern Pacific shops at Mandan, N. D., has been promoted to the position of master mechanic at the same place.

Mr. James P. Ring, engine dispatcher for the Boston & Maine at Concord, has resigned. Mr. Ring had been with the company forty years as engineer and engine dispatcher.

Geo. Royal, Sr., represented the Sunday Closing Association of Chicago, at the Engineers' Convention in Atlanta last month, and secured their indorsement for Sunday closing of the Exposition of 1893.

The Nathan Manufacturing Co., New York, have recently issued a revised catalogue of all their goods. Every mechanic who has charge of the repairs of injectors, lubricators or oil-cups should send for it.

Mr. John Howard, for some years general foreman of the West Shore shops at Frankfort, N. Y., has been appointed master mechanic of the Weehawken division in place of Mr. Aldcorn, resigned.

Mr. E. R. Beatty, formerly a Pan Handle engineer, and late assistant road foreman of engines, is now R. F. of E. of the Richmond division of the P., C., C. & St. L. Ry., with headquarters at Richmond, Ind.

Mr. Chas. B. McCormick has been promoted from engineer on Division B of the Pittsburgh division of the Pan Handle to assistant road foreman of engines in charge of Division A; office at Pittsburgh, Pa.

Mr. George Foster, an engineer on the Newport News & Mississippi Valley, has been promoted to be trainmaster. Mr. Foster had been less than a year on this road, and came from the Chicago & West Michigan.

Mr. C. H. Wiggin, master mechanic of the Boston & Maine's Concord division, is said to be the youngest master mechanic in the country. His youth is not found to be any drawback, as he has no end of vim and energy.

Mr. George E. Merchant, president of the Rochester & Pittsburgh Coal and Iron Company, has also been appointed assistant to the president of the Buffalo, Rochester & Pittsburgh Railroad, and becomes general manager.

Mr. Thomas Aldcorn has resigned his position as division master mechanic of the West Shore Railroad to accept the position of mechanical superintendent of the Empire Car Coupler Co., with office at No. 15 Warren street, New York.

Mr. H. H. Warner has been appointed master mechanic of the Seattle, Lake Shore & Eastern, with headquarters at Tacoma, Wash. Mr. Warner has long been master mechanic in charge of the Northern Pacific at Tacoma.

Mr. George S. Branch has been appointed master mechanic of the Wilmington, Onslow & Eastern Carolina. He was formerly roundhouse foreman of the Norfolk Southern, and went there from the Port Jervis shops of the Erie.

Mr. M. Patterson has been appointed division master mechanic of the Union Pacific at Salt Lake City, Utah, to succeed Mr. A. C. Hinckley, resigned. He has been general foreman of the shops at Omaha, Neb., for a number of years.

The many friends of Mr. Morris Sellers among our readers will be gratified to know that the beautiful young lady shown in "A Revery," in the *Cosmopolitan Magazine* for April, is Miss Blanche Sellers, daughter of the old-time master mechanic.

H. K. Porter & Co., of Pittsburgh, Pa., have closed a contract with Colonel Pedro Villar, chief engineer of the Army of the United States of Colombia, for five middle-gauge locomotives, which are to be used on railroads in the mountainous regions of Colombia.

We made a slight error last month in saying that Mr. James E. Sague had been appointed assistant superintendent of the Schenectady Locomotive Works. Mr. Sague was made mechanical engineer, and Mr. White continues to be assistant superintendent.

Mr. E. P. Jones, lately promoted to the position of road foreman of engines of the Norfolk & Western, has been with the company for thirteen years. If intelligence and knowledge of the business commend men for promotion, Mr. Jones truly earned his rise.

Mr. O. F. Nichols, chief engineer of the Brooklyn Elevated Road, has been appointed general manager in place of Mr. Frederick Martin, resigned. Mr. Nichols is the practical railroad man who has been supplying the knowledge on which the road was operated. He is now coming to his own.

Theodore L. Woodruff, inventor of the Woodruff sleeping-car and formerly president of the Central Transportation Company, was run over and killed by a railway train at Gloucester, N. J., May 2. He was eighty-one years old. It will be remembered that Mr. Wagner, inventor of the sleeping-car which bears his name, was killed in a collision.

Mr. William Mahl, who has long been private secretary for President Huntington of the Southern Pacific system, has been appointed assistant to the president. Mr. Mahl is a particularly able railroad man, and has enjoyed a great range of experience. He is a mechanical engineer, and is exceptionally well posted about rolling-stock matters.

Mr. A. C. Hinckley has been appointed master mechanic of the St. Joseph & Grand Island. Mr. Hinckley was for years an engineer on the C. B. & Q., and was made road foreman of engines of the Union Pacific by Mr. G. W. Cushing. From that he went to be master mechanic of the Salt Lake division, which he left to accept the position he now holds.

Mr. Lewis Gleason, who went to Brazil two months ago to be resident engineer and representative of the Brooks Locomotive Works, is reported to have had a slight attack of yellow fever. We have received a letter from Mr. Gleason, written shortly after his arrival, and he was in excellent health then, but he must have been seized with the disease a few days afterwards. We are pleased to learn that the attack was slight and that Mr. Gleason is recovering.

Mr. Charles A. Thompson has been appointed superintendent of motive power and rolling equipment of the Port Reading Railroad, which takes in all the lines of the Central Railroad of New Jersey. Mr. Thompson has long been with the Long Island Railroad, and has enjoyed a long and varied railroad experience. There is no man in the country more faithful to his employers or more zealous for their interests than Mr. Thompson. He has charge of all the master mechanics and car builders on the road.

Mr. Lewis W. Towne, late general superintendent of the Kansas City, Fort Scott & Gulf, died last month. Mr. Towne was one of a family of railroad men who all rose from humble positions to important offices. The best known of these brothers is A. N. Towne, now general manager of the Southern Pacific system. Mr. Lewis W. Towne was successively fireman, locomotive engineer, shop foreman, master mechanic, assistant superintendent, and general superintendent. The latter position he filled with honor and success on several important railroads.

People who are in the habit of going to Dunkirk, N. Y., on business, will be pleased to learn that a first-class hotel has been opened in the town. From what we have heard the Hotel Gratiot will compare favorably in all respects with any of the first-class hotels in other cities. We note in an illustrated pamphlet, sent out about the hotel and other attractions of Dunkirk, that Mr. R. J. Gross, of the Brooks Locomotive Works, is president of the company that owns the hotel and that Mr. H. C. Hequembourg is secretary and treasurer. With such names in the management, travelers will have the assurance of everything being first-class.

Railroad men and others interested in obtaining accurate information respecting the real value of compound locomotives have reason to be thankful to Mr. Geo. Gibbs and the other members of the Railway Master Mechanics Association Committee investigating the subject for the extensive work done to obtain facts relating to the working of this type engine. The Chicago, Milwaukee & St. Paul Railroad Company permitted no expense to stand in the way of thorough tests being made. The amount of work involved in getting the data obtained into shape for a report was enormous. About sixty runs were made and all the information obtained had to be digested for the report. At one time Mr. Gibbs had eight men working on the figuring required to get the data into comprehensive form. Ever since the committee was appointed we have felt assured that a report of the very greatest value to the engineering world would be prepared, and appearances now indicate that we are not going to be disappointed.

## The Cambria Iron and Steel Works.

A large party of railroad men went with Coolbaugh & Pomeroy, New York, in an excursion party to visit the Cambria Iron and Steel Works at Johnstown, Pa., and the Lukens Iron and Steel Works at Coatesville, Pa. Incidentally the party took in Altoona, and visited the Pennsylvania Railroad shops there.

Arrived at Johnstown they were taken around the outskirts of the immense Cambria Iron and Steel Works by a locomotive. The magnitude of the place could well be judged from the views obtained on the heights above the establishment. They were then taken from building to building for the purpose of following the product in all the varying processes, from the time when it left the cars in the form of crude ore until it came out as shining steel. The leading officers of the works accompanied the party round, and they seldom receive visits from a more appreciative company.

The departments in which the visitors were most strongly interested were those that produced the open-hearth steel products. The genesis of this part is in a row of Pernot revolving furnaces. This furnace is a novelty to most men who are familiar with the plain open-hearth furnace. The Pernot furnace has a circular bed which rests on a central spindle, and wheels like a turn-table. The bed is set at an angle of about six degrees. As it revolves the charge keeps moving, so that the whole is exposed to the heat of the gas flame. The claim is made that the product of this kind of furnace is much more uniform than that of the common furnace, where mixing of the metals depends on the boiling action.

After seeing this metal poured into ingots, we follow them to the rolls, where, after much skillful manipulation, they emerge in the shape of axles and blanks for crank-pins, the two products that our party are most interested in following. This material is about to go through the Coffin process of toughening steel, and we follow the details with keen interest. The process is based on the discovery that a small bar of steel if suddenly reduced to a certain temperature by dipping in water and then permitted to cool slowly will be toughened. It is said that the effect of this process is to produce a double internal action on the molecules of the metal that changes the texture from crystalline to what is called the amorphous form—that is, a form where the fracture shows neither crystals, grains or fibers.

After coming through the rolls, the axles and blanks are cooled slowly to put the carbon in a non-hardening state. They are then taken to a heating furnace of peculiar shape with a charging-door on one side and a drawing-door on the other. Here the axle is heated to the temperature at which carbon changes to the hardening state, the effect being to break up the crystallization. It is then drawn by an ingenious apparatus and dipped in a trough of water and kept revolving. In a few seconds it is raised out of the water and rolled on to a cooling-bed. When it first passes on to the bed the axle is black, but the internal heat soon makes itself manifest and the metal becomes red again. The axle is now permitted to cool in the air, after which it is ready for the lathe. This company rough-turns all the axles and crank-pins made.

The party could not follow a single axle from the furnace, but the various processes were traced. From the cooling bed we followed an axle taken at random to the drop test. The axle was put on the usual supports and a weight of 1,600 pounds permitted to fall upon it from a height of 25 feet. Each time the blow was struck the axle was turned round. Some of the party stood watching till it received about thirty blows, with no sign of fracture, then most of them left, one of the wits telling them to keep on and he would return in a week. The axle broke after receiving 49 blows. All material intended for crank-pins is treated by the Coffin process.

These works turn out an enormous quantity of iron and steel, their Bessemer plant being one of the finest in America. Space does not permit us to go into details. After visiting most of the leading rolling mills in the world, the conclusion arrived at here was that the Cambria Works are far ahead of all others in the mechanical appliances employed in the various operations. Nothing is done by hand where machinery can be employed, and the most perfect appliances known are the kinds used. The extent of the works may be judged from the fact that about 5,000 men are engaged in keeping the machinery in good order. Another suggestion as to the amount of work done is the fact that fifteen small and twenty-five large locomotives are in use daily handling the material.

DELEGATES TO ATLANTA CONVENTION B. OF L. E., MAY 11, 1892. GRAND OFFICERS IN FIRST ROW.

*Photographed by Edwards & Son, Atlanta.*


# The A. B. C. of the Steam Engine Indicator

BY HARRIS TABOR

The recent designs of locomotives for fast passenger service show that the lesson of the indicator has been heeded by the designers. The great reduction in initial pressure at high-piston speed and the consequent increase in back-pressure indicate that the limit of piston speed, with present port openings, has been reached, if it has not been exceeded. In new passenger engines, especially the "record breakers," there is a tendency to larger drivers, which means an increased speed in miles without increase in piston travel. The "Vauclain" compound, 385, on the Central of New Jersey, has driving-wheels 78 inches in diameter, and the engines drawing the Empire State Express on the New York Central have wheels the same size. Both these engines are famous; the former has made the quickest recorded mile, and the latter have the reputation of making the fastest long-distance runs. The cylinder capacity of these engines is about the same. The compound has two high-pressure cylinders 13 inches in diameter, and two low-pressure cylinders 22 inches in diameter, with a stroke of 24 inches. The New York Central engines have simple cylinders 19 inches in diameter by 24-inch stroke. The compound would probably start a heavier train because steam is admitted from the boiler to the low-pressure cylinders in starting, and a comparison, at that time, would be between 19-inch and 22-inch cylinders. But at these very high speeds it is not the starting that makes the problem difficult. The real question is to make the time, and, in this respect, the cylinder capacities of the two engines, assuming equal ports and pipes, would be about the same.

Attempts at higher speeds will probably result in larger cylinders and drivers. The Pennsylvania road is building a fast passenger compound with drivers 84 inches in diameter, and the New York Central have under way a simple engine with drivers the same size. If these engines have the boiler and cylinder capacity, they can easily add 10 per cent. to the speed of the wonderful Empire State Express. We may look for fast riding when the compound, with 90-in drivers, said to be under consideration by a prominent builder of locomotives, is on the rails. This locomotive may not inaugurate the 100-mile gait that so many seem to be looking for, but the chances are that she will demonstrate the fact that a limited train of three cars may be pulled at that speed over good roads, if enough people are willing to pay for the luxury of riding that fast, and are willing to take chances of the train being controlled by the system of brakes now in use

Wire-drawing and abnormally high back-pressure are not the only evils incident to fast running. The strain on side-rods, due to centrifugal force, when an engine is running 300 revolutions per minute, is enormous This fact is occasionally attested by a broken rod. The English designers of locomotives for fast runs have so great a fear of this danger that they avoid it by using one pair of drivers only. With their light trains this may be done without fear of putting too much weight on bearings or track. American trains are much too heavy to be handled by uncoupled drivers, notwithstanding our friend Le Van insists that the side-rod is the great bar to high economy in American locomotives. If one would ride between Jersey City and Philadelphia on a "slippery rail" behind the "Webb" compound, he will readily understand how weak the English system would be on our roads There is, undoubtedly, an evil in coupled drivers for fast trains; but the heavy passenger trains in this country cannot be handled by uncoupled wheels. The tendency to slower piston speed, and consequently less number of revolutions per mile, due to larger drivers and larger cylinders, will correct the evils that follow the unnatural rotative speed that many American locomotives have to make to meet the requirements of their schedules.

In the preceding paper attention was called to indicator diagrams from a simple engine, taken at widely different speeds, which illustrated the tendency of steam to wire-draw or reduce in pressure when compelled to flow too rapidly through pipes and ports. The accompanying cards were taken from a "Vauclain" compound (No 385) running in fast passenger service on the Central R. R. of N. J., and will serve to show how great an influence reduced flow of steam through pipes and passages has in its cylinder distribution. In considering these remarkable diagrams we must keep in mind the fact that some of them were taken at the fastest speeds ever indicated or authentically recorded. The record was not made by an attempt to count the revolutions by touch or sound, but was carefully timed, by the aid of a stop-watch, from mile post to mile post.

In the compound engine the function of the steam-pipe is to supply the high-pressure cylinder with steam from the boiler. When the ratio between the high and low-pressure cylinders is three to one, as is the case of the compound in question, the high-pressure cylinder is much smaller than the cylinders on a simple engine The high-pressure cylinder of 385 is 13 inches in diameter, and the low-pressure is 22 inches The cylinder equivalent in a simple engine would be about 19 inches in diameter. The area of a 13-in. cylinder is 132.7, and of a 19-in. cylinder it is 283.5, more than twice as large. In the compound engine this smaller cylinder is fed with a larger pipe than is generally used on a simple engine of this class, and the steam ports in the piston-valve are much more liberal, hence we expect much less wire-drawing of steam, at fast speeds, in this type of engine. The diagrams fully confirm our expectations.

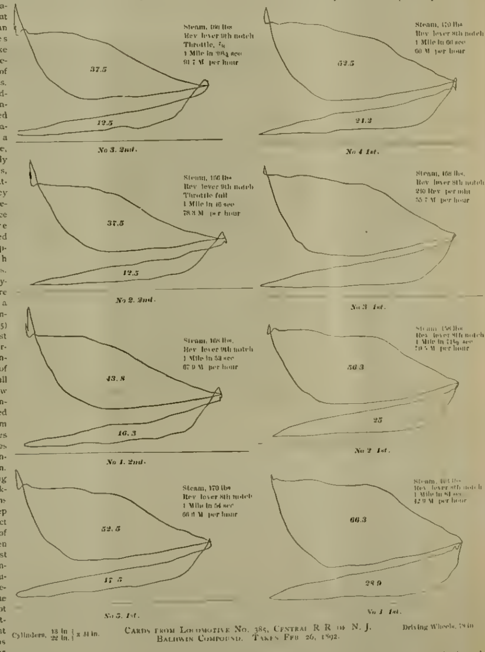
Two sets of cards are submitted. The first, at slower speeds, with reverse lever in the eighth notch, and the second, with reverse lever in ninth notch, the latter showing an earlier cut-off. The scale of pressure in both sets is 100 lbs. to the inch.

If the reader will take the series of five cards, with reverse lever in the eighth notch, he will notice that, beginning with No. 1, at a speed of about 43 miles per hour, all the valve functions are discernable on the card. The point of cut-off is very distinct, and there is little of what is called initial expansion, that is, the expansion of steam before cut-off takes place, due to wire-drawing. As he follows up this series he will find that, as the speed is increased, the valve functions are less distinct; but in no case are they difficult to locate. No. 5 shows the effect of speed more clearly than the others, and here the steam line is well kept up and point of cut-off well developed at a speed of 66.6 miles per hour.

The second series is more remarkable than the first, if the great speed at which they were taken is considered. The piston speeds are, respectively, 1,170 feet, 1,348 feet and 1,581 feet per minute. With ordinary steam-pipes and passages the least of these speeds would render an indicator card almost unintelligible, so far as defining the steam and expansion line is concerned; these lines would run together so that they could not be separated by the most practiced expert. It may be suggested that larger pipes and ports in the standard engine would reduce the evils of wire-drawing. If the steam pipe be too large, another serious trouble appears, viz., a tendency to draw water from the boiler when the engine is working hard. The free admission in the compound does not come from larger pipes, but from a reduction in the cylinder which takes the steam from the boiler. The effect of this reduction in the "Vauclain" compound is to double the size of the steam-pipe and passages without enlarging the opening to the boiler

If speed above sixty miles per hour is to be sought economically, larger wheels and cylinders will follow. The lesson of the cards published in this number insist upon the piston speed being kept below 1,000 feet per minute, even when cylinders are compounded, if the best duty be expected from the motive power.

Harris Tabor




Cylinders, 13 in. / 22 in. x 24 in.   CARDS FROM LOCOMOTIVE NO. 385, CENTRAL R R OF N. J. BALDWIN COMPOUND. TAKEN FEB 26, 1892.   Driving Wheels, 78 in

Mr William A Baldwin has resigned the vice-presidency of the Buffalo, Rochester & Pittsburgh Railroad.

## Some More Points on Combustion.

By M. E. Weil.

In my article in the March number it was shown that the hydrogen of the hydrocarbons was the first to burn, and that the union or combustion of hydrogen with oxygen produced water, $H_2O$. Before proceeding to the chemical changes that take place in the combustion of carbon with oxygen, I wish to give some idea of the intense heat given off when hydrogen is burned in the locomotive firebox by the oxygen, from the air. The reason for the hydrogen burning first is on account of the strong chemical attraction of oxygen for it. In fact, oxygen has a stronger affinity for hydrogen than for any other combustible.

You have learned that it is the clashing together of these atoms that produces the heat. Now since the attraction of oxygen for hydrogen is so great, the clashing will be more severe and therefore the heat more intense. In the complete combustion of one pound of carbon there are given off 14,500 heat units, while in the complete combustion of one pound of hydrogen there are given off 62,000 heat units.

The intense heat produced by the burning of hydrogen in oxygen is shown by the oxyhydrogen blow-pipe. This is an arrangement by which oxygen and hydrogen are brought together into one gas jet from two separate gas-holders. The heat produced by this blow-pipe flame far exceeds in intensity of temperature that produced by our most powerful furnaces. It is employed to melt platinum, which requires a temperature estimated at 2,000 degrees centigrade or 3,632 degrees Fahrenheit. This, of course, is pure hydrogen burning in pure oxygen. No such intense heat can be obtained by burning hydrogen in the air, for four-fifths of the atmosphere is nitrogen and only one-fifth oxygen. Neither is the hydrogen pure as consumed in the locomotive firebox being more or less mixed with other gases.

*One pound of hydrogen burned with its proper equivalent of oxygen gives off the same amount of heat, whether the combustion takes place in the locomotive firebox or in the oxyhydrogen blow-pipe.*

From the above, the importance of burning all the gases (hydro-carbon), and especially the hydrogen, is readily seen.

From the fact that only one-fifth of the air passing through the firebox is oxygen, the necessity of a free admission and good draft is very apparent. So much has been said about light fires and free admission, that I fancy I hear some of you saying "Chestnuts." Perhaps they are "chestnuts" to some of you, but they are truths, nevertheless, and will stand repeating. This matter of light fires can be overdone, however. I have in mind a young and energetic fireman who was so zealous in his desire to get the best possible results from the coal he put in the firebox, that he overdid the matter of shaking grates and cleaning fires.

While it is important to have a clean and light fire, you must not lose sight of the fact that enough fire must be on the grate to heat the oxygen to the igniting point as it passes through. What is needed in firing, as in all other things, is the "happy medium." This same "happy medium" is what Dame Nature hit upon when she diluted the oxygen of the air with four-fifths nitrogen. Did you ever think what would happen to the locomotive firebox if the atmosphere was pure oxygen? I have seen the time, before now, as the pointer lingered at 90 and 100, when I have wished for an atmosphere of pure oxygen.

Firemen often say of a good steamer, "I can burn her up." This they certainly could do if they had pure oxygen to work with. The effect of pure oxygen on combustion is shown by the following experiments.

A lighted match blown out so as to leave a coal of fire on the end—this inserted into pure oxygen, immediately bursts into bright flame. A piece of watch-spring with burning sulphur attached, plunged into pure oxygen, burns with greater brilliancy, and kindles and burns the watch-spring as if it were a shaving from the carpenter's bench. The combustion that takes place in our own bodies is identical with that in a locomotive firebox. It is the union of carbon and oxygen that produces animal heat.

With an atmosphere of pure oxygen this combustion would be accelerated, the blood would leap through our arteries and veins with increased velocity, our bodies would be practically burned up, and our light would finally go out. This odorless, colorless, tasteless nitrogen can be compared to the governor on an air-pump, in that it controls action, which, if allowed to go on unchecked, would lead to death and destruction.

I have asked you thus far to keep in mind but four chemical terms. Have you got them and can you tell where each one is found?

For the convenience of those to whom this appears difficult, I will repeat each chemical name I have used, giving its symbol. Carbon (C), hydrogen (H), oxygen (O), nitrogen (N). From now on, in using above terms, I will only use the chemical symbols C, H, O and N. You have not forgotten that H has a chemical affinity of one and that O has a chemical affinity of two. This was shown in the formation a molecule of water ($\begin{smallmatrix}H-\\H-\end{smallmatrix}O$ or $H_2O$). Now comes C with a chemical affinity of four. It naturally follows that one atom of C is capable of taking on four atoms of H, thus.

$C\begin{smallmatrix}-H\\-H\\-H\\-H\end{smallmatrix}$ or $CH_4$, which is the chemical formula of one of the hydrocarbons given off from bituminous coal. In nature this gas is called marsh gas. This same gas collects in mines and is called fire-damp. It is very explosive, and is much dreaded by the miners. In the complete combustion of C, one atom of C unites with two atoms of O, thus. ($C\begin{smallmatrix}=O\\=O\end{smallmatrix}$ or $CO_2$ *carbonic acid* gas. If, from any cause, the flow of O through the grate is retarded or checked, C will be content with taking on but one atom of O, thus. ($C\begin{smallmatrix}=\\=\end{smallmatrix}O$ or CO *carbonic oxide*. I say the atom of C will be content with but one atom of O. I might better say that it is content with but one, because it could not get two, on account of the scarcity.

In looking back, you will see that C, burning to CO, has two affinities unsatisfied. The atom of C passing up through the fire unites with one atom of O, and has two hands left feeling around for another atom, but it could not get in. The carbon is not to blame for this; it is more apt to be the fireman, who has not cleaned his ash-pan or who has allowed a foot or two of dead ashes and cinders to collect on the grate. Perhaps the blame may be on the engineer, who thought they could "get in," and would not stop to have ash-pan or fire cleaned.

A pound of C, burning to carbonic oxide, CO, as just described, gives off but 4,452 heat units; whereas, if sufficient oxygen had been present for it to burn to carbonic acid gas, $CO_2$, the same pound of C would have given off 14,500 heat units.

If from a dirty fire or other cause the C on the grate cannot get sufficient O for perfect combustion, what can the hydrocarbons, and especially the H, the king of heat producers, do but pass out of the stack unconsumed? You may say, admit O above the fire. This is not the difficult part. The admission above the fire must be regulated and under the control of the fireman. The O thus admitted must also be heated to the igniting point—here is the sticker. The man who by some *simple* means accomplishes this end for locomotives will have solved the smoke problem and immortalized himself to future generations. I have an "idee," but as none of my family have ever immortalized themselves I don't wish to break the record, and I propose to give every reader of Locomotive Engineering a chance for this honor.

A Flounced Petticoat.

## Cheap Passenger Cars.

The Pennsylvania Company is building an experimental excursion car at the Columbus shops which, if it turns out as expected, will solve an important problem. The company expects to handle a great many more people at the world's fair at Chicago than its ordinary passenger equipment will accommodate. To provide for the emergency it is proposed to construct a large number of cheap excursion cars which can be disposed of with as little loss to the company after the fair as possible. To this end it has been proposed to build a car body on an ordinary gondola. The idea is to make a sightly and comfortable car, but plain. An experimental car is now being constructed, and if it is satisfactory a large number will be built. The car will be about thirteen feet shorter than the standard passenger car and will seat about forty-five people. The cost would be about $850 to $1,000 against $5,000 or $6,000 for an ordinary passenger coach. The idea appears to be a practical one and is being worked out with great care. After the fair the gondolas can of course be utilized for freight traffic. In 1876 the Pennsylvania Railroad made a mistake in building a large number of cheap passenger coaches which could only be utilized on the branch lines and were of no practical value.—*Ohio State Journal.*

## A Flounced Petticoat Pipe.

In the engraving shown we see a form of a petticoat pipe very popular with some engineers, as it appears when the smoke-box front is taken down. It does not seem as if the contrivance would lead the gases in a straight line to the stack, yet the engine steams well. The view is from an old Portland locomotive, built in 1856, and still in use switching at McAdam Junction, N. B.

## Group of Master Car Builders and Master Mechanics.

When we decided to publish a group of the older officers and older members of the Master Car Builders' and Master Mechanics' Associations, we requested those whose portraits were to appear to supply us with some particulars of their professional career. Our intention was to publish as good a biographical account of each man as we could procure, but we have found it necessary to modify this design. A few of those who sent in notes of their career appeared afraid to let their light shine, and made the particulars as brief as possible. Others, however, wrote at considerable length about their experience, and we find on our hands a series of extremely interesting and valuable biographies of men who have performed a highly important part in the development of American railroad rolling stock. The biographies are too valuable to be condensed, and we cannot give them in full this month because they would entirely fill up the paper. So we have decided to give merely a plain outline of each man's professional career, and we will follow this up with detailed biographies as our space permits.

There are several old and prominent members conspicuous by their absence from our group. This happens in most cases from the excess of modesty that led to the refusal of a photograph. We have pleasure in presenting to our readers

JOHN KIRBY, President of the Master Car Builders' Association and General Master Car Builder of the Lake Shore & Michigan Southern Railway. Mr. Kirby learned the business in England and entered railway service in this country in 1848. He has been on the Lake Shore nearly 40 years and has risen from a workman to his present position. The Master Car Builders' Association was formed in his office at Adrian, Mich., in 1866. He acted as chairman of the meeting and was always one of the hardest working members.

JOHN MACKENZIE, President of the American Railway Master Mechanics' Association and Superintendent of Motive Power of the New York, Chicago & St. Louis Railway. Mr. MacKenzie rose to his present position through the course of training that has made a large proportion of our master mechanics. The outline is machinist apprentice, fireman, locomotive engineer, shop foreman and master mechanic. He was a foreman in the Rogers Locomotive Works for two years, and from there went to be superintendent of motive power of the Hannibal & St. Joseph. Was afterwards on the Kansas Pacific and the Union Pacific. In 1883 he went to the position he now holds. He joined the Master Mechanics' Association in 1876.

G. W. DEMAREST, Treasurer Master Car Builders' Association, and Master Car Builder of the Northern Central part of the Pennsylvania Railroad. Mr. Demarest learned the carriage building business in Rahway, N. J. Began car building with Cummings & James in Jersey City in 1852. Shortly afterwards he entered the shops of the Camden & Amboy Railroad and remained there till 1856. That year he went to take charge as foreman of the car shops of the Trenton Locomotive Works, remaining there till 1859. He went from there to be assistant foreman of the Pittsburgh, Ft. Wayne & Chicago shops at Ft. Wayne, Ind. In 1862 was appointed general foreman of the car department of the Northern Central and has remained there ever since.

O. STEWART, Treasurer Master Mechanics' Association and Superintendent of Motive Power of the Fitchburg Railroad. We have received no information respecting Mr. Stewart's professional career. He joined the Master Mechanics' Association in 1885, and has been an industrious member, taking an active part in many of the discussions.

JOHN W. CLOUD, Secretary Master Car Builders' Association and Western agent for the Westinghouse Air-Brake Co. Mr. Cloud was for several years mechanical engineer, and subsequently engineer of tests for the Pennsylvania Railroad at Altoona, Pa. He left there in 1887 to become superintendent of motive power for the New York, Lake Erie & Western, where he remained for about two years. He was for several years representative member for the Pennsylvania Railroad to the Master Car Builders' Conventions, and took a very active part in the proceedings.

ANGUS SINCLAIR, Secretary Master Mechanics' Association and one of the editors and proprietors of LOCOMOTIVE ENGINEERING. Mr. Sinclair received a mechanical training on a part of the Caledonian Railway, in Scotland, and subsequently had some experience in marine work. Began work in this country on the Erie; worked in Brooks' Locomotive Works and was engaged on engineering work on several Western railroads. Went to Chicago, Clinton & Western as assistant engineer, and subsequently was locomotive engineer. Then locomotive engineer and roundhouse foreman on the Burlington, Cedar Rapids & Northern. Joined the editorial staff of the *American Machinist* in 1883, and since then has been engaged on editorial work. Joined the Master Mechanics' Association in 1883.

Our artist has arranged the remaining names by numbers and placed them so as to give the best effect according to the tone of the photographs.

1. JOHN BLACK, an honorary member of the Master Mechanics' Association, and one of the first members. Mr. Black received the first part of his mechanical training in Scotland, and on coming to this country entered railroad service in the West and rapidly rose to the position of master mechanic of the Dayton & Michigan Railroad. When that road was absorbed by the Cincinnati, Hamilton & Dayton, Mr. Black became superintendent of motive power of the whole system, and remained there till a few years ago, when he retired from service. He has been a very regular attendant at the conventions.

2. WILLIAM GARSTANG, Second Vice-President of the Master Mechanics' Association and Superintendent of Motive Power of the Chesapeake & Ohio Railroad. Mr. Garstang received the greater part of his mechanical training on the Cleveland, Columbus, Cincinnati & Indianapolis Railroad under the late W. F. Turreff, and rose on that system through various grades to be master mechanic, with charge of the shops at Brightwood, Ind. In 1888 he was appointed to the position he now holds on the Chesapeake & Ohio. He joined the Master Mechanics' Association in 1887, and was elected vice-president two years ago.

3. JACOB LOSEY, now an honorary member, was one of twenty men who met at Cleveland, O., on September 20, 1868, and organized the American Railway Master Mechanics' Association. There are only four others of these men alive to-day. He was then master mechanic of the Louisville, New Albany & Chicago Railroad. He is now superintendent of the Louisville Steam Forge Co. Mr. Losey is a New Jersey man, and learned the machinist trade with the famous Seth Boyden at Newark, N. J. In 1853 he went West and went to work fitting valve and link motions by contract in the Menominee Locomotive Works at Milwaukee, Wis. From there he went to be foreman of the Detroit Locomotive Works. After remaining there four years he left to be foreman of the Detroit shops of the Michigan Central. Shortly afterwards he was made master mechanic of the Western division and held the position three years, leaving to take mechanical charge of the New Albany road.

4. H. A. TOWNE, an honorary member of the Master Mechanics' Association, is one of a family of railroad men who have all risen to prominence in the business. He is one of the oldest members of the Association, and was for years one of its most active and hard-working members. He rose by the foot-board, having been fireman, machinist and locomotive engineer on the Chicago, Burlington & Quincy. Next he was shop foreman on the Illinois Central, and then master mechanic of the Hannibal & St. Joseph. Here he devoted a great deal of study to boiler incrustation and water purification, and was for years an authority on the subject before the railroad world generally. Among prominent positions which he afterwards held were those of superintendent of motive power of the Northern Pacific and superintendent of the road.

5. CHARLES R. PEDDLE, an honorary member of the Master Mechanics' Association and purchasing agent of the Vandalia Line. Mr. Peddle learned the machinist trade in William Norris's Locomotive Works, Philadelphia, beginning in 1836. From there he went and worked in the Reading Railroad shops under Lewis Kirk. Among his associates there were Andrew and James Vauclain, David Clark, J. O. D. Lilly, George Peterman and others who have made their mark on railroad machinery. After working in the shops for a time he went upon the road as a locomotive engineer. From there he went to New England and worked in the different locomotive building shops there. In 1848 he went West and ran an engine for a time on the Madison & Indianapolis. Three years later he accepted the position of master mechanic of the Terre Haute & Richmond Railroad, which grew and swallowed others until it became the Vandalia Line. He joined the Master Mechanics' Association in 1872, and for years took an active part in the proceedings.

6. J. H. SETCHEL, Past President and Past Secretary of the Master Mechanics' Association and now agent for the Pittsburgh Locomotive Works. Mr. Setchel has doubtless done more to advance the interests of the Master Mechanics' Association than any other man. He joined the association at the second meeting, and at the fourth convention was made secretary, an office which he held till the close of the twentieth convention, when he was elected president. He has been present at every meeting of the association since he joined, and no man has taken a more active part in the proceedings. When he joined the association Mr. Setchel was master mechanic of the Little Miami Railroad and he remained there till 1882. From there he went to be superintendent of motive power of the Ohio & Mississippi, holding the position for three years, when he was induced by the late Mr. Brooks to accept the position of superintendent of the Brooks Locomotive Works. He left there three years afterwards and entered his present position.

7. W. H. DAY, Member of the Executive Committee of the Master Car Builders' Association and Master Car Builder of the Atlantic Coast Line. Mr. Day entered railroad life on the Chesapeake & Ohio at Richmond, Va., in 1866. Three years later he left to go with the Wilmington, Charlotte & Augusta, and has remained in the same place ever since. Mr. Day has been Mayor of Florence, S. C., for the last five years. He joined the Master Car Builders' Association in 1885, and is renowned as one of the most eloquent speakers in the association.

8. T. A. BISSELL, Third Vice-President of the Master Car Builders' Association and General Manager of the Wagner Car Shops at Buffalo. Mr. Bissell is one of the most celebrated car builders in the country and has held the most important positions in the business. He was for years superintendent of the Barney & Smith Manufacturing Company's works, and before that was in charge of the Pullman shops at Detroit. He was elected a member of the Executive Committee of the Master Car Builders' Association in 1883, and was elected vice-president at the 1890 convention.

9. JACOB JOHANN, an honorary member and Past President of the Master Mechanics' Association and Western Agent for the Safety Car Heating and Lighting Co. Mr. Johann has passed through an unusually varied experience as a railroad mechanical officer. He was born in Germany, but learned the machinist trade in the Norris Locomotive Works at Philadelphia. He worked in various Eastern shops for a few years and went West about 1855. His first prominent promotion was to the position of assistant master mechanic of the Missouri Pacific. He held this position for three years, when, in 1861, he was made master mechanic of the southwest division of the same road. The railroad position which he held longest was that of superintendent of motive power of the Wabash. He was there for eleven years. Mr. Johann has been a leader in the Master Mechanics' Association and a hard worker. A pet scheme of his was the converting of the Boston Fund into college scholarships, a thing that was consummated last year.

10. F. D. CASANAVE, Member of the Executive Committee of the Master Car Builders' Association and Superintendent of Motive Power of the Pennsylvania Company's lines west of Pittsburgh. Mr. Casanave received the regular mechanical training accorded to apprentices in the Pennsylvania shops at Altoona, and afterwards worked there in various capacities. From there he was appointed assistant superintendent of motive power at Fort Wayne, and on the promotion of Mr. Wood was advanced to the chief position. He is considered one of the ablest mechanical officers in the employ of a company that has been famous for developing men of ability.

11. JOHN HICKEY, First Vice-President of the Master Mechanics' Association and Superintendent of Motive Power of the Northern Pacific Railroad. Mr. Hickey was for about ten years master mechanic of the Milwaukee, Lake Shore & Western, and while there made his mark as one of the most progressive men in the business. Two years ago he was appointed to the position he now fills. He joined the Master Mechanics' Association in 1883, and was elected Vice-President in 1890. We have received no particulars of Mr. Hickey's experience.

12. WILSON EDDY, honorary member of the Master Mechanics' Association, is one of the few men remaining who had reached a working age when the first locomotive turned a wheel in America. Mr. Eddy was born in Vermont, in 1813. His first experience with locomotives was acquired in the shops of the Locks & Canal Co., Lowell, Mass. Here, in 1831, he helped to build the first locomotive built in New England, for the Boston & Lowell Railroad. The engines were made after the style of the Stephenson locomotives and weighed about 17,000 pounds. In 1840, Mr. Eddy went to superintend the repairs of the locomotives on what is now the western part of the Boston & Albany. In 1850 he was made master mechanic of the road. In that year he built the locomotive "Addison Gilmore," which was the first with outside connections and horizontal cylinders. On this locomotive he put the first pipes applied for oiling the cylinders from the cab, and the engine had the first spliced frame generally known as the Mason splice, although not used by Mason for two years after it was made by Mr. Eddy. This engine, the "Addison Gilmore," in a public trial at Lowell took the first prize for speed—a gold medal. Mr. Eddy remained on the Boston & Albany till 1880. While in charge of the Boston & Albany machinery, Mr. Eddy built 135 locomotives of his own design, making the drawings himself.

13. WILLIAM MCWOOD, Past President of the Master Car Builders' Association and master car builder of the Grand Trunk Railway. We have little information about Mr. McWood's professional career. He joined the Master Car Builders' Association in 1875, and has been an earnest worker and ready speaker. He was president several years.

14. BENJAMIN WELSH, one of the oldest

members of the Master Car Builders' Association and master car builder of the Central Pacific. We have no information respecting the experience of Mr. Welsh.

15. JOHN THOMPSON, honorary member of the Master Mechanics' Association. In 1848, Mr. Thompson began railroad work in the locomotive repair shops of the Eastern Railway of Massachusetts. After working there for four years he went to Cuba to superintend the erection of sugar machinery. Returned after a year to the Eastern as shop foreman. In 1855 was elected by the board of directors master mechanic and held the position till 1877. Mr. Thompson was the inventor and patentee of the extension smokebox, and he was the first to introduce other improvements on locomotives that are now universally used. We shall give more particulars in a future issue. Mr. Thompson joined the Master Mechanics' Association at the second meeting.

16 W. A. ROBINSON, honorary member and Past Vice-President of the Master Mechanics' Association. Mr. Robinson began railway work by serving a seven years' apprenticeship in the locomotive department of the London & Northwestern Railway of England. In 1862 he was appointed assistant mechanical superintendent of the Great Western of Canada and shortly afterwards became chief. He joined the Master Mechanics' Association in 1871, and for years took a very active part in the proceedings. He was several times elected vice-president. In 1875 he retired from railway life and entered into a manufacturing business at Hamilton, Ont.

17. JOHN W. PHILBRICK, honorary member of the Master Mechanics' Association, and long known to railroad men as Master Mechanic of the Maine Central. Mr. Philbrick was born at Waterville, Me., in 1821, and began mechanical work on the steamers on the upper Kennebec. In the fall of 1849, with a fellow engineer from a river boat as fireman, he ran a construction engine on the Androscoggin & Kennebec Railroad. The following season he set up the engine and tools for a repair shop for the road at Waterville. After working as a machinist there for two years, he was made master mechanic of the road. When the consolidation of roads forming the Maine Central was effected, Mr. Philbrick was appointed general master mechanic and held the position until 1883. In 1868, he built at Waterville the first locomotive ever built in Maine. He joined the Master Mechanics' Association at the first meeting and previous to that was a member of the New England Master Mechanics' Association. Since 1883 Mr. Philbrick has been in retirement from active service. At the age of 71 years he is still well and retains all his faculties.

18. MORRIS SELLERS, honorary member of the Master Mechanics' Association and one of the most active of the early members. Mr. Sellers belongs to the well-known family of engineers of that name. He received a first-class mechanical education, and in the Master Mechanics' Association was looked upon as authority on all scientific lines of engineering. A paper on "Combustion," which he read before the Association attracted the attention of the scientific world, and was translated into several languages. Some time in the early sixties, Mr. Sellers was made foreman of the Michigan Southern shops at Michigan City, a position he left to run a locomotive on the same road. After varied experience as engineer, machinist, draughtsman and foreman on different Western roads he was appointed master mechanic of the Des Moines Valley. He left that position about 1873 to become agent for the Westinghouse Air Brake Co. He introduced this brake upon a great many roads. After working at this line for three years he went into the business of rolling railroad splice bars and has been exceedingly successful.

19. JAMES M. FOSS, honorary member of the Master Mechanics' Association and Assistant President of the Vermont Central Railroad. Mr. Foss has been in railroad service all his working life. He learned the machinist trade in the Concord Railroad shops, and went upward on that road through the course of machinist, engineer and shop foreman. In 1861 he was appointed master mechanic of the New York Air Line, and remained in that employ four years. In 1865 he returned to the Concord Railroad as master mechanic. Three years afterward he changed to become master mechanic of the Vermont Central. Here he rose through recurring grades of superintendent of motive power, assistant superintendent, superintendent, and general superintendent. He was made assistant president last year.

20. CHARLES GRAHAM, one of the oldest members of the Master Mechanics' Association, and well known to railroad men for his long connection as master mechanic of the Delaware, Lackawanna & Western. Mr. Graham was born in Scotland, in the same town where Andrew Carnegie first saw the light. He learned the machinist trade there, and came to America in 1853. His first work was done with the Rogers Locomotive Works. Being an exceptionally fine mechanic, he had no difficulty in getting a choice position even in the dullest times. His first railroad work was done in the Piermont shops of the Erie. From there he went to the D., L. & W., at Scranton, as machinist and extra engineer. After a year's work here he was made general foreman. In 1864 he was appointed master mechanic of the Lackawanna & Bloomsburg road, which was controlled by the D., L. & W., and when the latter road was extended to Buffalo, his authority was extended to that point. In 1886 Mr. Graham took charge of the Scranton shops and the engines running on the main line. Few men have received more tempting offers to leave railroad work than Mr. Graham, but he clung persistently to his old road. He joined the Master Mechanics' Association at the second meeting, and has been a useful member of committees and a regular attendant at the conventions.

21. JAMES M. BOON, one of the oldest members of the Master Mechanics' Association and Superintendent of Motive Power of the West Shore Railroad. We have no notes of Mr. Boon's professional career, but we know that he has been one of the leaders in imparting progressive ideas into the designing, running and repairing of railroad rolling stock. He was one of the first to introduce standard parts, and his advocacy has greatly helped to advance the cause of uniformity and interchangeability in car and locomotive work. He was long master mechanic of the Pittsburgh, Fort Wayne & Chicago, and while there performed a highly valuable work to the company in reducing a chaos of oddities into convenient standards. Mr. Boon joined the Master Mechanics' Association at the third convention, and at once took his natural place as a leader in all the business transacted. He was ever active in the discussions and in committees and always had valuable information to impart.

22. WILLIAM SWANSTON. On June 10, 1868, six master mechanics met by appointment at Dayton, O., and talked over the advisability of forming an association of men having charge of railroad motive power. This resulted in an invitation being sent out to all master mechanics to meet at Cleveland three months later, when the Master Mechanics' Association was organized. One of the six men who met at Dayton was William Swanston, master mechanic of the Cincinnati, Sandusky & Cleveland Railroad. There is only one of the others alive, viz., Reuben Wells. Mr. Swanston learned the machinist trade in Scotland. He went to work in the shops of the Little Miami in 1850, and rose through the ranks of machinist, gang foreman, and general foreman. In 1866 he was appointed master mechanic of the Cincinnati, Sandusky & Cleveland road. Subsequently, after several changes, he settled as master mechanic of the Jeffersonville, Madison & Indianapolis. He is still on the same road, although it is now a part of the Pennsylvania system. Mr. Swanston is not only a first-class mechanic, but he is well informed on engineering science. There are few men in the business better fitted for the higher positions.

23. H. ELLIOTT, honorary member of the Master Mechanics' Association and one of its oldest members. Mr. Elliott learned his business in the Stephenson Locomotive Works, in England, and came to this country in 1849. Like many other mechanical men who have risen to be master mechanics, he began work in the shops of the Little Miami. He worked for the company successively as machinist, locomotive engineer, and assistant master mechanic. In 1857 he was appointed master mechanic of the Ohio & Mississippi. In 1863 he left this road and went into the Government service as master mechanic on the military roads of Tennessee, with charge of the shops at Nashville. Here he remained till the close of the war. Then he returned to the Ohio & Mississippi, but left it in 1874 to enter business for himself in the manufacture of railroad track supplies, and is now president of the Elliott Frog & Switch Co.

24. R. C. BLACKALL, a member of the Executive Committee of the Master Car Builders' Association and Superintendent of Motive Power of the Delaware & Hudson. Mr. Blackall entered railroad service in 1850 as machinist on the Saratoga & Washington Railroad, and rose through the usual course to be master mechanic on a road afterwards absorbed by the Delaware & Hudson, where he is now the chief mechanical officer. He has always taken a deep interest in the affairs of the Master Car Builders' Association and has been for many years a member of the Executive Committee. He is also a member of the Master Mechanics' Association and president of the New York Railroad Club.

25. E. W. GRIEVES, First Vice-President of the Master Car Builders' Association and Master Car Builder of the Baltimore & Ohio. We have received no particulars about Mr. Grieves' experience in his business. He joined the M. C. B. Association in 1885 and has always been a particularly active member.

26. J. MULLIGAN, honorary member of the Master Mechanics' Association and President of the Connecticut River Railroad. Mr. Mulligan was one of the charter members of the M. M. Association. About the time he joined he was made general superintendent, but he has continued to take a warm interest in the association, although unable to attend the conventions. He rose through the grades of machinist, locomotive engineer and foreman to the position of master mechanic. He held this position sixteen years, and then was made general superintendent. Later, he became general manager, and last year was elected president. His success is a fair gauge of Mr. Mulligan's ability. He is one of the most genial men in the business, and his pleasant face betokens his character.

27. J. W. MARDEN, a prominent member of the Master Car Builders' Association and Superintendent of the Car Department of the Fitchburg Railroad. Mr Marden entered railroad service in 1861 as apprentice in the car shops of the Concord Railroad. From there he went to the Norwich & Worcester and rose to be general foreman, and subsequently master car builder He went to the Fitchburg in 1881. He has been one of the hardest working members of the Master Car Builders' Association and has been repeatedly a member of the Executive Committee.

28. JOHN F. DIVINE, General Superintendent of the Wilmington & Weldon and other lines and honorary member of the Master Mechanics' Association. We have received no information respecting the professional career of Mr. Divine, but we know that he has always been a leading member of the Master Mechanics' Association. He joined at the second convention, and he appeared to exert a good influence in bringing Southern master mechanics into the organization.

29. J. T. CHAMBERLAIN, Master Car Builder of the Boston & Maine and a member of the Executive Committee of the Master Car Builders' Association. We have no notes of Mr. Chamberlain's life. He joined the M. C. B. Association in 1883, and has always been a hard worker.

30. ROBERT MCKENNA, one of the oldest members of the Master Car Builders' Association and Master Car Builder of the Delaware, Lackawanna & Western. We have no information about Mr. McKenna's life.

31. DR. E. H. WILLIAMS, honorary member of the Master Mechanics' Association and a member of the firm of Burnham, Williams & Co., proprietors of the Baldwin Locomotive Works. Dr. Williams is universally known wherever railroads are operated. The first railroad experience of Dr. Williams was in Canada in 1851, on a line which was being constructed between Rouses Point and Montreal; then on another line as resident engineer and afterwards as superintendent from Montreal by way of Lachine and Caughnawaga to the Province line, both since absorbed by the Grand Trunk. Then in 1854, division superintendent and division engineer on the Michigan Southern & Northern Indiana Railroad, first on the Eastern Division, then on the Western, with headquarters at Laporte, Ind. Leaving there in 1858, he assumed the position of assistant superintendent of what was then the Milwaukee & Mississippi Railroad, extending from Milwaukee to Prairie du Chien, now a part of the St. Paul system. Next as assistant superintendent of the Galena & Chicago Railway, now in the Northwestern system, where he remained until he became connected with the Pennsylvania Railroad in the winter of 1864 and '65, as assistant general superintendent and general superintendent until 1870. In that year he connected himself with the Baldwin Works, where he has remained up to the present. Besides being the most genial of men, Dr. Williams is a famous organizer and is said to have been the author of the organization under which the Pennsylvania Railroad is now operated. He is blessed with a phenomenal memory, and can tell details of events and names extending back forty years ago as exactly as if they were before his eyes yesterday.

32. R. H. BRIGGS, Past-President of the Master Mechanics' Association and Master Mechanic of the Kansas City, Fort Scott & Birmingham. We have no information about Mr. Briggs' career. He has been a prominent figure in the M. M. Association, and was successively elected vice-president and president.

33. M. N. FORNEY scarcely requires mention. Those who are not familiar with Mr. Forney's career are not likely to see this paper. He is the most celebrated railroad journalist in the world, and besides that has long been an industrious worker in the various organizations for advancing the interests of railroad appliances and increasing the knowledge of railroad men. Mr. Forney received an engineering training in the Baltimore & Ohio shops at Mount Clare, Baltimore, and was for some time chief draughtsman of the Illinois Central. He was then considered the most expert draughtsman in the country. He left railroad life to become editor of the *Railroad Gazette*. He is now proprietor of the *Railroad and Engineering Journal*. Mr. Forney joined the Master Car Builders' Association in 1873, and at once became one of its most valuable members. Principally through his efforts the association was reorganized in 1882, and he became secretary, holding that position till 1889. He is also a member and active worker in the Master Mechanics' Association.

34. J. N. LAUDER, Past-President of the Master Mechanics' Association and Superintendent of Rolling Stock of the Old Colony Railroad. Mr. Lauder is recog-

nized as one of the ablest and most progressive mechanical officers in the country. The Master Mechanics' Association has been his pride, and no one has worked more faithfully and zealously to advance its interests. We have received no notes of Mr. Lauder's career, but we know that he learned the machinist trade in New England and for a time worked in various shops, among them the Pennsylvania shops at Altoona, where his uncle, Mr. Laird, was superintendent of motive power. He rose to be master mechanic of the Northern Railroad of New Hampshire till 1882, when he accepted the position of superintendent of motive power of the Mexican Central. A year later he returned to New England to the position he now holds. Mr. Lauder is a ready speaker, and he is exceptionally well informed on all matters relating to railway machinery, and seldom talks on a subject without throwing new light upon it. He joined the M. M. Association at the second meeting; in 1877 was elected vice-president, and held the office till 1880, when he was elected president and held the office two years.

35. JOHN S. LENTZ, Vice-President of the Master Car Builders' Association and Superintendent of the Car Department of the Lehigh Valley Railroad. We have failed to obtain any information about the railroad career of Mr. Lentz. He has been for years one of the leaders in the Master Car Builders' Association, which he joined in 1879. He is considered one of the ablest car builders in the country.

36 E. T. JEFFERY, honorary member of the Master Mechanics' Association and President of the Denver & Rio Grande. Mr. Jeffery was born in Liverpool, England, in 1843. He entered railway service October, 1856, as office boy in the machinery department of the Illinois Central Railroad, served his apprenticeship as machinist on that road, and from 1863 until 1871 he was mechanical draughtsman and secretary to the superintendent of machinery; from February, 1871, to May 4, 1877, he was assistant superintendent of machinery of same road, when he was advanced to general superintendent, and on December 15, 1885, to general manager, which position he resigned on September 1, 1889. After having made a trip to Europe in the interest of the World's Fair at Chicago, in the latter part of 1889, he returned to Chicago, taking the management (as president) of the Grant Locomotive Works, which had just been organized, and under his direction the plant just completed at Cicero, near Chicago, was designed and erected. On October 1, 1891, Mr. Jeffery assumed the position of president and general manager of the Denver & Rio Grande Railroad, where he now is. He took an active part in the World's Columbian Exposition of 1893 for Chicago, and his earnest efforts in the interest of Chicago contributed to the selection of that city for the Exposition. After the organization of the Exposition Company, he was elected a director and made chairman of the Grounds and Buildings Committee, which arduous and unremunerative office he held until his change of location from Chicago to Denver. Mr. Jeffery is generally considered to be one of the ablest railroad managers in the country, and he has pushed his way to the top of the tree by sheer merit and energy. He joined the Master Mechanics' Association in 1874.

## Southern Pacific Shops at New Orleans.

Strictly speaking the S. P. shops are not at New Orleans, but just across the Mississippi river at Algiers, La.

Of all the shops in the South anywhere, those of the old Morgan line—now all S. P.—are the best. The management do not invest in poor equipment. Their shop buildings are excellent, the tools new and modern, the motive power in excellent condition, and their freight ships the finest in the world.

During my visit to New Orleans Master Mechanic Connell was in Cuba removing the machinery from one of their ships that had been lost.

The shops are under the care of General Foreman John P. Nolan, a mechanic who served his term right there.

Patrick J. McGuire is a master builder. I can't hardly see what his position really is. He is a ship carpenter and has charge of the repairs to the fleet, is over the M. C. B. at the car shops and superintends the erection of buildings.

The buildings are of brick, well kept up, and are quite extensive. The motive power of the shops is furnished by a compound Westinghouse engine set in the center of the shop, supplied with steam from a locomotive pattern of boiler, also located in the shop. There is one advantage about this plan, and that is that it insures cleanliness and care of both boiler

Fig. 1.

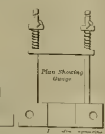



Fig. 2.

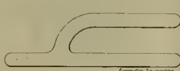


Fig. 3.

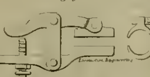


Fig. 4.

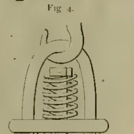


Fig. 5.

and engine. This boiler is covered with galvanized iron fitted up in sections, braced with angle iron, the edges fitted down to the boiler, leaving an air space of about one inch, no other lagging being used.

In the shop there are one or two old tools used for rough work, one of these being an old Confederate gun lathe with the face-plate solid with the spindle.

This shop does all the steamship work, some of which is very heavy. They have some ships with steeple compound engines, using a single crank with a pin about 12 inches in diameter.

Instead of red lead they use ¼-inch asbestos gaskets around boiler fronts, under stack saddles, etc. This requires little work to get ready, and makes a tight joint, but one that "lets go" when the work is taken down.

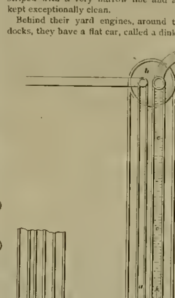
This road is level all over this part of the country, and there is very little use for heavy engines, so that a very nice class of 16 and 17-inch cylinder eight-wheelers are used, and these have a good sized boiler, and are just right for solid comfort for enginemen.

They have a nice little trick here that I should think would pay to imitate in any country, and that is in setting the water tank upon inch and a quarter strips running across the tender deck. Around the inside of the coal pit they fasten a molding that prevents coal from getting under the tank proper, yet all the water can run out.

This plan gets the tank up off the wet deck, prevents its rubbing on the sharp coal dust and prevents its rusting out. They say that it is often possible to find a leak and insert a copper rivet without lifting the tank off the deck at all. This practice is followed on several Southern roads more or less, but seems to be the standard practice here.

The engines are very nicely painted and striped with a very narrow line and are kept exceptionally clean.

Behind their yard engines, around the docks, they have a flat car, called a dinky




DEEPWELL PUMP.

These cars are painted and striped the same as the engines, have side and end steps, a headlight, and carry tool-boxes, wrecking frogs and switch ropes.

Cars and engines are fast being equipped with air, most of the engines being ready, and cars receiving their fittings by the dozen daily.

In the shop, they have recently fitted up a power hose-cutter that is very efficient, and are at work on a device for putting hose-heads on.

On their wheel press, they have fitted up a neat little kink. Of course, there is no test gauge around to compare their press gauge with, it registers too high—tons instead of pounds—and they became suspicious that it wasn't exactly honest. They tapped into the cylinder and made a safety-valve of the lever pattern that was graduated the same as the gauge, and then put a stop-cock under the gauge itself. When doing common work, like freight car wheels, the safety-valve is set to the maximum pressure wanted, and it will instantly let up and relieve the press when this pressure is reached, and the gauge can be shut off and saved from constant strains.

No railroad mechanic can go through these shops without admiring the many handy kinks to be found in the blacksmith shop, which is under the care of James Lusted. He does a great deal of work on his steam hammers that is usually done on a press or shear. I have made a rough sketch of a device he uses to cut bar iron up into lengths, a great deal of this having recently been done in getting out brake rigging for cars.

Fig. 1 shows the cutters as arranged. A pair of coil springs lift the knife to allow of handling the work. Fig. 2 is a plan of the same tool, showing the gauge extending back of the cutter. This gauge is held against stops by springs, so that when the hammer cuts off a piece, it is pushed through and the gauge returns to its correct position. Fig. 3 shows a form of draw-bar they make for engine-tenders. It is capable of being used in six different positions. Fig. 4 represents the business end of a quarter-bar for handling axles, or other heavy work. As will be seen, this bar insures a fair grip on the axle no matter what its shape or size—the hold is a solid one.

In forging frames or heavy work of any kind they use the arrangement shown in Fig. 5 between the crane and the work; the heavy spring prevents damage being done by a foul blow.

In punching heavy work they use loose punches that are driven entirely through the stock. The latter is then straightened, and a drift driven through the hole to get it true and to the exact size. In a fork-ended piece, where the holes must be in line with one another, this plan is a surety.

Between the engine and tender they use here a draw-bar with a knuckle in it. This admits of heavier fastenings in the engine and tender frames.

While at New Orleans I had the pleasure of visiting this company's steamers, *El Monte*, Capt. Quick, and Chief Engineer Geo. Uhler, and the *El Mar*, Capt. Morgan, and Chief Engineer Miller. These are exceptionally fine steamers, the former being driven by a steeple compound engine, and the latter by the latest triple expansion style of engines. The engine-rooms are full of machinery and the quarters close, while the fire-rooms are dark and close. But it was comical to listen to one of the assistant engineers tell of a ride he had on a locomotive, how mean it all seemed to him, and how much he had rather be under deck with the engine and let the captain steer. All the time I was thinking how much I would rather run a "hog" than be cooped up between a condenser and a grease extractor with the best engine in the line, and four thousand feet of water between me and the bottom. But these sea-going engineers are jolly good fellows, just the same, and there is no accounting for tastes. One of these ships has carried 288 car loads of cotton, so the captain told me, and to save my life I couldn't think of ever hearing an engineer claim to haul more than 280 with a locomotive, so I kept still. I hate to be beaten that way, however.

J. A. H.

Apparatus for leading the smoke-stack of a locomotive to the back end of a passenger train has again been patented. This sort of a device has been patented so often that it is difficult to see where the opportunity is given to accept Patent Office fees, but the feat has been accomplished, which is greatly to the credit of the patent lawyer employed. There is one good opportunity for novelty about this invention, and that is the prevailing on some railroad company to try it.

## The Empire Car Coupler.

The latest candidate in the coupler field for consideration by railroad mechanics is the Empire, illustrated herewith.

This coupler has a locking device of very strong construction, and a knuckle-opening arrangement that is simple and entirely closed within the draw-head.

It can be unlocked against considerable pull, which is an advantage in yard work.

The knuckle is thrown open by the continuation of the unlocking movement.

Provision is made for unlocking if the

coupler or draft-gear breaks, thus preventing the head from falling on the track.

The knuckle is heavier and stronger than the average, and a smaller pin is used, thus leaving extra metal in the angle of the knuckle, where most needed.

This coupler has recently gone through some very severe trials on the West Shore road, where it is being used.

The Empire Car Coupling Co., of 15 Warren street, this city, are introducing the invention.

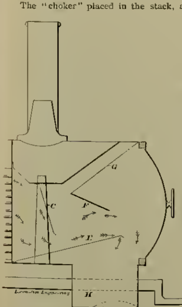
## New Arrangement of Extension Front.

The sketch shown herewith makes plain the internal arrangement of an extension front designed and used by Master Mechanic J. W. Addis, of the Texas & Pacific, at Algiers, La.

There is a hopper under the arch proper, and an opening in the partition sheets through which the cinders are thrown, and are then prevented from being picked up by the force of the blast.

The netting is higher and there is not quite as much of it as usual.

The "choker" placed in the stack, as




shown, was found to help the engine's steaming wonderfully.

The T. & P. have in use a great many Brown spark arresters. These are large diamond stacks with a 6-inch pipe running from the lower part of diamond back to the ash-pan. They are very heavy and troublesome. Sometimes the netting becomes clogged and then the gases going back through the pipe take fire at the ash-pan, and several men have been burned severely by them.

The company are cutting off some of these pipes and turning them directly into the smoke-arch, just back of the stack saddle.

## Lukens Iron and Steel Works.

A party of railroad men, at the invitation of Messrs. Coolbaugh & Pomeroy, New York, last month visited the Lukens Iron and Steel Works, at Coatesville, Pa. They made the tour of the establishment and very great interest was manifested in the various processes to be seen. Beginning at the fine new open-hearth furnaces, lately put in operation, the party watched the charging of one furnace, and others interested themselves in looking through colored glasses at the boiling mass inside the furnaces nearly ready for pouring. The manner of selecting the pig and iron to produce the desired mixture was carefully noted, as well as the means employed in making preliminary tests of the charge.

Next they witnessed the pouring of a charge and saw the working of the wonderfully ingenious machinery for doing the work. The furnaces are built and operated by the most approved methods, and the latest kind of appliances are employed in handling the product. The rolling-mill received great attention, and the systematic fashion in which all operations go on excited great admiration. One of the most observant of the party remarked that he had never before seen such a place where there appeared to be so little lost labor. There was no hurry or tumult, but every man appeared to have a certain thing to do and was doing it.

General surprise was expressed at the great capacity of this rolling-mill, which is devoted entirely to plate work. The first boiler plate rolled in America was made in these works, and that was away early in the century. Although the owners of the place are proud of its history and the work done here by crude appliances, they possess none of the spirit that clings to the old methods. Nothing of the most approved and advanced character is too good or too new for them. They want the best of everything in the line of their business, and take care to have it. They have the largest rolls in the country and the best machinery for handling the material in its way to and from the rolls. The party had the opportunity of examining boiler sheets $1\frac{1}{4}$ inches thick and other sheets as thin as $\frac{3}{16}$-inch. They roll sheets 120 inches wide, and have quite a demand for that size.

The Chicago Rock Island & Pacific Railway people have entered to the Illinois Supreme Court a bill for injunction to restrain the City of Chicago from causing the arrest of engineers for whistling at certain places in violation of a city ordinance. Whistling is necessary at the crossings, which are protected by interlocking signals, but the city authorities make this necessity a crime. Several engineers have already been arrested and fined for whistling. If they did not whistle they would be discharged by their employers. This condition of things is exceedingly hard on the men. If the court does not give relief there is likely to be a hot kind of quarrel with the city authorities.

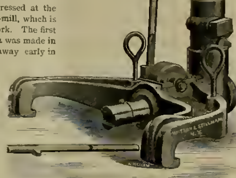
The Delaware, Lackawanna & Western have been lately introducing the extension front on the locomotives on the Eastern divisions. In connection with this Mr. W. H. Lewis, master mechanic, has been experimenting with single-nozzle and high exhaust-pipe. He tried several forms of pipe before he got the engines to work satisfactorily. One he is now using with excellent results has a bridge that extends up far enough to contract the opening a little below the area of the nozzle.

The New England Railroad Club has got up an illustrated pamphlet with the constitution of the club and a list of the members. It also contains engraved portraits of President Twombley, Vice-President Chamberlain and Secretary Curtis.

## Hydraulic Rail Bender.

The well known hydraulic engineers, Watson & Stillman of this city, have recently placed on the market a rail bender of some use. The rails are getting too heavy for screw benders, the latter are slow, clumsy and require a gang of men to work them, while a couple of years' wear ends their usefulness.

This tool, while it weighs a little more, is not so clumsy to handle, and can be quickly applied and worked much easier by *one operator*. Experiments have shown that it was not the method of bending, but the long spacing which sprang the rail up, so that a very heavy hook to catch the web was not necessary. In this tool the ram may be run in and out without pumping for a distance of $3\frac{1}{2}$ inches. This allows the tool to be placed over the rail and the ram brought up to its work on the rail head, when a few strokes will bend the rail to the desired curvature; it may then be slid along easily and another pressure given. The ram is graduated to show the spring of rail, and has a loose steel head which fits the rail head which is being bent. In a recent test in service two men bent forty 30-ft. 90-lbs. steel rails in



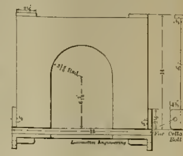
one day, where previously twenty had been the best work of six men with best of screw benders, and one rail was bent perfectly flat on 45 feet radius in $1\frac{1}{2}$ *minutes*, on 16-inch centers of application. The tool weighs 275 pounds.

A test was lately made by Professor Johnson, Washington University, St. Louis, of hollow stay-bolts taken from the ordinary stock of the Falls Hollow Stay-bolt Co. The breaking strength was 49,200 pounds per square inch of area, the limit of elasticity, 28,300 pounds; percentage of elongation, 34, area of reduced section, .30; percentage of reduction, 50. Professor Johnson remarks about the material "This is a remarkably fine specimen of wrought-iron for stay-bolt purposes. Its elongation, 34 per cent., is the greatest I have ever found for wrought-iron, and this is of the utmost importance in stay-bolt iron. The fracture shows a pure, fibrous, unlaminated and uncrystalline structure."

## Wearing Plates for Taking Up Lateral Motion.

The accompanying engraving shows a simple little device used upon the S. C. road for taking up lateral play between driving-boxes and hubs and also on engine trucks.

The brass plate, as shown, is dropped in between the hub and box and secured by




putting the cellar bolt through the lugs cast on bottom of plate.

They keep on hand plates of ⅛-inch and ¼-inch for driving-boxes, and ⅛-inch, ⅜-inch, and ¼-inch for trucks. They are not planed up, but the sand is cleaned off them.

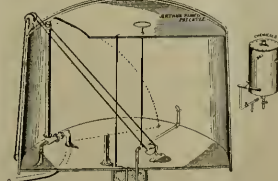
These are very useful where engine is "running to one side," as it admits of taking up all the slack on either side. When worn out they are nearly as valuable as scrap as when new.

The Wood Extensible Air Step Co. have sent out a graphic illustration of the advantages of having their extensible air step on cars. Two trains are shown side by side. From one a lady is descending by the ordinary steps and the stool on the ground tips over with mortifying results. From the other train which has the Wood step a lady trips down with dignity and comfort. A step of this kind is convenient for all trains, but for suburban trains it is an absolute necessity. We daily receive in the neighborhood of New York exhibitions of the inconvenience and annoyance of getting on and off trains with high steps that make us indignant at the railroad company which forces people to engage in acrobatic performances.

## Feed Water Purifier.

Mr. Arthur Pennell, of Kansas City, Mo., has been investigating the feed-water question for some years, and has recently perfected a system that seems to have decided merits of its own.

Instead of burdening each locomotive with a device which must of necessity be small and through which a large quantity of water must be passed, he goes directly to the station water-tank.



The process consists in treating the water with chemicals that precipitate the foreign matter, an arrangement for drawing off the deposit from the bottom, and a tank spout so constructed as to draw water from the top of the tank instead of the bottom.

The cut shows how this is accomplished. A jointed stand-pipe inside the tank is so arranged as to be drawn down to any incline that will allow it to fill with water.

Where mud is the trouble, it would seem as though Mr Pennell's plan was a good one.

Most railroad companies accept rails from the makers without requiring tests. The Louisville & Nashville is an exception in this respect.

## FARMING IN THE SOUTH.

It is not astonishing that hundreds of Northern farmers have settled in the South at points on, or adjacent to, the southern division of the Illinois Central Railroad within the past five years, nor is it remarkable that instead of confining themselves to the cultivation of cotton exclusively, they are diversifying their crops with gratifying results. One of the important questions in the mind of any Northern farmer who contemplates locating in the South is: "What crops can be profitably grown in that latitude?" The passenger department of the Illinois Central Railroad will, on application to Mr. J. F. Merry, Assistant General Passenger Agent, Manchester, Iowa, mail free the following pamphlets: "Southern Home Seekers' Guide," "How to get Rich in the South," "Truck Farming," and "Farmers' and Fruit Growers' Guide to McComb City, Miss." These publications contain valuable information and should be read by every farmer looking for a Southern home.

## Jim Skeevers Illustrates a Point.

Skeevers was "acting master mechanic" once while the real article went "down East," got married, and honeymooned around a while for all the world like a common engineer or a human being.

Skeevers didn't make any startling changes, but while he sat in the office he was boss, all the same, and he put the knife into every sore caused by friction between engineers and firemen.

They couldn't any of 'em shut Skinny Skeever's eye with a five-act story—Skinny knew all the stories by heart, and the men, too.

Skeevers went over the road with the officials on a tour of inspection once, and saw, for the first time, a middle-aged scrap heap on the Coalville branch, and Skeevers made a note in his book that the "38 was the dirtiest engine he ever saw."

When he got back home he wrote a letter to the engineer, saying that he was ashamed of the engine and of him, that whoever the fireman was, he, the engineer, was responsible for him, and that if the engine wasn't at once put into decent condition the engineer would hear something drop.

In a couple of days a reply came in couched in very dignified language; there was no excuse for the dirt, no promise to remove it, no word about the fireman, but a protest against the summary way that Skeevers wrote.

"I want you, sir, to distinctly understand that I am a gentleman and shall insist on being treated as such," concluded the epistle of the offended "plug-puller" of the branch run.

Skeevers sent him a pass by the first train,—and also sent a man to relieve him.

The next day he climbed the stairs to Skeevers' office with three gauges of indignation on—Skeevers knew he was coming and was busy writing.

"Is Mr. Skeevers here?" he asked, as he leaned his arm on the railing.

"What do you want to see him about?" asked a fresh young clerk.

"I want to see the master mechanic of this here road," said the gentleman from Coalville.

"I am that person," said Skeevers, quiet like. "May I ask who you are?"

"I'm the engineer of the 38."

"Oh, yes, let's see, how long have you been running an engine here, sir?"

"Six years, and I—"

"Never mind, now, but don't you draw pay from this company for another position?"

"No, sir!"

"Just hired for an engineer and paid for that and nothing else?"

"Yes, sir."

"I'm glad to know that; I got the impression from a letter you wrote me that you were down on the pay rolls as a gentleman. They may need some of them in other departments, but I want engineers, firemen and mechanics; I wouldn't give the best gentleman in America $20 a month for my part of the work.

"I understand, sir, that you are connected with some of the first families here, but that cuts no figure with me. After working-hours you may lead the German at the Governor's ball if you want to, for all me, but while on duty here you are in charge of a locomotive and are responsible for it to me, and I to the management. I don't care a Continental cuss whether you were born in the White House or the gutter, who you married or what church you belong to. It cuts no figure here, as I remarked before.

"I do care what kind of an engineer you are, though, and you can't be any better engineer because you belong to the Masons, the Episcopal church, the Greenback party or the Holy Rollers. Marrying into the first families won't help you, and being born in a hovel won't hurt you,—as an engineer.

"It's an engineer's duty to see that his engine is kept reasonably tidy; the fireman should do most of this work under your direction, but you are as responsible for that as you are for the packing of the valve-stems.

"Now, sir, this road wants good engineers, and gentlemen would be a drug on the market. If you want to try running the 38—as an engineer, mind you—I am willing. You go right ahead and marry a wench or a Pawnee squaw, if you want to, and tell 'em all it's none of my business, but if you don't clean up that engine before Saturday night I will fire you off the face of the earth and hire an engineer.

"Give Mr. Pangborn a pass to Coalville, James. Good-day, sir."

"Good-day, Mr. Skeevers."

"That's what I call a dry roast," said the chief clerk, as the gentleman runner shut the hall door at the foot of the stairs.

"That's what my old fireman calls an object lesson, illustrated," said Skeevers, "and, whatever it is, I know that Pangboro sees something in a different light than he did, and he won't forget it, *eyether*."

## An Improved Pilot.

Making and keeping in repair the ordinary wooden pilot is rather expensive, and the iron pilot has this serious disadvantage when it gets a crimp in it—you can't get rid of it.

The most expensive part of a wood pilot is the cross-framing, and this framing picks up cinders and often gets on fire. The method of fastening the drawhead is also liable to many ills; and to support the nose of the pilot heavy heel-braces or supporting-rods are necessary.

The accompanying diagrams taken from the working drawings of the S. C. roads show a cheap and strong pilot that is fast becoming popular in the South. The triangular sill-frame is of hard wood, and instead of angle-braces framed into it, the bracing is a single casting, as show in Fig. 2; this is of angle-iron section and securely braces the three sill-pieces, will not burn, and is lighter and stronger than wood braces.

From the nose of the pilot to the center of the buffer-beam two wrought-iron forgings, as shown in Fig. 1, are used, the upper end, which carries the drawhead, being thicker than the lower end that merely supports the nose. When a pair of these braces are bolted from the buffer to the nose of pilot they form a strong frame; the pilot slats are merely dropped into place and held at each end with a lag-screw; they are not even beveled off, but the corners are rounded.

The drawhead swings on a heavy bolt

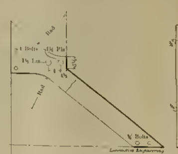


Fig. 1.

across the wrought-iron backbone, and another pin holds it in position for work or when thrown back out of the way. No long drawbar is needed.

This pilot is as strong as an iron one, has all the advantages of a wooden pilot, and is cheaper to make and keep in repair than either.

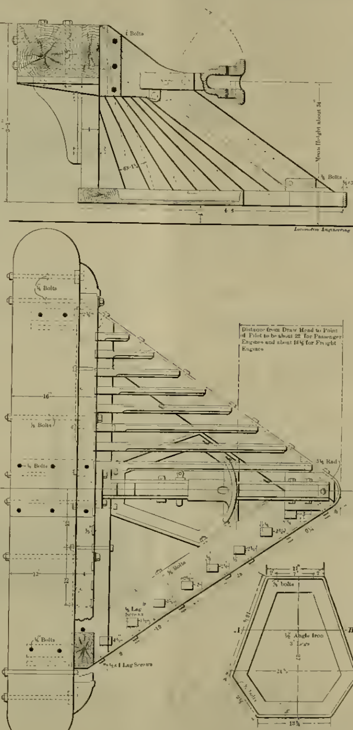


Fig. 2.

## Combustion Chamber Boilers.

There is a tendency among some of the most enterprising locomotive men in this country and in Europe to revive the form of boiler that has a double set of flues and a combustion chamber between the two internal flue sheets. That kind of boiler has been tried years ago in various forms with all the influence of patent rights behind it, but nothing could make it a success. Talking on this subject lately, an old superintendent of a leading railroad said, that when coal burning was first introduced they tried nearly every thing invented that promised to improve combustion and increase the amount of the heat absorbed by the steam-making medium. Among other devices the combustion chamber was tried in numerous forms. It was tried from 1 to 5 feet long, tried next the fire-box and in the middle of the boiler. Large flues and flues as small as 1½ inches were tried with it. Brick arches were applied in various forms to protect the chamber, and different methods were tried to help the mixing of the air with the fuel gases in the combustion chamber. It was all of no avail. When the combustion chamber was removed and the space filled with tubes the boilers invariably steamed better.

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Railroad men visiting the ancient city of Quebec would do well to make the acquaintance of Mr. W. R. Russell, superintendent and master mechanic of the Quebec, Montmorency & Charlevoix Railway. The railroad he operates is small but it has some unique features. The principal business done is the carrying of pilgrims to the holy shrine of Ste. Ann, where a great pyramid of crutches may be seen that have been thrown away by holy cripples that went to the shrine and were cured. Scarcely less wonderful than the pyramid is the means that Mr. Russell employs to carry people there. He carries 135 passengers in a 16-ton car, which is something unparalled in railroad operating. And the people are carried safely and comfortably

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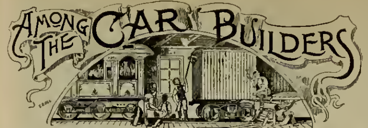
Mr. Arthur Pennell, of Kansas City, who has devoted a great deal of study and experiment to the subject of feed-water purification, has lately obtained a patent on a water purifier for boilers.




The Ohio Southern is said to be in the market for 1,500 cars.

The Buffalo, Rochester & Pittsburgh are in the market for 500 cars.

The Delaware & Lackawanna have placed an order for ten coaches.

The New York, Ontario & Western have ordered 500 cars from the Peninsular people.

The Southern Pacific have awarded a contract for the building of 500 cars to the Ensign Co.

An improvement on the quick-action triple-valve has lately been patented by H. H. Westinghouse.

Within the last month over 2,500 cars have been specified to be equipped with the Butler draw-bar attachment.

A contract for the construction of twelve tank water cars has been awarded to the Madison Car Company by the Mexican Central Railroad.

The Southern Pacific have placed an order with the Pullman Palace Car Co. for twelve new improved parlor cars. They will be longer than the other cars belonging to the road, and will have two drawing-rooms.

The Staten Island Rapid Transit Co. have contracted with Baldwin's for three Forney and one eight-wheel engine. They have also ordered sixteen coaches. Engines and cars will have Boise wheels and Cambria steel axles.

An improved form of car bolster to be made of pressed steel has been patented by Charles T. Schoen, Philadelphia. The invention seems to produce a bolster that will combine the greatest strength with the least weight of material.

All new cars belonging to the Atlanta Coast Line are being equipped with air-brakes and M. C. B. couplers. They have marked in bold letters "Westinghouse Air-brake." About twenty new cars a month are being built in the company's shops.

The Staten Island Rapid Transit Co. have placed an order for twenty-four new cars. Twelve of them will be the ordinary suburban car, eight excursion cars and four combinations. The cars will have Boies steel wheels and Cambria axles made by the Coffin process.

A rather ingenious slack-adjuster for car-brake gear has been invented and patented by Howard Hinckley, Trenton, N. J. By a very simple arrangement a ratchet is made to turn an extended nut on the brake-rod, which lengthens it as the wear of shoes imparts lost motion to the gear. The invention seems practicable and likely to work well.

As a precaution against the dangers that result from broken stay-bolts, the New York Central are now using a great many of the hollow stay-bolts made by the Falls Hollow Stay-Bolt Co. This kind of stay-bolt has been specified for the one hundred new locomotives under construction for the company by the Schenectady Locomotive Works.

The Franklin Institute at Philadelphia has recommended the award of the Elliott Cressen medal to Mr. C. H. Batchellor, chief draughtsman of the Rhode Island Locomotive Works, for his improvement on compound locomotives. The improvement consists mostly of an intercepting valve which was illustrated in the January number of LOCOMOTIVE ENGINEERING.

The Chicago, Milwaukee & St. Paul Railroad Company has just completed at its West Milwaukee shops fifty Wickes refrigerator cars. These cars are especially designed for business in the California fruit trade, which the C., M. & St. P. is preparing to take care of during the coming season. The cars are equipped with air-brakes and are modern in every respect.

The shops belonging to the Wagner Car Company at Buffalo are very active with car building at present. About 1,600 men are at work in the shops, and this force will soon be increased. They have under way more then one hundred new sleeping cars, and they are also building part of the new passenger car equipment for the Adirondacks & St. Lawrence Railroad. The first instalment of this work consists of ten day cars and two observation cars. They are also building a car for the transportation of horses, having 15 stalls. The A. & St. L. people are also getting some smoking cars built at Troy, N. Y.

At a convention of railroad commissioners held lately at Washington, D. C., Hon. John R. Wheeler, of Illinois, read a paper on "Private Freight Cars" in which strong grounds were taken against the use of live stock, refrigerator and other cars owned by shippers. He held that the practice of operating such cars was a serious loss to railroad companies and injurious to the interests of shippers who did not own or control cars. The profits made by the owners of certain lines of private cars was said to be enormous, while the railroad companies doing the work receive less than a fair share on business that is carried away from the legitimate channels.

An improved vestibule connection for passenger cars has been designed by Messrs. A. M. Kitteridge, of the Barney & Smith Mfg. Co., and John Kirby, general master car builder of the Lake Shore & Michigan Southern. The patent on the invention covers a vestibule upon the platform of a car composed of an inherently elastic extension always projecting beyond the outer end of the vestibule and forming a practically tight connection under all conditions of train operating. The elastic element appears to be formed of a tubular cushion strengthened by webs to give it stiffness. This tubular cushion forms the closing part between connecting vestibules.

In a discussion on draw-bar attachments of cars that took place at the May meeting of the New York Railroad Club, a curious objection was raised to some of the appliances for strengthening the draw-gear. The first aim of a maker of these things is to prevent breakage of the draft timbers. The objection was made that this practice was carried so far that the draft timbers were made so strong that in case of a collision they held intact and the longitudinal stringers broke. Mr. George McGuire, who was present, made the point that the Butler draw-bar attachment was so proportioned that it resisted ordinary shocks, but when a blow was given that was bound to fracture something, the Butler attachment broke, although strong enough to resist anything short of a collision.

The orders which General Superintendent Brown of the Fall Brook Railroad issues are noted for being pointed. Here is a specimen from the order board called out by some delay in getting a wreck cleared away "In case of a wreck, all trains occupying the main track must be side tracked at once and get the engines to work at both sides of it as soon as possible. It will not be necessary for the men to go and look at the wreck and talk matters over until their trains are side-tracked and engines return ready to go to work, and then go to work in earnest to clear the track as soon as possible. Do not wait for Corning office to tell you every move to make. Wake up and do something yourselves. You are on the ground and know better what is necessary to be done than we do at Corning."

The New York City & Northern is one of the most crooked roads we know of. The greater part of it is single track, yet there has never been a serious collision on the road during the ten years it has been in operation. This is highly creditable to the superintendents who have had charge of the operating of the road. The first superintendent to put the operation of the road in first-class order was Mr. Frank S. Gannon, now in charge of the Staten Island Rapid Transit Road, and he was succeeded by Mr. H. H. Vreeland, the present incumbent. Both these men are noted for being popular with the employes under them, yet they maintain rigid adherence to rules. Accidents are not prevented by severely punishing all and sundry after something has happened, but by the keeping of all hands vigilant at all times. The careless and neglectful practices that lead to accidents are checked before they lead to their natural effect. We do not know of two men in charge of comparatively small roads who are more deserving of advancement than Messrs. Gannon and Vreeland. Both are practical railroad men with experience in different branches of the business, and both are good organizers with the talent for seeing that their plans are carried out.

## Old and New Defects in Car Interchange.

Those familiar with the disputes and heart-burnings that arise in the interchange of freight cars in the endeavor to make every road act justly in carrying its own share of the expense of repairs will be likely to sympathize with remarks made by Mr. C. A. Schroyer at a recent meeting of the Western Railway Club. He said most emphatically that there are defects which should not be carded. "We are getting," he continued, "into such a state of affairs in interchange that if a nut doesn't stand square you have got to card it."

This strong expression of dissatisfaction was brought out in a discussion on carding cars for old defects. Many railroad men, especially in the West, are opposed to carding for old defects, but we cannot see where the line can be drawn between old and new defects. The annoyance caused by excessive demand for carding is due to certain roads holding to the final letter of the rules of interchange, and getting the better of their neighbors by strictly legal means, carried beyond the line of justice. This lack of fairness is the real cause of the trouble. The only way for all the roads to get justice is to hold to the letter of the rules as closely as possible. It is impracticable to establish rules that will indicate exactly when a defect card is due if the spirit of fairness is absent.

Those who are opposed to the carding for old defects have good practical reasons to give in support of their position. Old defects are generally of a character that result from ordinary wear and tear, and the owners are the parties who should bear the expense of doing the work. For that reason old defects ought not justly to call for carding. On the other hand, it frequently happens that a car is a long time away from home, and defects due to hard usage become old while it is dancing to and fro on a foreign road. It is rather hard that this car should be returned in a half-wrecked condition to the owners to repair when all the damage was done while the car was earning money for parties who held it away from home as long as it could be used with safety. Another objection to the non-carding of old defects is that the man inclined to act unfairly will insist on making many defects, old or new, just as the decision will favor his own interests. We have listened to both sides debating this question with much earnestness, and we are inclined to believe that the only practical solution of the question is in holding to the rule that a card may be demanded for a certain defect, no matter when the defect appeared.

## The Unreliable Tail-Bolt.

The increasing capacity of cars is constantly developing new weaknesses in the cars of old dimensions that demand increase of sizes. A part that has been greatly under fire lately is the tail-bolt of the draw-bar. This was long the popular means of connecting the draw-bar to the draft attachments. Straps are now on the ascendant. In proposing an amendment to the M. C. B. rules of interchange requiring the strengthening of the tail-bolt, Mr. William Forsyth lately said:

"We have recently taken out of foreign cars some tail-bolts which were 1½ or 1⅝ inches in diameter, secured by a key, and pulled them in our testing-machine. We have broken such keys at as low as 40,000 pounds, and broken the bolt at 50,000 or 60,000 pounds. A 1¾-inch bolt with a key will not stand much over 70,000, and you would be surprised to see how small a section of iron there is in a tail-bolt which has a key. The area is not as large as that of a common link, and I think it is essential, with our large engines and heavy capacity cars, that the strength of the whole train should not be impaired by the introduction of the old cars having small tail-bolts. The accompanying figures are full-sized sections through the key-ways of 1½, 1¾ and 2-inch tail-bolts, and underneath is given the results of tests made upon them. In view of these results, I think it is important that in this section of Rule 3, there should be added, 'tail-bolts for cars of 40,000 capacity and under, not less than 1¾ inches diameter; tail-bolts for cars of 50,000 pounds and over, not less than 2 inches diameter.' I move that the clause be inserted in that part."

In the treatment of fine steel after it leaves the maker's hands it is often forged, annealed reannealed, hardened and tempered, each operation requiring an application of heat. In these processes the steel is subjected to more or less sudden and extreme changes of temperature, being sometimes improperly plunged into ice-cold baths from white heat. If the steel does not remain perfectly sound under all forms of torture, it is very likely to be condemned as bad. Thus steel is many times unjustly blamed, not for fault of its own, but because the steelworker is either not careful to observe, or does not fully comprehend, the laws of its treatment.—*Sparks.*

Several new patents have lately been granted to Mr. James F. McElroy, of Albony, N. Y., and assigned to the Consolidated Car Heating Co. There is a novel system of charging car-heating apparatus with the heating medium, a temperature regulator, and a coupler for electric wires. They are all designed as improvements, to be applied to the company's system of car heating.

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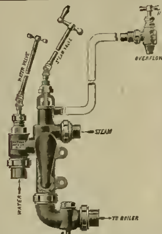


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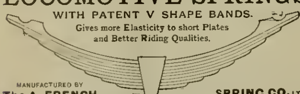

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## A Correction.

*Editors:*

In the rule which I gave you for counterbalancing driving wheels, by some unaccountable and unfortunate circumstance a very serious error was made in the figures used as an example, and which I, through carelessness, overlooked before sending to you.

I will give you a corrected example as taken from actual practice, as follows

| | | |
|---|---|---|
| Weight back end main rod, | 117 | lbs. |
| Weight front end side rod, | 97 | " |
| One-third weight crosshead piston, front end main rod, | 108 | " |
| Total . . . . . . . . . . | 322 | " |
| One-half stroke . . . . . . | 12 | " |
| | 3,864 | |

Point of suspension, 30) 3864 (128⅘

I am very sorry that this error occurred and appeared in the May issue, but I hope that it will not lead any one wrong before the correction reaches them.

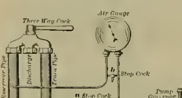
E. M. Roberts.

*Charleston, S. C.*

## Why is this Stop-Cock Used?

*Editors:*

A class of engines running on a road out of this city are equipped with the regular Westinghouse air appliances and deviating from the standard only in having a three-




way cock instead of brake-valve and the two air-gauge pipes connected with a pipe fitted with a stop-cock as shown below.

Will some air-brake man tell why those gauge-pipes are connected?

Will W. Wood.

*Terre Haute, Ind.*

## Not an Explosion.

*Editors,*

Last month Engine 206 on our road, the Illinois Central, dropped her crown-sheet, and engineer and fireman were hurt. It was claimed the engineer was blown two hundred feet, may lose his eyesight, and the fireman suffered a broken leg.

Now, the crown-sheet pulled off 16 of the crown stays and only sank two and a half inches, the force of the explosion (?) did not displace the brick of the arch or crack a glass in the cab.

There are two parties here. One says it was a *bona fide* explosion, the others claim it was simply a case of low water or other cause for crown pulling off the stays, and that the crew were scalded by steam from the open fire-door and jumped off, the engine running 200 feet, and that they were not *blown* anywhere. An explosion that does not break windows is tame, isn't it?

A. D. Prentz.

*Chicago, Ill.*

## A Cinder Lasso.

*Editors.*

What a painful thing it is to get a cinder in your eye, and have to wait until you find some one with experience and a steady hand to remove it for you. Even then the "experienced hand" will take a match, whittle a point on it, and "prod" your eye with it until the eye becomes inflamed,

and after all his "monkeying" the cinder, or whatever it may be, still remains. Never use a match to take anything out of the eye.

Up to date I have taken three car loads of cinders out of men's eyes and have never found anything equal to the little "Lasso," made of horse hair, as per sketch herewith. I hope you will show it up to the boys. It will be found especially handy while running along the road, because if you get anything in your eye, all you have to do is to take hold of the eye-lash, pull the lid away from the eye-ball, and put the "Lasso" up under the lid, drop the lid, roll up the eye, pull out the "Lasso" and the cinder is yours—provided, however, it has not been in long enough to imbed itself in the eye—in that case we use a lead pencil or knitting needle with a sharp, flat point. Don't *pick* but *scrape* off the particle.

W. F. Relyea.

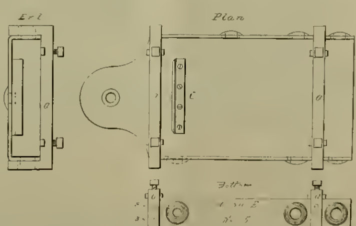
*Syracuse, N. Y.*

## Template for Rod Straps.

*Editors:*

At the B. & A. shops here we use a template for drilling rod straps that saves a great deal of time and insures uniform work.

It is made of ⅜-inch flange iron, flanged and planed on inside the width of the strap. The yokes *A A* are 1 inch square, fitted




snugly down over flanges and riveted at *B B*. Stop *C* is 1¼-inch angle iron and fastened with screws, *D*. After strap is placed in template it is secured with set-screws and gibs, as shown. This, you will notice, is for strap without key-way, but where wedge and screw are used instead of key.

T. B. Purves, Jr.

*East Albany, N. Y.*

## Effect of Large Equalizing Drum.

*Editors:*

The criticisms published in the last number of your paper, on the engineer's brake-valve that had a broken pipe connection to the equalizing drum, make very interesting reading for air-brake men, and show clearly a very largely increased knowledge of the engineer's equalizing brake-valve, and this in turn indicates a better knowledge of the air-brake in general, as this valve is about the hardest to master of any in the system, and cannot be well understood without at least a fair knowledge of the action of the other parts. Cases such as that cited by Mr. Hooker, in which a stop-cock in the train-pipe exhaust became accidentally closed, preventing any application of the brakes in the service stop position, were not infrequent when the valve was first put into service, for at that time Westinghouse sent them out with a stop-cock in that place instead of the small threaded elbow now used, purposely to provide a convenient means of meeting just such contingencies as that described by Mr. Bishop, or any difficulty encountered from leakage by the train pipe exhaust-valve.

Occurrences such as Mr. Hooker mentions (accidental closing of this stop-cock) finally brought about the change to the threaded elbow, which may be plugged up with either wood or a ⅜-inch pipe plug in any case where it is necessary to cut out the automatic action of the valve. If there is an exhaust-pipe in the elbow a blind gasket may be put in the union.

While running an instruction car on one of the railroads, I frequently, for purposes of illustration, had occasion to put a blind gasket in the connection to the equalizing drum, and when the valve was so "fixed," found great difficulty in controlling the brake without plugging up the train-pipe exhaust and making reductions by a slight opening of the emergency port. Cutting off the drum so greatly reduces the size of the cavity above the piston that the moment the handle of the valve is brought around to service stop position the pressure on the gauge disappears like a flash, and there is then no way to prevent all the air from escaping from the train-pipe except to release the brake.

Of course, with great care and very quick movement of the handle back to the lap some of the air may be retained in the valve cavity, but if Mr. Desoe got *satisfactory* results in this manner on an engine in motion he is much more skillful than the great majority of "us experts."

A very amusing experience in connection with the size of this drum came under my notice up in the northwestern part of the country a number of months ago. The brake equipment for an engine had been sent without the equalizing drum, and when the foreman had it set up he substituted a passenger car auxiliary, not thinking at the moment of the effect this would have on the action of the valve. The engine was on a passenger run and the slow action of this valve became famous. A number of the men thought the trouble might be in the size of the drum, but did not like to stand against the action of the foreman, so for some time the engineer had to make the best of it, though it was rather hard on him, as he had to begin applying his brake a long distance from the station to make a service stop at all.

While riding with him he tried to get me to make some of the stops, but as I felt sure I could not handle the thing half as well as he was doing I declined with thanks.

Paul Synnestvedt.

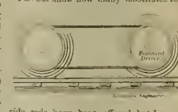
*Chicago, Ill.*

## Proposed Substitute for Side Rods.

*Editors:*

Everyone who has put in any time on a railroad has seen evidence of the damage done by broken side rods, to say nothing of the loss of life and limb.

I do not know how many substitutes for




side rods have been offered, but I never heard of belting the drivers of an eight-wheeler together.

What stands in the way of the use of a steel wire cable, say two inches in diameter, running on sheaves on the outside of wheels?

Why is it not practically possible to use it? It would certainly be far cheaper than side rods, be almost noiseless, require no counter-balance or crank pin boss cast in rear pair of wheels and less counter-weight in the forward pair and would certainly reduce the hammer blow.

Rope transmission of power is very common now-a-days. Who says it won't work?

H. K. Bates.

*Fort Scott, Kan.*

## Tink's Puzzles on Air.

*Editors.*

Permit me to hazard a guess at the answers to Mr. Tink's two problems

In the case of the engine which could not be moved from the table because the brake stuck when the pump was started, one thing is plain, air must have reached the cylinders or the brake would not have stuck. From the description given, the only way this air could get into the cylinder-pipes was through the triple-valve under the tender. It is possible that the handle of the four-way cock was on wrong, and stood in a horizontal position, when the straight air port was open from the train-pipe to the cylinder. There might have been a leak from the train-pipe to the cylinder connection, either around the plug of the four-way cock, or by the slide-valve in the triple, but in either such case the air should have blown out of the exhaust instead of accumulating pressure in the cylinders, and Mr Tink does not mention such a symptom. If there was no blow from the exhaust, either the four-way cock could not have been in "automatic" position, or the triple-valve piston must have been stuck down uncommonly hard with some leak, for the accumulation of pressure above it, or possibly the exhaust might have been stopped up, which in conjunction with a small leak through the valve would stick the brake.

Now let us proceed in a similar manner with the other problem. This triple-valve worked satisfactorily until the emergency was set, after which, on endeavoring to release there was a continual blow through the exhaust, the brake remaining set. The opening of the exhaust shows that the main piston and slide returned to release

position, but as the brake remained set, the air must have been entering the cylinder as fast as it was escaping. This blow could only have been supplied from the train-pipe, and as there is no other passage where it could get through except by the emergency-valve, this valve could not have been properly seated. It might have been held away from its seat in any one of a number of ways Dirt or cinder on the seat, or scale above the emergency-valve piston, preventing it from going back to its proper position; but as in either such case the valve should have blown before the emergency application was made, as well as after, the indications are that either the spring under the valve was too weak to return it to its seat, or else it had been left out altogether, or put in on the wrong side of the valve, as happened in a case that came under my notice a couple of years ago. Evidently the spring did not seat the emergency-valve after it was once opened, either because the spring itself was too weak or the resistance was greater than is ordinarily the case.

PAUL SYNNESTVEDT.

*Chicago, Ill.*

## Tink's Puzzle.

*Editors:*

In answer to Tink's "Little Puzzle on Air-brakes," page 161, May issue, will say, the trouble was caused by air-hose not being properly coupled between engine and tender. SINK.

*Durham, N. C.*

## Answer to Puzzle on Page 159.

*Editors:*

In answer to the little puzzle on the air-brake This engine had but one triple-valve for the tank and driver-brake, so it is necessary to have two hose between tank and engine; this engine had been disconnected the day before in order to do some work on her, and in connecting her again they connected the hose wrong, so that when the pump was working, she was pumping air direct into brake-cylinder instead of into the train-line, and the driver-brake was connected to the train-line; this is something that may happen a great many times, as the hose look to be all right connected either way.

TINK.

## Answer to Puzzle on Page 161.

*Editors:*

The trouble with this little triple-valve was that the bore of the check-valve No. 15 was out of line $\frac{1}{16}$ inch with the bore of the emergency-valve, seat No. 9 in the case, so that after an emergency application the valves would bind and remain open, and after recharging the train-line it opened exhaust from brake-cylinder and the air blew continually through triple exhaust, and the brakes would remain set as long as there was any pressure in the train-line; then, by tapping the case, the valves would drop to their places again; then it would work all right again in service-braking. This emergency-case was a new one that had been put on. TINK.

*South Kaukauna, Wis.*

## Care of Side-Rods.

*Editors:*

The side-rods of engines to run with success, when put up standing on the center, should bear on the inside of the pins; then this will allow for the lengthening of the wheel-center, which is necessary on account of the driving-box playing "up and down" in the pedestal jaws. If rods are put up in this manner and receive the proper care from the engineer, and he keeps his wedges adjusted, there will be very few bent rods and sprung pins. If they are stub ends with straps, they should be put up without keys, for the key has not enough bearing; the brass to run well should have full bearing of the stub end. When they need adjusting, have the machinist slip in a thin liner, giving the bolt a small draw; this will give better service than the key. There are many engineers who will not keep the rods properly keyed, letting the straps and brasses wear out of shape. I have seen engineers who would run with their wedges down, in this way letting all the work come on their side-rods; the brass would gap open on every revolution of the engine. These men are always complaining "that their rods are always giving them trouble." A great many are prejudiced against the solid rod. They claim they pound worse than the strap. This is not according to my experience. The straps not being solid give a little, which kills the pounding and knocking, and it not being so perceptible as with the solid rod, but the lost motion being there it must be the same with both.

Some claim they cannot keep oil cups on solid rods. If they will use a leather or pasteboard washer underneath the cups it will soften the shock, and they will have no trouble with their cups, no matter how bad the rods get.

AN OBSERVER.

*Paducah, Ky.*

## Completed History of the Rebel General.

*Editors:*

Let me tell the rest of the "Rebel General's" story, commenced by Mr. W. H. Wesley in a recent issue of your paper.

I took charge of the motive power of the Tenn. Coal & R. R. Co. in 1880, and found this old engine—then named the "Sewanee"—out back of the shop, where she had been furnishing steam for the shop.

She was re-built and did switching service up to 1887, when she went into the scrap.

They had at that time another engine, the "A. S. Colyar," that was just like the "General" in war times and before her re-build.

Mr. W. W. Knight, of Memphis, Tenn., has photographs of these old timers that might be used in your paper as examples of "before and after." W. A. KNIGHT.

*Birmingham, Ala.*

[We are indebted to Mr. W W. Knight for use of photos from which our engravings were made.]


"ENDURIN' DE WAH."


A PEACEABLE CITIZEN.

## Tbat Overworked Wheel Lathe.

*Editors:*

I notice in your issue for May, a criticism on the statement made by Mr. Purves of the time it took him to turn driving wheels in his shop. This does not take up the question of time, but is a criticism of Mr. Purves for making a tool work too hard—that is, in the writer's opinion.

To be a critic, a person must be, or should be, an expert in the work he criticizes.

Now, I am afraid that, while the article mentioned shows the writer to be a person of intelligence and one who would, by personal attention to his abilities, shine in another field, and his article would lead us to suppose him to be just the kind of a man that railways are looking for to fill positions at the present time. For all that, he is a poor critic.

I would judge, by the article, that he is a machinist and that his interpretation of a machinist's duty is to do work good and in as long a time as possible, and, unfortunately, this seems to be the opinion of many machinists of the present day, while the idea of a few years ago was, for a man to be competent to do the work, and in doing it he was to, and did, devise mechanical means to do it expeditiously and well.

Such a man was proud of what he had done, and there is no doubt that the man who run the planer with four heads—a very common tool that seems to be unknown in Nashville—was one of the kind who found

a means of clamping the driving-boxes down to the planer *between* the boxes. A machinist devised the four heads when he was employed as a *machinist* and not as a *tool*, and took rank above a laborer for the reason that he used his brain.

But, now, let us take up Mr. Purves on the wheel question, and see if it was an extraordinary thing to turn a driving wheel in the time mentioned.

I suppose Mr. Purves has a lathe designed by a machinist who knew the nature of the work it was to do; then it was the duty of Mr. Purves to see that it did it, and let me say that the tool did the work and not the machinist—he controlled the machine, and more by mental than physical effort. Let us turn to the lathe which wants our sympathy, and see if it is suffering from overwork.

The diameter of the driving-wheel was 44 inches. Now, you say that these wheels had only $\frac{3}{8}$-inch to come off—let us say $\frac{1}{4}$-inch, that leaves $\frac{1}{8}$-inch cut and that is a very light one; now let us also make a light feed, say $\frac{1}{16}$-inch, and we must confess that these conditions are all light in view of the fact that a modern wheel lathe will take a $\frac{1}{2}$-inch cut and $\frac{1}{4}$-inch feed without suffering to the tool or lathe. Let us allow a cut of 10 ft. per minute (now this is light, as a good tire steel will permit 11 ft.), and see if Mr. Purves is guilt of cruelty to his lathes. The wheels were 44 inches. There would be a face on a tread of about $4\frac{3}{4}$-inches; this would give 76 feeds of $\frac{1}{16}$-inch. The circumference of the wheel would be 11.55 ft. and the time it takes to turn that wheel on a tread equals $\frac{11.55 \times 76}{10} = 87.7$ minutes.

Let us again be liberal, and allow 60 minutes for flanging, and there will be left 33 minutes in which to change the wheels and do the work in 3 hours.

Perhaps the wicked Mr. Purves used a hydraulic lift with which to remove his wheels; if he did, it was wrong. Water should not be used in that way, and it is not intended that it should be; he should first boil and convert it into steam before attempting to use it, or by absorption in the body of a laborer, and utilize it in that form of energy usually called "man power;" or, perhaps he has diverted electricity from the use for which nature intended it—which is to—well, I will let Sir Wm. Thompson tell what that is—and is removing wheels by that means. If so, this is decidedly wrong, and when Mr. Purves is older (I see he is a junior), he will know better and curb his ambition, which now seems to be great, and I would not be surprised to hear that he has apprentices in his shop.

Now, when we get to an investigation of the work this lathe has to do, I have no sympathy for it, while I have for the man who is compelled to sit on a hard bench, or perhaps the bottom of a nail keg, for four or five hours of the day, and, like Helen's babies, "Zee the wheels go wound."

*New York.* ROUNDHOUSE.

## Recharging in Quick Time.

*Editors:*

In your April issue, Mr. W. C. Parsons is quoted as saying, "We must bear in mind that the air has to pass into the auxiliary reservoir through a very small opening, and it takes some time to recharge them;" and again, "The attempt to apply them at once after release often results in running past the water tank, and the blame is laid on the equalizing discharge-valves, when it should be laid to the fact that sufficient time was not given for the auxiliary reservoir to be recharged with air." What he says is quite true, but he neglects to inform us how we are to recharge a reservoir through these small openings in the usually very limited time between release and an attempt at reapplication. In fact, at such times it is impossible to recharge reservoir and brakes are released and a second application is required when, or even before, brakes are fully off. Under these conditions it is apparent that reservoirs cannot be recharged, and to cause brakes to respond to a second attempt at application we must have an equalized pressure both sides of triple piston, not by recharging reservoir, but by regulating flow of air from main drum to train-line sufficiently to move triple to release position and no more. This can readily be done by moving brake-valve handle to release position and immediately back to lap. If brake-valve is moved to full release position and left there till the second application is required, a considerably higher pressure results in train-pipes above that in reservoir, and it is obvious that brakes will not reset till this train-line pressure is reduced below auxiliary pressure. If a half minute or more elapse between release and second application, or when descending grades, then it is proper to move brake-valve to full release and leave it there, thus taking advantage of the time to recharge the reservoir.

*Chicago, Ill.* S. J. KIDDER.

## A Break-Down.

*Editors:*

I beg space to give the readers of your most valuable paper a nut to crack. I am running a standard 18-inch engine on a five-car local passenger train. On a very hilly part of the division I broke down. The engine in question had her eccentrics put on in halves. These were bolted together securely with two bolts. One of these bolts is what broke, letting the cam slip loosely around shaft. In trying to set set-screws up so as to hold cam, I found it bound tightly in strap. I did not put washers in strap to open it more, as I consider this a very poor method. Neither did I disconnect, but came in working both sides and without any fear of stopping on dead center. I was just twenty-five minutes from time of break-down until I was ready to go, and most of this time was waiting for flagman to return. I will add still further that I made better than schedule time over remainder of division. How did I have engine fixed?

*Wymore, Neb.* OIL-CAN.

## Long Mileage.

*Editors:*

I noticed in the April number of LOCOMOTIVE ENGINEERING an article from an engineer on the C., H. & D., saying they have engines that double a division of 131 miles every day, making a mileage of 7,860 per month. I am ready to admit that engines are capable of making such mileage. But the brother of the oil-can forgets to add whether one or a dozen men were running them. Until he does, I shall claim the longest mileage ever made by one man in one month. I am running passenger engine No. 103, B. & M. R. R., and during the month of April made 7,363 miles, with L. Dean as fireman, who never missed a trip. The most mileage I made in one day was 504. Our division is 125 miles long and we have been doubling this for the past three months. As a rule we miss several days in the month for repairs.

*Wymore, Neb.* LIN MOLER.

## A Test with Three Engines Supplying Air.

*Editors:*

In your May edition, page 159, our E. T. friend recommended a cock in place of exhaust-pipe fitting No. 25, plate D 8, in order to use piston No. 17 in service stop, when $\frac{3}{4}$-inch union-nut No. 23 has blind gasket. I do not, for my part, believe that it would be needed often enough to pay for its cost, and the dangerous predicament in which a man might be placed by this cock being closed, accidentally or otherwise, more than over-balances, in my opinion, any benefit that may be derived from its use. I was once on an engine where this cock had been closed by wiping the brake-valve after the brakes were tried, and we came so near hitting another train that I shall fight against their use whenever I come in contact with them.

Once more in regard to Brother Ellis and his problem. On reading the S. D. criticism I went to the roundhouse and coupled three engines together, first setting their governors with a test-gauge. Two of these engines had American brakes, the other a pull-up cam brake. One of the American brakes was practically air-tight, the others leaked a very little. On reducing 10 pounds on one engine, all pumps would start promptly, but everything except pumps worked slower than with single engine, and brake-valve that applied brakes would blow at service exhaust hard enough to raise train-pipe pressure about two or three pounds, but no brakes would pump off while on; the driving brakes that leaked the air would hardly take hold, and would then leak off. The tender brakes being push-out cylinders and practically air-tight, would not leak off at all (would say they had 12x33-inch reservoirs and 8-inch cylinders, and so had more power). At the end having the engine with tight driving-brakes, when air was applied from the other end these brakes would stay on for ten minutes, and then we released them, as that seemed proof that it would not pump off. We made several trials at different pressures, and repeated our tests from each engine, and our conclusions were that with three engines with pumps in first-class order, coupled together, and all pumps running and supplying train-pipe, two of these pumps could not make air fast enough to choke exhaust in brake-valve on third engine, when brakes were applied by it and handle then placed on lap. On one engine the packing-ring No. 18, plate D 8, leaked a little, and in ten minutes the black hand came up five pounds, and if left long enough would have let the brakes off.

The brakes all worked slower and more in the style they used to before packing ring No. 24, plate D 9, was put in, and after brakes were released each pump had to make up the air in its main reservoir before it could help the lead engine, as their reservoir pressures were but a few pounds more than the air in space above piston No. 17, plate D 8, on braking engine, as that space was a governor or pop-valve spring in respect to the engines whose brake handles were in release positions. There is a lot to think about right there.

I also believe this to be a very dangerous practice, as the rear pumps were forcing all sparks and sediment lodged in air-pipes ahead of their brake-valves into space under piston No. 17, and it would be but a question of time when the packing-ring would be so dry and this space so full of dirt that the piston could not seat itself, or, something might be deposited in service exhaust when brakes would be released, and in this go-as-you-please style would probably lead to serious consequences.

*Roanoke, Va.* GEORGE HOLMES.

## A Point on Firing.

*Editors:*

There is a difference of opinion in regard to a point on firing which we would like you to settle through your valuable paper. I am firing a passenger. We have a Baldwin engine which carries 160 pounds of steam. Forty-six miles of the division is up-grade; between that point and the terminus, a distance of eighty-seven miles, it is up and down hill. The point in dispute is, as to the best method to save coal. Some claim that by firing an engine at from 120 to 140 pounds and regulate your fire so that the needle will not advance beyond that point is the best. I claim that you lose coal by so doing. They are free steaming engines, and you have to let your fire burn so low that when you pick her up and you throw in green coal which will not ignite right away, down goes your steam, and consequently you have to work under great disadvantages; but by keeping a good fire to work on, and carrying from 140 to 155 pounds of steam you can save coal, yet not allowing your engine to blow off.

A FIREMAN.

*Marquette, Mich.*

[We should say that your method was best by long odds.]

## Repeating Emergency Stops.

*Editors:*

It is often asserted that an emergency action of the quick-acting triple-valve can not be obtained after a ten-pound service reduction, and in a recent number of the *Engineer's Journal* a correspondent of their technical department expresses the same opinion, giving as reasons that the pressures in brake cylinders and train-pipe are sufficient to resist the movement of emergency-piston.

Each successive application of the brake will increase the resistance against emergency-piston, by increasing the pressure in brake cylinder until the emergency-valve is inoperative, and in order to determine the pressures in brake cylinder, an expert in the service of the Westinghouse Air Brake Co. gauged auxiliary reservoir and brake cylinder of one car in a thirty-car train and from 70 pounds pressure made the following reductions with accompanying results

| | Reduction from train-pipe. | Pressure in brake cylinder | Pressure in auxiliary reservoir. |
|---|---|---|---|
| Service application, | 10 lbs. | 20 lbs. | 60 lbs. |
| " " | 14 " | 29 " | 55 " |
| " " | 18 " | 43 " | 52 " |
| " " | 20 " | 50 " | 50 " |
| Emergency " | 10 " | 58 " | 58 " |
| " " | 35 " | 58 " | 58 " |

Now with a 10-pound service reduction we have 60 pounds left in the auxiliary reservoir; the pressure on the slide-valve, which is the only retardation to the movement of triple-piston, is considerably lessened, and another quick reduction of eight pounds will compress graduating spring and uncover emergency port; the auxiliary pressure at 60 pounds per square inch bearing on the $1\frac{1}{2}$-in. emergency-piston with a total force of 294.5 pounds. The service reduction of 10 pounds gives a pressure in brake cylinder of twenty pounds per square inch, which amounts to a resistance of 98.17 pounds against emergency-piston. The other point of resistance is the train-pipe pressure, which, we will say, remains at 70 pounds per square inch between the emergency check-valves, giving a pressure against the upper one—which has $1\frac{1}{4}$-in. seat—85.9 pounds, but from which must be subtracted the brake cylinder pressure against its upper side, which through the 1-in. port amounts to 15.7 pounds, leaving a total check or train-pipe resistance of 70.2 pounds, and adding it to the brake cylinder pressure under emergency-piston we find the full power of resistance to the operation of emergency-valve to be 168.35 pounds against an actuating force of 294.5 pounds.

It is plain that a pressure of 126 pounds in excess of all resistance, will very easily force down the emergency-piston and open communication between train-pipe and brake cylinder. There is 52 pounds in train-pipe and but 20 pounds in brake cylinder, and when the emergency-valve is opened, unless figures lie, it is quite possible to get a certain amount of benefit from an emergency application, following a 10-pound service reduction.

The trouble with Tink's quick-acting triple-valve was caused by the emergency-piston "sticking" when forced down; the other case was the result of a leaky four-way-cock opening communication directly from train-pipe to brake-cylinder, as with the old straight-air system, the air press-

ure was low, as the pump was not started until engine was on the table, and after stopping the pump the brakes released from leakage. WILL W. WOOD.

*Terre Haute, Ind.*

## Boiler-Making and Boiler-Makers.

*Editors:*

Your article on one cause of leaky flues is very timely and to the point on the leaky flue question. Now any one that is a practical boiler-maker knows that the results of allowing your men to run the shop to the extent of being able to have the holes made to suit their convenience is bound to make grief for some one that may have the care of their work. I am a foreman boiler-maker who happens to have this to oversee, and I can say that one thing I look after very sharp is the flue holes and the setting of the flues. You well know that is the most important thing about the engine. Now, the first point is, make your men as intelligent as you are by giving them some pointers on this work, and you will get a better quality of work than can be had by telling them that anything will do so that they get the flues in and set.

I make a practice of giving the workmen a few lessons on the length of the flues. They should be the proper length, say about ⅛ for beading over, as the rolls will expand them some, and that makes a solid bead and as much as the iron or steel, as it may be, will stand, and saves blows that are more injury to the flues than all the expanding they may get. In using the Prosser segment expander the number of blows should be determined, so that they may be of uniform number, then you get a first-class job in flue-setting, reflecting credit on all concerned. This is my rule for flue-setting, and one that I exact from the men doing the job.

We all know that boiler-making is making rapid strides from the old thumb and finger rule of the years gone by, and a more intelligent set of men has grown up, and now have the trade down to some system. It is one of the best trades, if the men willing to learn it will only study a little, first the metal, then the most practical way of getting at results in working it to the best advantage. I always have flue fit holes tight, rolling the copper by a gauge furnished the men then the flues will be a fit every time and results in a good job. Work done in this way will last some four years or more without any great amount of labor on them after being put in.

Now a few remarks about boiler-makers. There is quite a large percentage of them that had better be called boiler butchers, as I have seen some wretched work done with the drift-pin. This is one source of trouble in bad work and poor boilers. We have quite a number of a well-known maker's engines on the road, and we find evidence of want of intelligence in boiler-work; the front shell sheets are cracked at the point spoken of by your correspondent, Mr. Heron, in his "How to Lay Out a Boiler," and which ought to make it plain to any intelligent man who cares anything about his reputation as a first-class boiler-maker. Several roads make the same complaints of these engines, while the other makes of engines give no trouble in that line. Now, to my mind, the only way out of the slough is by creating a better class of men that will produce boiler-makers, not boiler butchers; men who will give a little time to educate themselves up to their trade and less running around gin mills. I am glad that Mr. Heron has taken the true way to make a good boiler-maker, if they will only give application to the work in hand. I have never been afraid of giving the men all the information on any point, and always like to have men quite as well informed as myself on the true and best way of doing things as they ought to be done. This practice gives best results, and the best interest of my employers are thereby served.

CHARLES E. BETTS.

*Marshall, Mich.*

## Lining Guides.

*Editors:*

On page 112 of April, 1892, issue of LOCOMOTIVE ENGINEERING, Mr. A. Dolbeer, of Rochester, N. Y., explains a lightning method of lining guides. I am glad to have him explain this method, for if it is a quicker and better way to do this work than that explained by myself in the February issue, his method is just what we wish to get before the readers of LOCOMOTIVE ENGINEERING. While I have never seen this method tried, nor heard of it previous to reading Mr D.'s description of it, there are several questions which came to my mind in regard to whether it is always best to follow his advice when he says "Do not fool with a line or take measurements when you can avoid it" I have seen guides lined where a mandrel or the piston-rod was used in lieu of a line, and the work, when completed, certainly looked as though the operator had taken no measurements and had been fooling with something other than a line, and the length of time taken to do the work should have been productive of far better results.

By the way, it appears to me, that the plan of taking correct measurements and working closely to them is a good one, allowing that it is a little old.

Now, relative to planing the crosshead while keyed to piston-rod, and the rod placed in V blocks. Any person having planed a head in this position knows that the back end of the head will settle unless blocked up from the planer-bed, and the correct distance it should be raised is simply a matter of guess-work. Whereas, if the head is bolted solidily to planer-bed and the short mandrel perfectly in line with same, no guess-work is necessary and you *know* that the planer work will be in line with the rod when the head is bolted to it. Now, Mr. D. says, "Have gland ready to slip on the piston. This gland should fit the stuffing-box at back cylinder-head."

Just so, and it strikes me that it should fit both rod and stuffing-box very closely, as a slight amount of lost motion at this point would throw the crosshead out considerably. This, then, necessitates making a special gland to fit each rod after it is trued up in the lathe. For, when turning them, the best way is to let each go as large as it will true up, and where this is done no two rods will be exactly the same size, and if any kind of metallic rod packing is to be used (and this style of packing in some form, I believe, is pretty generally used) the glands used while lining the guides must be replaced by another style of gland when the engine goes into service. Another thing in Mr. D.'s method is that from the fact of the spider being wedged to the center of the cylinder, the guides are lined to the wearing part of the cylinder in front, and to the center of counter-bore in the back, and I think that the better way is to line to the center of the counter-bore in each end of the cylinder and let the packing adjust itself to the wearing surface of the cylinder.

Then, too, it appears to me that if the guides fit closely between the cylinder head flange and guide-yoke (as they should do) it must be a difficult and tedious matter to clamp them firmly to the crosshead and not throw it and the spider out of proper position, the replacing of which would of course take time. Now, I do not wish to be understood as insinuating that the method, as previously explained by me, is the best way, for in it I have only related my experience in lining guides, and I am not prepared to speak from experience upon the merits or demerits of Mr. D.'s method, but have simply expressed the thoughts which occurred to me while reading his article, and have given them expression for the sole object of drawing out others and obtaining through the medium of our good LOCOMOTIVE ENGINEERING, their ideas upon the subject, which will, I am sure, be beneficial to us all. So stand up, boys, and speak right out, and I am sure that by so doing you will receive (as has Brother Dolbeer) the thanks of us all. L. C. HITCHCOCK.

*Minneapolis, Minn.*

## Protecting the Rear of Trains.

*Editors:*

Cannot the frequency of railroad disasters be diminished? is a question discussed perhaps as often as their occurrence. I shall not here discuss this subject at large, but I do want to say a word about the kind of accident here referred to—"rear collisions." I do not hesitate to assert, that the fatality resulting from this kind of collision could certainly be lessened in extent, and that by a very simple expedient.

The remedy which I am about to suggest is not "carefulness" in running trains. I concede this is first in importance, and I am willing to assume that railroad men generally try to do their duty; but it seems useless to expect human efficiency beyond a certain degree, and therefore, collisions are likely to occur in the future about as they have in the past, and unless something else can be devised to supplement human efficiency, lives must be sacrificed. My plan, then, is that trains should be "made up" with the baggage car last. An examination into the results of "rear" collisions will show, I think, that it is the last car of the train run into that suffers almost exclusively. It gets the full force of the blow, as well as the dreadful effects of escaping steam and devouring flame; 'tis here that life is sacrificed and bodies mangled. The car immediately ahead usually suffers little in proportion, and the colliding train still less.

Now, with this fact so repeatedly demonstrated, it is clear that were the baggage-car placed last, it, and not a passenger or sleeping coach containing many invaluable human lives, would, in event of such collision, be the object to take the brunt of the shock. Perhaps if passengers should insist upon being more level-headed than the "officials" and refuse to take berths in an end sleeper, the railroad companies might realize the necessity of running trains in such a manner as to insure all possible protection to the traveling public.

I do not overlook the slight added inconvenience to the railroad men of placing the baggage-car last, but it is practicable and possible, and if only one human life would thereby be saved it becomes a moral responsibility. G. B. PRICE.

*New York, N. Y.*

## Lining up Guides—Which Way is the Best?

*Editors:*

In the February number of LOCOMOTIVE ENGINEERING, I read the article on guides, by L. C. Hitchcock, with a great deal of interest and pleasure, thinking to myself, after reading it carefully, that it was one of the best articles I had ever read on the subject of guides. It was so clear, concise and to the point, full of practical information in all its details in regard to putting up guides, and so impressed me, as an article that should be read by every progressive machinist apprentice (and machinist also) that I spoke to several machinists in regard to it, telling them that in this age of mechanical progress and improvement, it was the right kind of instruction desired by our young men, as I fully believed that a young apprentice of progressive ideas and ordinary intelligence could put up a set of guides by carefully following Mr. Hitchcock's instructions.

In reading April number of LOCOMOTIVE ENGINEERING I was very much surprised at A. Dolbeer's criticisms and remarks on Mr. Hitchcock's method.

Elaborate methods, as he calls it. He says it is all right, but decidedly slow. I think that is where he is mistaken. I should say, Mr. Dolbeer's plan is radically wrong; is harder work, and a great deal slower than Mr. Hitchcock's method.

By his own explanation he cannot put up his guides until crosshead, piston-rod, spider and gland are completely finished. Does he call that the proper way to expedite his work, waiting for all that work to be finished before guides can be put up.

Suppose an engine breaks down, comes in shop or roundhouse with back cylinder head, piston-rod, spider and crosshead broken, to be repaired as soon as possible. With Mr. Dolbeer's plan, we could not line up guides until we had spider, rod, crosshead and gland finished.

With Mr. Hitchcock's method, all we want is the back cylinder head, we get that laid out and drilled, put in position, and we are ready for our guides.

Our plan is to fool with a line, notwithstanding Mr. Dolbeer's objection. It is a great deal easier than lifting a heavy piston in position, putting crosshead on, clamping guides to same, and then lining up spider to suit and running a chance of multiplying errors at every step of your work, for, if your gland is loose in back head as it should be, and a free fit on piston-rod, we will have to block up crosshead end to make allowance for same. We make a very simple calculation, measure from bottom bearing of crosshead to center of piston-rod, and we are all ready for our bottom guides (it is not the complicated calculation Mr Dolbeer would have us believe), decidedly easier, and a great deal more accurate than lifting all the heavy work he does to find out the same result. If crosshead is not finished we can line and level bottom guides to our measurement, and if ordinary care is taken I guarantee they will be correct if Mr. Hitchcock's method is followed. If crosshead is ready we can put up top guides and we are ready as far as guides are concerned. If eccentric cams were disabled at same time we can square valves and put valve motion in proper shape while waiting for piston work to be finished.

By Mr. Dolbeer's method we have not commenced doing anything to our guides, as we are waiting for our piston-rod, spider and gland.

Taking both methods into consideration and judging them on their merits, I think the advantage is decidedly in favor of the line and measurement system of Mr. Hitchcock, both in regard to quality of work, and time and labor saved, and you are confident that your work is correct and true every way.

When I worked in the erecting shops part of my work for several years was hanging cylinders and putting up guides on new locomotives. And my method was precisely the same as Mr. Hitchcock's method. In all that time I never had a set of guides to cut or piston-rod to run hot, though engines were put to service after a trial trip of ten miles each way. I never felt cheap about the looks of guides when finished. I lined as close as possible. All I required was the crosshead to be perfectly free in guides.

ONE WHO HAS LINED UP GUIDES.

*South Easton, Pa.*

## Use of Graphite for Front Ends.

*Editors:*

Replying to yours of May 9th. We use for our stacks and fronts—S. L. & S. F. Railway—genuine Ceylon plumbago.

When prepared for use in the shop we mix it with varnish, making a paste, this is thinned with equal parts of raw oil and turpentine so that it can be applied with a brush. Where we do not have a polished surface this application is sufficient, but where we desire to polish it we apply this mixture and before it is dry sprinkle over it the dry plumbago, this is allowed to dry and is polished with a brush or a piece of waste.

Many of our firemen mix the plumbago with water, others with vinegar, and others with lard oil. We think, however, that our shop formula is best because it does not wash off so readily when exposed to the rain.

I have no knowledge of graphite having been used for the purpose of polishing head-light reflectors.

J. R. GROVES, S. R. S.

*Springfield, Mo.*

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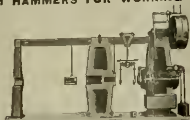

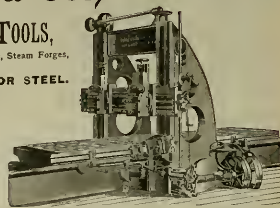

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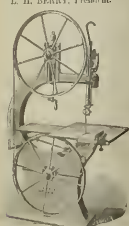

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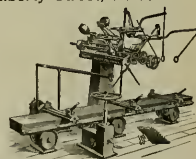

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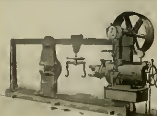

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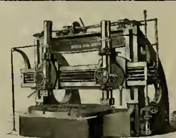

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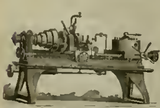

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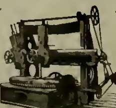

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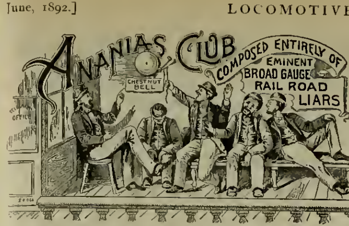



## Good Flavor For Water.

A party of New England railroad officials and others interested in the new Reading combination were lately making a tour over the main line, and, of course, were very much interested in all that was to be seen.

"What river is that?" inquired one of the party, addressing the colored porter.

"Dat, sah, dat am de celembrated Schuylkill riber."

"The Schuylkill; isn't that the river where the city of Philadelphia gets the water supply from?"

"Yis, sah; dat am where dey get da watta."

"It's very nasty-looking stuff. Where do they take out the supply?"

"Jes dar, sah, under de bluff."

"Take the water there with that grave-yard on the bank draining into the river?"

"Yis, sah. But dat am all right. Why, sah, none but de bes people in Philadelphia am buried in dat dere grave-yard."

## A Moral Certainty.

He was a stout, elderly German farmer, who traveled twice weekly over a short one-train road in the West. He persistently avoided buying a ticket, and a good deal of quiet banter occurred between him and Conductor George Flensen on the subject.

One day last week the cars were pretty full and as Conductor Flensen collected the farmer's fare he asked, in a voice loud enough for all around to hear:

"How is it, Mr. Schlappenhausen, that you never purchased a ticket at the depot? You must have some reason for it."

"Yah! I for mein gonduct a goot reason haf," answered the German in a sort of confidential voice, "but berhabs it vas bedder dot I it should not dell. Howefer, if you vould like to know, I dond mind delling you all aboudt it in der sdrictest gonfidence."

"All right, old Sauer Kraut, toot out your strictest confidence," said some one.

"Vell, you see," he began, looking around benignantly, "aboudt dree years ago I haf a cow on dis railroad killed, and whent to der gombany for gombensation. I abblies, dey answer no. But I abblies a segond dime, und den dey answer dot dey gondemblate putting in a glaim againsdt me for injury done to deir enchine. Den I gedts mad, und I a vow svears dot not von odder cent of mein shall dot gombany efer bocket, und—(looking up pleasantly at Flensen) as long as you vas gonductor on der drain, Sheorge, *I don't believe dey efer shall*."

## A Powerful Machine.

A party of master mechanics and other railroad men were visiting the Cambria Iron and Steel Works, and every few minutes their steps were arrested to witness the enormous power exerted by machines in kneading great masses of steel with as much ease as the plastic clay is shaped in the hands of the potter. One machine excited great attention. It was beside a puddling furnace and its duty was to grasp the puddled roll and squeeze the cinders and slag away from the iron. It grasped the roll between serrated revolving cones and squeezed and twisted it till the metal seemed turned outside in several times.

The party stood in awe and watched several operations of the ponderous machine. Exclamations of wonder and admiration were whispered. "Tremendous," "Immense," "Wonderful," "Terrible," were heard in heartful echoes above the din. And then E. N. Lewis gratified the desire for expression by exclaiming, "Wouldn't that give a fellow's girl all the hugging she wanted!"

## The Coroner's Opportunity.

Nearly a dozen years ago, when the Rio Grande road got to the wild and woolly western town of Durango, in Southern Colorado, the cow-boy gamblers were running the town and proposed to show off some of their "dead cinch" on the railroaders. As an introduction, one of them shot the fireman on the first engine that came into town, and it was given out cold that if the car-hands wanted to live they hadn't better come up town.

That night the boys "got together," went up town in a body and hung the revolver artist to a telegraph pole. Then they interviewed the coroner and intimated, in an unmistakable way, that railroad men were the proper people to sit on a coroner's jury. The verdict was *suicide*.

A more recent case is reported from Texas, by the San Francisco *Examiner*, in which the coroner looks out for his State in a patriotic way:

Down in Texas, near the little town of Langtry, a laborer fell off a big viaduct that is being built for the railroad across the Pecos River canyon and was killed.

An inquest was held shortly afterward by Coroner Roy Bean, and when he arrived at the scene of the accident with a number of people from the town and a score or more of the bridge workmen, he found on the body a Colt's revolver and $40 in money.

Mr. Banzano, of the Phœnix Bridge Company, who is building the viaduct for the road, was present at the inquest, and in a letter to W. G. Curtis tells about it.

According to Mr Banzano's letter Coroner Bean's verdict was as follows.

"'Gentlemen,' said his honor to the by-standers, 'there is nothing to find out how that man came to his death. He fell from the bridge; that's all there is about it. But there is one thing which is not so plain, and that is, what was he doing with that gun? Of course he is dead and can't explain, but that ain't the fault of the law; it's his own misfortune. Justice is justice, and law is law, and as he can't offer no satisfactory explanation of the matter I shall be obliged to fine him $40 for carrying on or about his person that pistol. Because a man chooses to don his wings and skim off to the skies is no reason why the great State of Texas should not have what is coming to her all the same.'"

An hour later the body was buried by the bridgemen.

## Anecdotes of Alick Gordon.

At the last Master Mechanics' Convention a number of veterans had ensconsed themselves on the shady side of the hotel veranda, and were exchanging experiences for mutual delectation and instruction. This practice of comparing notes is a very valuable feature of these conventions and many a man carries away information that saves thousands of dollars to his employers in the course of a year.

From business talk they dropped into social and personal reminiscences. Meehan had been telling anecdotes of workmen with his inimitable style, and Swanston began stroking his beard as an aid to memory.

"My men," he remarked, "have not been so funny as Meehan's, but I have at times heard things from some of them that struck me as amusing. I once had a blacksmith, named Alick Gordon, who was an excellent hand and a pious man as becometh my countrymen, but he liked a drink of whisky and at long intervals he would forget his professions enough to get fuller than he could comfortably hold. We had a Burns Birthday anniversary one year, and Alick got comfortably drunk before the meeting broke up, and several others were in a poor condition to sing with him, "We're nae sae fou." Alick lived outside the town, and at a very late hour he started for home. On his way he found one of the crowd lying by the wayside suffering from leg prostration.

"Give me your hand and help me up, Alick," exclaimed the inebriate sufferer, as he saw my blacksmith stagger within sight.

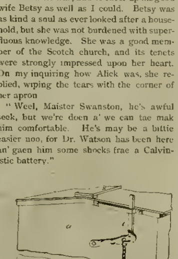
Alick stopped and with drunken gravity studied the situation. Then he answered.

"No, ma freen'. I winna try tae help ye up, but I'll just lie doon a-side ye." And he did.

Some years after that Alick received a paralytic stroke, and it eventually finished him. Dr. Watson was called, and did all in his power to relieve the sufferer, among other things giving him treatment with a galvanic battery.

The day after he was prostrated, I called to see how he was, and to cheer up his good wife Betsy as well as I could. Betsy was as kind a soul as ever looked after a household, but she was not burdened with superfluous knowledge. She was a good member of the Scotch church, and its tenets were strongly impressed upon her heart. On my inquiring how Alick was, she replied, wiping the tears with the corner of her apron

"Weel, Maister Swanston, he's awful seek, but we're doen a' we can tae mak him comfortable. He's may be a bittie easier noo, for Dr. Watson has been here an' gaen him some shocks frae a Calvinistic battery."



CAR COUPLER, WITH CAR ATTACHMENT.—A STORY WITHOUT WORDS.

Those who have the designing of driving-brake apparatus are aware that there is often difficulty in getting the gear conveniently and securely fastened to the engine frames. Mr. Charles C. Higham, St. Louis, Mo., has attacked this difficulty at the foundation by inventing and patenting a locomotive frame with integral attachments for the driver-brake. The patent has been assigned to the Westinghouse Air Brake Co., and we understand that they intend putting the improved frame on the market.

## Romance in Railroad Life.

Considering the great magnitude of railroad interests in this country and the vast number of people who are directly and indirectly dependent on railroads for a livelihood, it is surprising the small figure that railroad life cuts in the literature of our time. Many of the most stirring romances that belong to the literature of the world relate to seafaring life and experiences on shipboard. The fundamental romance of the sea is the danger of the calling. Much of the romance of war has its sole origin in the dangers surrounding those engaged. If danger and the opportunities to display acts of bravery and heroism are real bases of romance, railroad life ought to be better represented in song and story than any other calling. It is the heroic calling of to-day, but its chroniclers have not yet appeared. Most of those who have tried to employ railroad life as the woof on which to weave a web of romance have been peculiarly unfortunate in their work. They have not been true artists, and used their imagination where they ought to have made use of their eyes and ears. The result has been inartistic productions that repelled those who readily perceived that the pictures were caricatures and daubs instead of likenesses. The work of the sensationalist and the ignoramus has brought railroad life into disrepute as a field for romance and poetry.

A light which suddenly faded came up for a few brief months and promised to redeem the railroad field and show therein in living shape the joys and the sorrows, the victories and the failures that are seen so attractively amidst the men and women who make up our railroad world. Wolcott Balestier, whose name first became familiar to readers of general literature through his associating with Rudyard Kipling a few months ago to write the American part of an Indo-American story, was familiar with railroad life, and there was the likelihood that he would favor the world with works of true art having a railroad background. This hope has been cut off, for he died in Germany about the time his name was becoming familiar to his countrymen.

Since Balestier's death the *Century Magazine* has published two railroad stories from his pen, which are greatly superior to the American part of the "Naulahka." When we read the first chapters of that story, which treat of railroad life in Colorado, we made up our mind that the author used a dictionary of Western slang and labored to make the hero and heroine work up as many of the words as it was possible to force through their lips. As the hero was an educated engineer and the girl a refined young lady, it was scarcely painting true to nature to make them more familiar with slang than a Leadville bartender. The other stories, however, indicated that Balestier had dropped the slang dictionary and was using his ears more. There was a power and vigor in his writings that promised a great future. We feel that in the premature death of this author literature lost a star whose rays were just beginning to shine.

During a recent visit to McAdam Junction, N. B., we were much interested in the motive power office building, which is said to be the finest belonging to the Canadian Pacific out of Montreal. It is remarkably well kept, and contains drawings giving full details of the standards belonging to the road. The designing and work was all done under the direction of Mr. G. A. Haggerty, master mechanic. He has built the shops twice and done a wonderful amount of work with limited facilities.

A patent was granted last month to F. W. Dean, Boston, for an intercepting-valve for compound locomotives. The valve is in use on the engines designed by Mr. Dean, of the Old Colony and the Lehigh Valley railroads.


(52) W. W. R., North Platte, Neb., writes.

Do you know of any car starter that applies its power against the car instead of the wheels? *A.*—We have seen such a car starter, but cannot tell where.

(53) E. L. Penruddocke, Weatherly, Pa., asks

While a locomotive is running under steam, which is the fulcrum—the rail at point of contact with the driving-wheel, or the side of the driving-box against which the engine is pulling? *A.*—At the rail. Those who argue that the axle-box is the fulcrum, ought to consider where the fulcrum of a bicyle would be

(54) C. A. H., New York, says

I inclose you a cutting from a daily paper giving an answer to a correspondent, saying That the cost of a first-class locomotive is from $22,000 to $25,000, and that a drill engine costs from $6,000 to $10,000. How is this? *A.*—A first-class eight-wheel locomotive of 18 x 24-inch cylinders costs about $8,000. Larger engines cost a little more, but $10,000 is an outside price. Switching engines cost from $6,000 to $8,000.

(55) Machinist, Buffalo, N. Y., asks

An eight-wheel passenger engine, Schenectady build, came into shop with forward driving axle bent so much that at the inside of journal it ran out of true three-sixteenths ($\frac{3}{16}$) of an inch. The journals and tires were turned and engine sent out. What effect would this have on valve motion, and what remedy could be applied other than new axle? *A.*—We know of no remedy, a new axle would be a cure.

(56) R. A. C., Buffalo, asks.

Was the Westinghouse air-brake the first kind of a brake that gave the engineer the power of holding the train? *A.*—No. There were a great number of continuous brakes tried before the Westinghouse brake was introduced. Steam brakes that operated the shoes by means of chains, compression brakes and numerous other forms were tried before the Westinghouse, but none of the inventions came within sight of being a success.

(57) Subscriber, Portsmouth, Va., writes

After the application of the brakes, how far do you think it is possible that a train of twelve cars would go down a grade of six inches to the 100 feet, the train moving at the rate of six miles an hour? The cars being equipped with hand brakes, the locomotive with hand brake on the tender, and engine reversed. *A.*—It is not possible to figure out such a problem. No one can tell the exact pressure used with hand brakes, how long it took to apply them cuts some figure, but the weight of cars, etc., is a big factor in the problem. How big is a piece of chalk? is as easy a question.

(58) C W W and G. C. M., Slovall, N. C., write

To settle conflicting ideas and arguments, will you please explain in your next issue, what holds valve No. 17 down in engineer's equalizing discharge valve when the valve is placed in *running* position. Please give us a full explanation and oblige. *A.*—When the valve is in running position air passes through feed port, lifts valve 21 and enters the cavity leading to train-pipe, it comes up under main valve 13 through direct application port and goes down through a small hole called the "equalizing port" (shown in Fig. 3, Plate D8., W. A. B. Catalogue), the pressure here keeps the piston 17 down.

(59) "Quick Action," Armstrong, Mo., writes.

1. On the Santa Fé passenger engines here I noticed under the running-board a circular cast-iron box with a bolted cover and air-pipes connected (I don't mean the small reservoir connected to the brake-valve). What is it for? *A.*—You probably saw a Boyden train signal. 2. On a coach I noticed a pipe running from the brake cylinder to a reservoir. What is this for? *A.*—We don't know. 3. Please explain the compressed air train-signal apparatus? *A.*—Signals are given by a reduction of pressure in train-pipe, which blows a whistle in the cab. Send to the Westinghouse Company for catalogue.

(60) J. E. J., Greenville, Pa., writes

1. I am informed by a reliable man that he has been running a small stationary engine for twenty-six years, and that the cylinders were never oiled or lubricated. Can this be true? *A.*—Very likely it is. In the early days even locomotives used to be made without any means of lubricating the cylinders. With low pressure steam and small cylinders there is not much use for lubrication. 2. I understand that there is a steamer on Lake Chautauqua that has a boiler carrying steam of 500 pounds pressure, and that the steam from the cylinders all returns to the boiler. Also, that the boiler has no safety-valve. Can this be so? *A.*—Water-tube boilers are made that carry safely the pressure named. When a surface condenser is employed, all the steam from the cylinders is condensed and returned to the boiler. We do not believe the boiler is used without a safety-valve.

(61) K. Ty., Sedalia, Mo., writes

1. Why are the cranks of a locomotive set at right angles? *A.*—To enable the piston on one side to exert the greatest power at the periods when that on the other side is doing little or nothing to propel the engine, through the crank being at or near the centers. 2. What is the unit of a grade and how do you know what per cent. a grade is? *A.*—American engineers generally speak of a grade being so many feet to the mile. That is the number of feet ascended each mile. When the calculation is made by percentage it is reckoned on the rise in each 100 feet. For instance, a grade that rises 1 in 100 feet is one per cent. and is close on 53 feet to the mile; that is, to give it accurately, 52.80 feet in 5,280 feet. 3. Is 640 tons an average train on a grade of 58 feet per mile for a mogul with cylinders 19x24-inches, driving-wheels with 50-inch centers, and carrying 150 pounds of steam? *A.*—It is rather a heavy load for that grade.

The Cooke Locomotive Works, Paterson, N. J., have lately completed the building of two cylinder compound locomotives. She has been running on the Delaware, Lackawanna & Western under the immediate supervision of Master Mechanic W. H. Lewis.

## Houston Shops of the Southern Pacific.

I don't propose to burden my readers with minute descriptions of all the railroad shops I visit. They are too much alike, but will only touch upon unusual features.

Like all S. P. shops, those at Houston are well built structures of brick, with large clean yards and considerable many flowers here and there.

These shops are exceptionally well supplied with tools and materials. They have their own foundry and make most of the castings for the Atlantic system.

A large brick stack stands in the yard and a tunnel carries the smoke from the shop boilers to it. Around this tunnel are arranged a lot of steam pipes through which passes the steam for heating the immense plant, for this is claimed a marked economy.

They have a splendid roundhouse of some twenty-four stalls.

On a platform overhead in the machine shop is located a home-made air-compressor that is much more efficient than a number of brake-pumps, and much cheaper.

There are two single-acting cylinders set upright on the base, and standards from either side extend up some two feet, carrying boxes for a horizontal shaft with two cranks to operate the pistons and a tight and loose pulley.

To the belt-shipper there is a rod connecting with a four-inch cylinder fast to a post below the platform, and a valve is so set that when a certain pressure, say 100 pounds, is reached in the shop drum, air enters this cylinder and shifts the belt to the loose pulley; when the pressure falls below the standard pressure, the air escapes from the small cylinder and the belt is shifted for work. A variation of half a pound will shift the belt, so that whatever air is wanted is supplied, no pops waste any, and a constant pressure is maintained automatically.

In this shop they are systematically putting new boilers into their engines after a certain service. They had already got in ten of them at the time of my visit. They buy them from the makers, and we noticed that the upper rows of side stays were but 2¼ inches from center to center, and in some new boilers that had come with stays 4½ inches apart, they put in two extra rows between those already in.

This road, in common with many, is putting on neat, cast-brass numbers on the sand box instead of painted ones, they are cheaper than gold leaf, last as long as the engine does and are always kept clean. I should think builders would never use anything else.

The best Krupp wheels are used for all engine trucks.

They have in use the most murderous looking pilots I ever saw. Under the pilot proper is bolted a half-inch steel knife that is ground off on the top side to a sharp angle; this forms a sharp point at the front of the pilot ten inches wide and narrows down till at the heel it only extends out four inches.

When an animal falls down in front of that it is cut into slices without further ceremony, which, after all, is better than having them roll up under the engine and landing it in the ditch; the knife also makes a good step for the trainmen, but I couldn't help thinking of their legs.

They are making a lot of metal boxes with glass sides to go on top of caboose cars and metal numbers that designate the train will be hung over the glass.

Many of the engines are equipped with steel rod cups, no brass about them, and they seem to be far stronger and just as good.

They are not afraid to cut up old locomotives here, which is a good sign, the tendency is to use these old-timers until, like the one hoss shay, they go all to pieces at once, but there is such a marked tendency for the boiler to suddenly go away somewhere—and take someone with it—that they should be discouraged.

General Master Mechanic Ryan has probably had more experience with deep wells than any other man in the business, and is using water from wells, on the west end, that is pumped 2,200 feet. This is done with compressed air of from six to eight hundred pounds pressure per inch.

Some years ago Mr. Ryan devised a pump for a 1,300 foot well to be operated by air, such a well is too deep for rods, and the bore, eight inches, prevents other well-known forms from being employed.

His plan was to send down a cylinder with piston, and connect the case with air-supply and water-discharge pipes so that it might work by pulsations. This pump worked, but not very satisfactorily; one day Mr. Ryan climbed to the top of the water tank to get a breath of air, and noticed that, though the pressure was not sufficient to operate the piston, water spurted out of the delivery. He reasoned that the piston packing leaked, but if a leak would pump water why not the straight pressure? The pipe was hoisted out and the piston removed, and the casing lowered again, when, lo! it pumped water better than before.

Several wells were equipped with these pumps, having foot valves only, as shown in the right-hand cut on page 201, but another plan was soon tried without piston or valves, as shown in the left-hand cut, and these are now employed.

The tube which answers the purpose of a pump cylinder is some thirty-two feet long, and the water-delivery pipe extends down into it six feet. The drawings, from which this sketch was made, were for a comparatively shallow well—only 600 feet deep. The water comes from pipe in distinct pulsations, as though being lifted by a direct plunger.

The S. P. is the one road of the South that tries to buy the best in the market regardless of cost, and there is nothing about the Houston shops that any of the officers need be ashamed of. J. A. H.

The daily papers have contained accounts lately of several accidents due to people falling from trains while passing from one car to another. This kind of accident happens most frequently on suburban trains, where passengers find it necessary to pass from car to car in search of seats In New England, nearly all suburban cars have the platforms protected by gates, and it appears to us very short-sighted on the part of railroad companies in other parts of the country to neglect supplying this additional security to their passengers. Platform gates cost little, they are not unsightly, and they cost next to nothing for maintenance. The damages that would be recovered for one accident to a passenger by falling from the unprotected platform would more than pay the expense of making a great portion of the equipment safe by the putting on of gates. How such a measure of safety is persistently neglected is one of the mysteries connected with railroad management.

A correspondent in an esteemed contemporary exclaims "Why does the law not step in to prevent the pernicious practice of ticket-scalping?" After long study of the loss of revenue to railroads that flows from the scalping system, we are inclined to exclaim with numerous dashes—Why do the railroad companies persistently foster the business of ticket-scalping?

One of our correspondents writes enthusiastically about the performance of the ten wheelers that were delivered last month by the Rhode Island Works to the Chicago & West Michigan road. The engines have cylinders 18x24 inches, driving wheels 54 inches, carry 160 pounds pressure of steam and weigh in working order 98,700 pounds.

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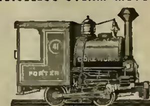


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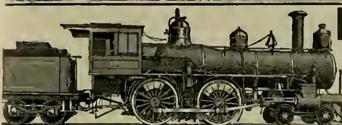

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The best results are obtained in freight train braking from having all the cars in a train fitted with power brakes, but several years' experience has proven conclusively that brakes can be successfully and profitably used on freight trains where but a portion of the cars are so equipped.

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| Year | No. Per Year | Grand Total. |
|---|---|---|
| 1881 | 105 | 105 |
| 1882 | 1,065 | 1,160 |
| 1883 | 4,998 | 6,158 |
| 1884 | 15,051 | 21,207 |
| 1885 | 10,410 | 31,617 |
| 1886 | 8,846 | 40,566 |
| 1887 | 9,281 | 49,844 |
| 1888 | 27,696 | 77,540 |
| 1889 | 26,065 | 103,605 |
| 1890 | 50,502 | 154,107 |
| 1891 | 39,061 | 193,168 |

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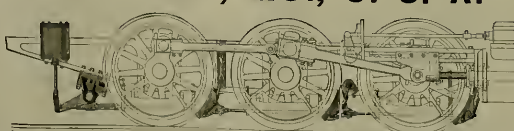

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# LOCOMOTIVE ENGINEERING.

A Practical Journal of Railway Motive Power and Rolling Stock.

VOL. V, No. 7. NEW YORK, JULY, 1892. PRICE, 20 Cts. Monthly. $2.00 per Year.



## Test of a Dean Compound Locomotive.

We have received particulars of a series of tests made under the supervision of Mr. F. W. Dean, to find out the relative economy and efficiency of a compound locomotive as compared with two simple engines. The work was done on the Old Colony Railroad and the engines experimented with were a compound built by the company having the Dean arrangement of cylinders and steam distributing appliances, but in other respects the standard engine designed by Mr J. N. Lauder, and two of the ordinary standard locomotives.

Four trips were made with each engine. The average load for one simple engine was 382 tons, of the other 387 tons, and of the compound 390 tons. All other conditions were about even for all the engines, except in the coal used. The simple engines used Pocahontas coal on all the trips, while the compound had that kind of coal only on the first trip, Cumberland coal having been used on the last three trips. As Pocahontas coal is of superior quality to the Cumberland it was felt that the compound did not get entire justice. The average consumption of coal for the four runs of each engine was 7,615 pounds for one simple engine and 6,464 pounds for the other. The compound burned 4,559 pounds. This makes out a fuel saving of about 40 per cent. in one case and 30 per cent. below the other engine. The average weight of water used was 50,918, 43,522 and 37,903 pounds respectively. This gives the compound the advantage to the extent of 26 per cent. against one engine and 12 per cent. as compared with the other. The water evaporated per pound of coal was 6.7, 6.75 and 8.3 pounds. This is remarkably good evaporation for engines pulling a heavy freight train at an average speed of 26 miles an hour. The engines all have fireboxes that give 19.2 square feet of grate with a total heating surface of 1,362 square feet for one simple engine and 1,372 square feet for the other, while the compound has 1,354 square feet. The simple engines are noted for their efficiency and economy, so that the compound had a foe worthy of her steel when entering the conflict.

A splendid reproduction of a photograph of this engine is shown herewith.


OLD COLONY COMPOUND—DEAN SYSTEM.

## The Biter Bit.

When a smart rogue having property adjoining a railroad sets himself to work to manufacture claims for damages against the corporation he rarely fails to succeed in obtaining money unjustly. This is a little more certain when the railroad happens to be elevated and has the reputation of being controlled by one of the Money Barons. The men who work up claims against railroad companies sometimes over-reach themselves even when the victim is the Manhattan Elevated. The particulars of a case in point lately reached us. Mr. Thomas, a property owner on one of the avenues, sued the Manhattan Elevated for heavy damages caused to his property abutting on one of the railroad stations. It was alleged to obstruct the light from a corner house and to greatly depreciate the value of a saloon on the ground floor. The jury found a case for the plaintiff and required the company to pay heavy damages or move their station. The company decided to move their station, and now the lessee of the saloon is suing the proprietor for $10,000 damages due to his loss of custom caused by the station being moved.

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We have the authority of a Cincinnati paper that a muskrat tied up the Cincinnati, Portsmouth & Virginia railroad for ten hours and did hundreds of dollars' worth of damage last month. The rat gnawed a hole through the embankment that protects the road from the canal, and the water washed out 100 feet of road and let out all the water in a six-mile length of the canal.

Put up all your pipe-joints with graphite use it on bolts and nuts, cover gaskets with it for hand-hole plates, and use it on all joints and bolts in and around the front end, and when you want to get the work down it will come without the use of cold chisel and sledge. In making pipe-joints, if some of it gets into pipe, it blows through as easily as oil and does not harden into a shot to destroy the efficiency of injectors, lubricators or what not. It is the only lubricant that doesn't burn away and is especially valuable for wash-out plugs or other boiler joints

## A GRASSHOPPER ENGINEER.

### Incidental Reminiscences in the Railroad Experience of Joseph York.

Joseph York is to-day one of the oldest living locomotive engineers, and has had, withal, a varied and interesting experience, meeting daily with incident and accident, but never of a serious nature.

Mr York was born at Henrietta, N. Y.,

January 14, 1819, and is, therefore, over seventy-three years of age When he was yet a little child his parents moved to the, then, wilds of western New York, where the boy grew to man's stature, with few advantages and hard work

Mr York had an older brother who was employed as musician with a show when a youth, and in 1835 turned up on the B. & O. Railroad, and in the spring of 1837 he came home on a visit. At that time the subject of this sketch had never seen a railroad, but when his brother returned to Baltimore in June, 1837, Joseph York went with him. He immediately went to firing on a Grasshopper engine, and the following summer found himself in charge of one of these original and interesting insects

The original Grasshoppers had tenders as shown in the picture here reproduced, those still in use carry their coal and water on the engine.

As can be seen in the picture there was a fan on these engines to increase the draft, but it is not generally known that this fan was driven by a steam wheel upon whose blades the exhaust steam acted before escaping up the exhaust-pipe.

A rather curious accident is depicted in another sketch. These Grasshoppers when hard at work bobbed around so much that it was impossible to fasten a broom on them anywhere that would keep on the rail half the time, and it soon became the custom in snow to run a small push-car in front of them to carry the brushes.

One day Mr. York was pulling passenger with one of these cob-choppers that bobbed around so lively that it got its drawhead over that on the car and closed up on it; then the crank on the gear shaft, that conveyed the motion to the wheels, came down on top of the car frame, and, instead of smashing the car, it lifted the engine off the track and she turned a sommersault into the ditch, the engineer and fireman making tracks for high ground.

After running this class of engines and the old-fashioned Norris dome engines until the spring of 1839, Mr. York had the tramp fever and quit, going the rounds of the roads of the country and soon finding himself on the Georgia Railroad running a Baldwin half-crank engine out of Augusta; this class of engine is shown in our sketch.

What the men had to contend with then can be imagined by looking at this picture. There was no cab to protect them from the elements; a simple railing to prevent their falling off; no steam-gauge or gauge-lamp, and no head-light.

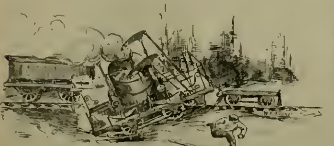
One night there was a big political meeting at a town on the line, and some one piled a lot of rails on the track. There being no headlight, the obstruction was not seen until struck. The negro fireman declared that "old Gabriel had done blowed his ho'n", but a rail struck the wooden frame of the truck, shivered it from end to end, but prevented the derailing of the engine.

In the spring of '40 Mr. York went to work for the old State road of Pennsylvania. Here he had his first experience with the Winans engines known to history as the "Crabs" These engines had vertical boilers, but horizontal cylinders, they were

RUNNING ON VERBAL ORDERS.

intended as an improvement on the Grasshopper and were geared much the same.

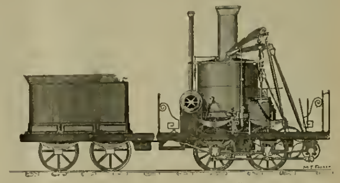
This class of engine is also shown in our sketch; the gearing was so arranged that when a cow was struck, it acted something like the feed on a sewing machine and helped them in further



LIFTING HERSELF INTO THE DITCH.

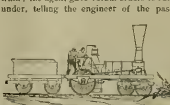
In the fall of the same year, 1840, Mr. York returned to Baltimore and went to work in the Winans locomotive shops, but was immediately selected to take the first Crab to the Western Railway, now a part of the Boston & Albany. The renowned Major Whistler was then in charge of the road.

Our sketch shows one of these old-timers that went through a shallow bridge with Mr. York, near Chatham, on the old Hudson & Berkshire, now a part of the B. & A



THE ORIGINAL "GRASSHOPPER."

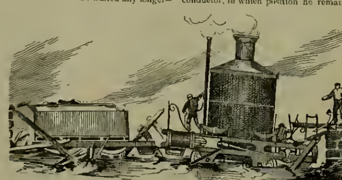
They did some queer railroading in those days, and Mr. York recalls an incident of it. One day he left Pittsfield, Mass., as second section of a passenger train, the agent gave verbal orders to run under, telling the engineer of the pas-



BALDWIN HALF-CRANK.

senger train to tell the crew of a certain passenger that they were to meet, to stay where they were until the second section came.

The passenger crew delivered this message to the already belated passenger, and the engineer, after the manner of his more modern brethren, kicked, saying that he had waited there long enough and he would be d——d if he waited any longer—and he didn't. The result is shown in the sketch—the Crab and the Norris rubbed their noses together.



A "CRAB" IN THE POND.

After this, Mr. York concluded to go West and give up railroading, but he didn't like it very well, and in a few years we find him back on the road.

In 1853 he was on the N. Y. & E., and in 1856 took a prominent part in the strike on that road, being one of the engineers discharged on the general order that to get off the switch on any pretext was a dismissal.

In the winter of '56 Mr. York got a job on the Michigan Southern, but soon came East, and in 1857 went to running on the D., L. & W. out of Scranton, where his older brother, Capt. York, was at work and well known.

A curious accident happened to Mr. York and proved, among other things, that he was a man for an emergency. He was running the ten-wheeler "Niagara," and coming down the mountain one day he discovered a huge hemlock tree across the track, there was no time to stop, nor even to attempt to stop. The tree looked sound, and in Mr. York's judgment would ditch the engine, anyway, he concluded it would be healthier on the ground, and he and the fireman hit the sod.

The "Niagara" struck the tree, surged back against her train of coal "jimmies" with force enough to uncouple herself from them, broke the tree in two and struck out down the grade alone.

The train was not running fast and York and his fireman were soon on it and over to the first two cars; these they cut off and poled them away, and soon they were flying after the truant. They passed a telegraph station, and five miles from where she started they re-captured the "Niagara," none the worse for her trip.

The conductor and trainmen brought the train along slowly, coupled up, and went in without trouble. No one need have known about the incident had the lone engine not been reported at the telegraph station.

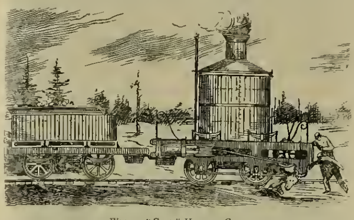
Mr. York was one of the first engineers on the Atlantic & Great Western, the broad-gauge road that connected the then broad-gauge Erie with Cincinnati. He went here in 1860, and for nine years ran an engine, or had charge of the men running them.

In 1869 Mr. York decided to give up running the head end and became a passenger conductor, in which position he remained continuously for twenty years, or until he was seventy years of age.

He then retired to a little home of his own at Meadville, Pa., where he still resides.

Mr. York has seen all and been a part of the development of the great railroad system of this country. When he went to work in 1837 there were no more than a dozen railroads in America, and the South Carolina road was the only one in the world with 100 miles of track. Now there are upward of 175,000 miles of road, some 35,000 locomotives, and more than a million of people earning their bread as railroaders.

Great improvement has been made in all railroad appliances since 1837, the "Grasshopper" and the "Crab" have been supplanted by the "Mogul" and the "Con-



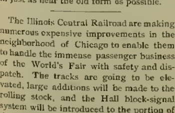
WINANS "CRAB" HERDING COWS.

solidation" and the "Snake-head" has been improved off the face of the earth. The engineer of to-day don't carry a pail of spikes and a maul on his engine to fasten down those cheerful harpoons that used to come up into cabs and cars and "muss things up."

Mr. York has a very wide circle of railroad acquaintances, and many friends of the long-ago who have been scattered to the four winds will be glad to see by this sketch that "Joe" York is still in the land of the living, and pretty well at that.

In all the years that Mr. York has railroaded he never killed but one man, and that one walked into a bridge ahead of him in Scranton yard. He had never had an accident serious enough to cause death and claims that it was his proverbial "good luck." But after a tolerable long observation of lucky men on railroads we know that "luck" oftener means good judgment, skill, some nerve and a natural liking for and adaptation to the work.

Mr. York is one of but two living men who are known to have run the original Grasshoppers and Crabs, and has recently made an agreement with the officers of the B. & O. Railroad Company to take



A "SNAKE-HEAD."

charge of a Grasshopper at the Chicago World's Fair next year. The company are now putting one of these old engines in just as near the old form as possible.

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The Illinois Central Railroad are making numerous expensive improvements in the neighborhood of Chicago to enable them to handle the immense passenger business of the World's Fair with safety and dispatch. The tracks are going to be elevated, large additions will be made to the rolling stock, and the Hall block-signal system will be introduced to the portion of the company's lines where traffic will be heavy.

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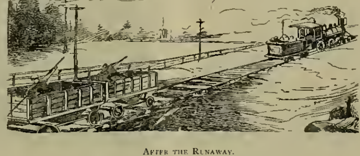
Some of those who are inclined to be a little "skeery" about the safety of radial-stayed boilers may be interested in the report of Superintendent of M. P., W. H. Thomas, of the E. T., V. & G. to the Master Mechanics' Association. They have had three big wagon-top boilers with radial stays carrying a pressure of 180 pounds per square inch. These have been in service for eighteen months without the failure or removal of a single radial stay.

## Relative Merits of American and English Locomotives.

Our friend and rival, Mr. M. N. Forney, has been engaged for the last year or two in the patriotic duty of vindicating the character of the American locomotive from the aspersions and slanders imposed upon it by the representatives of British locomotive interests. A London engineering journal has been noted for years as an unfair and scurrilous assailant of everything pertaining to American machinery, and particularly railroad machinery. Mr.



AFTER THE RUNAWAY.

Forney took up the cudgels with this paper in his *Railroad and Engineering Journal*, and the following is the conclusion of his latest defense, which has become very much of a flagellation:

"To explain the fact which we have proved by statistics, that American locomotives run farther, pull heavier loads, and cost less for repairs, he (the English editor) says they must therefore wear out sooner. Surely it cannot be expected that we will seriously answer such reasoning. Esteemed contemporary, how do you know they wear out sooner? who told you they did? or—what is probable—did you only imagine they do? What evidence have you to show that they are short-lived? There are locomotives in this country which have been in continuous service for over fifty years. Are there any English engines of that age in service? No table of mortality has ever been constructed to show an average 'prospect of life' of American locomotives; but, esteemed contemporary, seriously, if they wear out faster the expense of renewals ought to show in the repair accounts, because all companies, in this country, which keep their accounts properly, charge renewals of old engines to 'repairs.' Now, as the repairs of our engines cost less than yours do—even with more costly materials and higher wages—it would seem to show that in reality they are longer lived than yours."

* * * * *

"You say 'Our locomotive is adapted to our requirements and the locomotive of the United States to the requirements of Brother Jonathan.' But how about the railroad managers

"'From Greenland's icy mountains,
To India's coral strand,'
or
Where Afric's sunny fountains
Roll down their golden sand'!

—those are the people who are, or should be, open to conviction, and who will be interested in knowing that this discussion has shown that American locomotives *run farther in a given time, pull more, cost less for repairs, burn less fuel in proportion to the loads hauled, and last longer, than English locomotives do.*

## Chicago Elevated Railroad.

The people of Chicago are to be congratulated on the fact that they have now an object lesson in city rapid transit which is likely in course of time to develop into a net-work of railroads that will enable people in that city of long distances to reach remote points in a reasonable time. The concrete lesson is the Alley Elevated Railroad, which was opened for regular business on June 6. The structure is very substantially built and is capable of carrying with safety ordinary surface railroad trains. The handling of passengers and of trains is done in much the same fashion as that made familiar to so many people by the elevated railroads of New York.

We clip the following notes from the *Railroad Gazette* about the equipment of the road. The locomotives were built by the Baldwin Locomotive Works. They are compounded on the Vauclain system and weigh 29 tons fully loaded, with 40,000 lbs. on the drivers. The boilers are unusually large and have a firebox suitable for anthracite coal, coke or anthracite slack. The cars were built by Jackson & Sharp, of Wilmington, Del., and in general arrangement are much like those of the Manhattan Elevated, being finished with mahogany inside, with cane seats, etc. The doors are double and arranged so that when one-half is opened the other is opened at the same time, and by pulling one handle only, the two halves of the door being connected by wire ropes running over pulleys. The platforms of the cars are about a foot wider than those used in New York. The cars are lighted with Pintsch gas, and equipped with the Westinghouse automatic air-brake. The value of this brake for elevated service was shown on a trial trip made. The brake releases instantly, and applies with the "service" or "emergency" application, as desired. It is automatic, and in case a train breaks in two while mounting the two per cent. grade going in and out of the World's Fair grounds above the Illinois Central tracks, both portions of the train will be automatically stopped. There are many improvements on the "Alley" road that are not to be seen on the New York Elevated. The stations are arranged conveniently, with the waiting-rooms on the ground floor, and long covered platforms above on the structure. The road will be equipped with automatic block signals and railings for the platforms on the side next the track as well as on the other side and ends.

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On the M., K. & T. road they use stiff coiled springs on the studs between the packing-glands and the nuts that hold them on. These keep the gland up to the "wadding" and prevents a blow from cutting all the hay out when once started.

## Electric Locomotives.

If electric motors do not soon crowd steam locomotives off the railroads it will not be because they have not been properly advocated by the friends of electric traction. In a recent issue the *Electrical Engineer* says that Mr. Henry Villard has made a contract for electric locomotives to do the switching for the Northern Pacific at Chicago. The engines will be not less than 700 horse power, which is more powerful than our heaviest switching locomotives. The Thomson-Houston Co. are also building an electric motor of similar power.

It is said that the Baltimore & Ohio intend to equip the Baltimore belt railroad with electric locomotives and the necessary power plant. Although various reports have been published as to the details of this work, it was not until the close of last week that the details of the contract were finally settled. As far as can be ascertained, the contract involves the building, for delivery early next year, of three 80-ton locomotives, which are to develop, approximately, a draw-bar pull of 31,000 lbs. at 15 miles an hour. A station of about 2,500 horse power will be installed with four units and direct coupled engines and generators. This station will be midway in a run of 12,000 ft. The maximum work required of each locomotive in developing this draw-bar pull is to move a 1,200 ton freight train over a grade of about eight tenths of one per cent. at 15 miles an hour, and in passenger service to move a 500-ton train at 30 miles an hour over a similar grade. Each locomotive will also be expected to serve as a reserve or assistant engine for the regular steam locomotive just outside the tunnel, when the latter is hauling a freight train up a grade of $1\frac{8}{10}$ per cent. All told, there will be about 200 trains a day of each class. The tunnel is also to be lit by electricity.

## How Iron May Hold Its Own Against Steel.

There are many engineers and others whose views on structural material are well worthy of respect who continue to entertain opinions strongly adverse to steel for many purposes where strength and durability must be combined. Much of the feeling against steel is due to the failures that have resulted from the use of bad forms, yet there is no doubt that iron is preferable to steel for many purposes. But steel is making steady headway into favor and is rapidly replacing bad iron. If all iron-makers had combined to put on the market nothing but good reliable material, the advance of the steel age would have been much slower than it is, for iron had long an extremely firm hold on those who were anxious to combine strength, durability and reliability. When Krupp, of Essen, in 1847, made his first steel cannon, military engineers ridiculed the German metallurgist and exclaimed that he would be offering them glass guns next. That sentiment extended then to all the early attempts to introduce steel for engineering purposes, but ridicule, prejudice and interest in other material all failed to delay the progress of steel into favor. The only thing that can now retard the movement is the production of inferior grades of steel and the urging of grades such as Bessemer into lines for which they are unsuitable. This is being done to some extent, and the iron men may profit by it and hold their own by supplying a material that will prove more reliable than the other.

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The tendency toward diversity of forms where uniformity is desirable in railroad machinery is well illustrated by the great variety of center plates for cars that are in use. A committee of the Master Car Builders' Association took strong grounds in favor of establishing standard center plates, and the railroad companies will now have an opportunity of settling the matter. A standard form of stake pocket has also been recommended.

## A Pioneer Locomotive Builder.

The following sketch of the professional experience of Mr P. I. Perrin (with photograph), an honorary member of the Master Mechanics Association, reached us too late for incorporation in the group we published last month

In July of 1836, learning that Seth Boyden, of Newark, N J., a man of remarkable ingenuity and perseverance, proposed to turn his attention to building locomotives I engaged with him I had previously some experience in the details of such work at Lowell, Mass.

P. I. PERRIN.

The first locomotive was completed at the works in Newark in 1837, and was placed on the Morris & Essex Railroad For the next nine years my time was about equally divided between stationary steam engine work, and running a small machine shop in Pawtucket, R I, and farming.

In the Spring of 1846, Willard W Fairbanks retired from the firm of Fairbanks, Bancroft & Co, in Providence, R I, where I was then employed Their business was steamboat engines, with boilers and repair work Mr Fairbanks then organized the Taunton Locomotive Manufacturing Company, at Taunton, Mass.

These works are believed to be among the first (if they are not the first) in this part of the country built and especially designed for locomotive building Other parties were building, but relied upon other work for principal support

W W Fairbanks was elected agent and treasurer of the new company, and George S. Griggs, the master mechanic of the Boston & Providence Railroad, was a stockholder and director At the request of the agent I accepted the position of draughtsman and foreman of the company in June, 1846

The first business was to build a stationary steam engine to furnish power for the new locomotive shop, the foundation of which was then being laid

The agent obtained castings for the engine from his former works in Providence with no plan or drawings to work by. The work was done in a small shop, with a few second-hand tools The stationary engine was completed in time to start the new shop in December following

In order to secure an early completion of the first locomotive, Mr. Griggs kindly furnished nearly all the castings for the first locomotive from his patterns

With the assistance of Mr. B F. Slater, a thorough and practical mechanic and locomotive engineer from Mr. Griggs' shop in Roxbury, the first locomotive was completed and run first for trial on the Taunton Branch R R, May 19, 1847, and named "Rough and Ready." A more appropriate name could not have been selected.

This was a day of small beginnings prosecuted under difficulties.

It was soon found that some more accurate method for quartering the crank-pins for coupled drivers was necessary. It was in the early part of the year 1849 that I designed and built a machine by which the holes for crank-pins in a pair of wheels could be bored quartering at the same time

This was accomplished with great accuracy and saving of time and labor, and was the first machine built for that purpose, so far as I know

In June of the same year we built another machine from the same patterns for the Philadelphia & Reading Railroad Company, on which was placed a card marked "Patent applied for," but neglected to prosecute the claim and secure a patent This appears to have been the original machine, the basis of all subsequent improvements, which has performed so important a part in locomotive construction up to the present time The first locomotive that was run west of the Mississippi River was built at these works in 1852 for the Missouri Pacific Railroad and was shipped on a sailing vessel via New Orleans, and landed at St Louis in December of that year

Mr Edward Piers, a locomotive engineer, sailed with the locomotive, and started it on the road He is now (1892) a resident of Taunton

During my connection with the works for forty-two years (though among the smallest in the country) about one thousand locomotives have been built and distributed in various parts of the country—in nearly every State of the Union—and in South America and Canada I was a stockholder over thirty years and a director twenty-five years, and resigned in 1888

At the annual meeting of the stockholders of the Taunton Locomotive Manufacturing Co. the following resolutions were unanimously adopted

*Whereas*, Mr P. I. Perrin, agent and treasurer of the Taunton Locomotive Manufacturing Co, wishing to retire from the cares of active business, has tendered his resignation.

*Resolved*, That in accepting Mr. Perrin's resignation, the stockholders desire hereby to express to him their thanks for the valuable services which for so long a term of years he has rendered to them. That he has conducted its affairs with strict integrity, unwearied energy and great ability the success of the company in the past sufficiently shows. The best portion of his life has been passed in its service, and it is gratifying to know that, as a director, he will still give to it the benefit of his long experience and wise advice

*Resolved*, That these resolutions be entered upon the records of the company, and that the clerk send a copy of them to Mr. Perrin.

## A Stay-Bolt Drill.

The accompanying illustration fully explains a very neat device used in the Chicago & Northwestern shops at Winona, Minn., the invention of Master Mechanic Wm. McIntosh

STAY-BOLT DRILL FRAME.

The drill is driven by a Stow flexible shaft and is held in place by the framing shown The brackets are bolted to the side of the boiler and have slots long enough to admit of their being raised or lowered

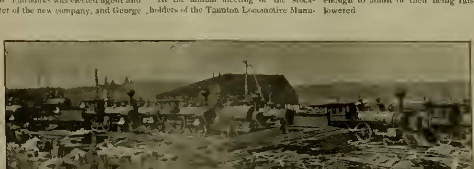
The rod is long enough to reach from end to end of the firebox, the drill is slid along from one stay to another in a row, and then the collar is lowered on the rod to bring the drill to the next row

The angle of the drill can be changed so as to insure the hole being in line with the bolt.

This is one of those ingenious devices that save time and money.

## A Locomotive Boneyard.

The annexed engraving is rather small to do justice to the subject treated. The place shown gives a graphic history of locomotive development in Europe and America. It shows the tracks at McAdam Junction, where worn-out locomotives are stored waiting for the cupola and forge. The engines originally belonged to a variety of small roads that have been absorbed by the Canadian Pacific, and they represent the product of more different builders than are to be seen in any other place. They are the product of the United States, Canada, England and Scotland. There are engines there which now look small articles but in their day were the pride of their builders and the admiration of engineers. Side by side in a state of helpless decay now stand locomotives on which an expert can yet see the marks that speak of Baldwin, Rogers, Manchester, Portland and Mason. Others have lost all traces of identity, except to the men who were familiar with locomotives over thirty years ago Foreign makes are well represented by engines from Kingston, Ont, Dübs, Glasgow, Sharp, Stewart & Co., Manchester, and others. An edifying feature about the old British locomotives is that they have been made as nearly American as circumstances would admit.



THE BONEYARD.

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One of our correspondents is excited because he has learned that one of the Webb compound locomotives has been running at the rate of 111,000 miles per year. He beseeches us to find particulars about some American locomotive that is beating the Webb engine record. In last month's LOCOMOTIVE ENGINEERING a case is mentioned on page 191 of a locomotive running on the Louisville and Nashville that makes 120,000 miles a year. We have no doubt that this is equaled or exceeded on other roads.

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A dictionary of electrical words, terms and phrases, by Edwin J. Houston, A M, has just been issued by Spore & Chamberlain, New York. This is a work of real merit and ought to be in the library of every man who is in any way interested in electrical matters. It costs $5.

## Locomotive-Running Among the Bush-whackers.

By Old Soldier.

My next trip from Nashville was a special with a General aboard, whose name, I believe, was Stromer. I understood afterward that he had orders from the Commanding General for Sherman's army to advance. I left Nashville about 9.30 P. M. with orders to run to Murfreesboro as quick as I could go; nothing was said about safety, I had only one coach. Well, we got there pretty quickly for those times, for the General kicked and swore that I made a mile a minute and that I had used no judgment, and furthermore he did not want to go back unless I had regular running orders. God bless his dear old soul. He had very little idea what dangers he had passed through besides fast running. My engine and crew were held there a day or two, as there were three or four other crews that used to follow up the army to take them supplies. When we left there, I think we left in two or three sections; I was head section. We proceeded on to Tullahoma. There the road had a branch to Winchester. We arrived there without any serious accident, but with a good many big scares. My memory fails in regard to dates. The next day I started back to Nashville with my engine. We then put on a regular passenger train from Nashville to Winchester; I got one of them. It is 90 or 91 miles from Nashville to Winchester, and our engines double that every day. This run was re-opened up without any accidents occurring for some time.

The Government had stockades built at all bridges and a company of soldiers left at each one to guard the bridges. There was a good-sized bridge over Elk river. At the south end of this bridge there was quite a large hill. The road-bed formed quite a curve and ran in close to the approaches of the bridge.

I left Winchester one night some three or four hours behind schedule time. I had four coaches and baggage car well loaded with army men and sutlers and as the road and all bridges and grades were in good shape for those times, and as I had run over that part of the road that morning and Elk river bridge was well guarded with Yanks, I felt pretty safe. The old girl skipped along at a good pace and I was making 30 or 35 miles an hour when I struck the curve approaching the bridge and saw a reflection of light from around the curve. Pat Crosby was firing for me this trip. I remarked to him that the boys were having a good time at the bridge, then Pat yells "Stop her, the bridge is on fire." Then I saw a lot of Johnnies swinging fire-brands. I had got in sight of the bridge this time and could see clear across it. I called off brakes, as I felt them being put on pretty strong. I had a good old-time Roger engine, with the outside angle iron for a running-board, and was now running about 45 miles an hour. Pat says: "Great God! are you going to try and cross that burning bridge?" I said "Pat I can see the rails and I think we can get across it safe." You see the Johnnies had routed our men and fired the bridge and block-house, torn down the telegraph wires and shut off all communication. I do not think there was one railroad man among them, if there was they would have torn up the tracks and come further around the curve to flag me. I often think how great their surprise was that they did not capture that train and engine. They flagged me so close to the bridge that I could not stop until I would get half-way across the bridge, so I made up my mind I had as well be launched into eternity quickly as slowly. Poor Pat was going to jump, but I grabbed him and told him not to do so for the jump would kill him sure, for at that time she was turning those wheels and dropping the rods about as fast as steam would do it. The blaze was scorching the engine and coaches. I guess a good many passengers were praying while the Johnnies were cursing. I got more than half-way across the bridge before they commenced firing into us, but we were going about as fast as their bullets. They said afterward that most of the Johnnies were crowded together expecting to have a good time robbing the passengers. Oh, Lordy! how it tickles me every time I think about how they got left.

The reader must not imagine that the bush-whackers were a sample of the Southern army; they mostly consisted of deserters from both sides. They would not stand and give a square fight, but would assault, and rob, and commit all kinds of depredations against both armies; the Johnnies were about as afraid of them as we were.

I forgot to remark in my other reminiscences that James Hevey's picture of the roundhouse and depot grounds is good. Jim is an old-time friend of mine, or at least, he was in our boyhood days. I have not seen him since 1864.

Well, to continue. I got back to Nashville without any further trouble on that trip, and had a couple of lay-over days and a good rest, and prepared for other hair-breadth escapes which I have not time to write up at present, but will try and get them ready for you in the next issue.

Remember, dear reader, that at this time we hardly passed twenty-four hours without some poor fellow of the train crews being either knocked over or captured.

(*To be continued.*)

## St. L. & S. F. Shops, Springfield.

At the Springfield, Mo., shops of the St. Louis & San Francisco road, they make complete tenders for a little less than $700 and they are good ones. No calked joints are indulged in for tanks, but a strip of tar paper is placed in each seam, and no trouble is had from leaking. Extra heavy sheets are used in the coal pit and two hollow cast pillars, each side of the manhole, carry the overflow water to the ground.

Oak is only worth $14 per thousand here and tender frames are made of it, while it is so cheap that it is preferred to metal for brake-beams.

Mr. Groves makes a strong, plain hand-car, with wooden wheels at a cost of but $32, in lots of ten or more.

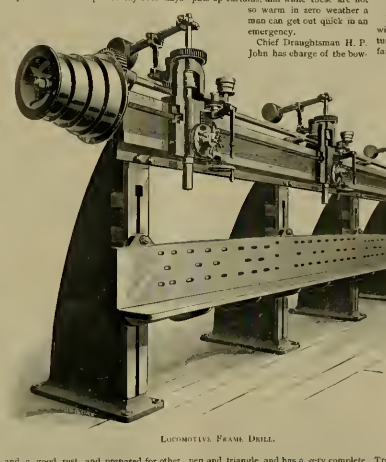
The roundhouse is not a very good one for the big engines now used and the machine shop is dark, but they have a most excellent planing mill and a good paint shop, a new iron-clad store-house is the latest addition to the plant.

Everywhere about the shops there is evidence of internal improvement. A new Westinghouse compound engine has taken the place of the old stationary; new tools are seen here and there; the wheel-work has all been arranged in one corner of the shop, and machines for other work arranged so as to require the least possible amount of handling of material.

They are using three boilers of their own make for the motive power of the shops. These have a water-arch and some other peculiar internal arrangements, they give good service and are smokeless with soft coal.

Mr. Groves is not a believer in cab-doors for consolidation or other engines where the boiler extends through the cab, but puts up curtains, and while these are not so warm in zero weather a man can get out quick in an emergency.

Chief Draughtsman H. P. John has charge of the bow-pen and triangle, and has a very complete and elaborate set of detail drawings and specifications of everything that is made at the shops. The plans for car-work are the best we have seen, and will be published in a future number.



Locomotive Frame Drill.

Before the recent awful flood of water and burning oil that overwhelmed the towns of Titusville and Oil City, Pa., the D., A., V. & P. road had condemned a bridge they owned in Titusville because it was alleged that the abutments were not safe. This bridge was the only one in the place that withstood the flood. It resisted the ramming of buildings, oil-tanks, cars, timber, flood and fire, and all the other safe bridges in town went down. This seems almost like a rebuke to engineering.

The Congressional Labor Committee are investigating into the condition, hours of labor, etc., of Government employés. It is admitted that the eight-hour law has been evaded in many ways by those in charge, and it is expected that the present committee will submit a report urging a strict enforcement of the law.

## Locomotive Frame Drill.

The engraving on this page shows the latest form of special drill produced by the Universal Radial Drill Co., of Cincinnati, O., who make a specialty of drills.

This machine seems to be designed for especial usefulness in railroad shops, and could, of course, have more heads if desired. The makers also furnish it with a bed-plate or base if desired, and a power device for raising and lowering the table comes extra.

The spindles have power and hand-feeds and are counter-balanced. The following are the principal dimensions of the machine.

Length of rail and work-table, 24 ft.

Greatest distance spindles to table, 4 ft 9 in.

Least distance spindles to table, 2 ft. 2 in.

Adjustment (vertical) of table, 2 ft. 7 in.

Extreme centers outside spindles 23 ft.

Closest centers outside spindles, 12½ ft.

Feed of spindles, 15 in.

Diameter of spindles, 1¹⁵⁄₁₆ in.

Height of floor to top of rail, 7 ft. 3 in.

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Do not spend your precious time in wishing and watching for something to turn up. If you do you will be like the famous Micawber and forever be wishing and watching while you are drifting upon the rocks of penury or of unrespected old age. Things don't turn up of themselves; you must turn them up. Idleness and indifference never accomplished anything. It takes energy and push to make headway in the world, and an active, energetic, persevering man is sure to succeed. If he cannot do one thing he will find something else. If he cannot succeed in one direction he will in some other. He will not waste his time in idleness. There is no lack of work no lack of opportunities. Do what comes to your hand, and do it well. True progress is from the less to the greater. Quit re-solving and re-resolving, and begin doing.

There is no part of a freight car that has led to so much discussion among those responsible for keeping cars in running order, as the truck. At the last Master Car Builders' convention this subject was brought up anew by a report on "Freight Car Truck Frames." The committee investigated the rigid-center truck, the swing-center truck and the Fox pressed-steel truck. The conclusion arrived at was that the rigid-center truck is coming rapidly into favor, and the swing truck going out of use. The belief was expressed that the Fox truck possessed good points, but that it had not been long enough in use to be recommended.

The Baldwin Locomotive Works have issued a pamphlet descriptive of their compound locomotive, and give the reasons why compounds are better than simple engines, together with suggestions for conducting simple tests for fuel economy. Every engineer who is interested in the latest form of locomotive should write to the Baldwin Locomotive Works, Philadelphia, for this pamphlet, it will cost nothing and contains a great deal of information.

Employés of the Grand Trunk are not to smoke while on duty or in uniform, must not occupy the same seat with a passenger, and must remove their hats when passing through dining-cars or those in which officials of the road may be seated.


## Running Repairs—Tire Wear.

Quite an important matter to master mechanics is to know at what points on a driving-tire the greatest amount of wear occurs. One benefit derived from this knowledge is that it aids a person to determine as to whether an engine is properly counterbalanced or otherwise.

It is a well-known fact that a driving-wheel not properly counterbalanced will slip at certain points in the stroke, and a consequent wearing of the tire at these points more than at other points is the result, which, if prevented, would insure a much longer life to the tire. Then, when worn spots occur where they would not occur if caused by improper counterbalancing, it would be safe to conclude that the trouble was with the material of which the tire was made. Hence it appears conclusive that to determine the cause of tires wearing unevenly, it is necessary to correctly locate the low spots on each relative to the pin, and also to know the difference in wear from one point to another around the wearing surface of the tire.

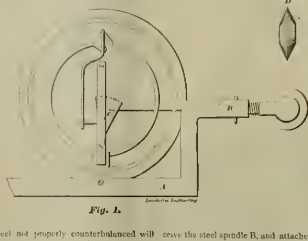


*Fig. 1.*

To accomplish this object, our master mechanic, Mr. E. A. Williams, devised the following method, and employs the appliances described, obtaining very satisfactory results.

After having gotten a pair of driving-wheels into the lathe, we draw a chalk line across the wearing face of each tire at the point where a line drawn from the center of shaft and through the center of pin would intersect the tire, and from this mark we mark off the face of each tire into thirty-six equal parts. Then marking the first line back of the pin No. 1, the second mark from pin No. 2, we number each line consecutively. No. 36 will thus fall upon the line directly opposite the pin. After numbering the lines, we place in the tool post of the lathe a gauge arranged by our machine-shop foreman, Mr. J. H. Hickman. He made a ¼x¼-inch steel bar, A (Fig. 1), and drilled the straight part to receive the steel spindle B, and attached the small end of this spindle to the geared quadrant C, in a small steam gauge. In the larger end of the spindle is cut a slot into which fits a small steel wheel about 1¾ inches in diameter, whose edge is turned down thin as shown by D; fine teeth are then filed in the edge; a slot is then cut through the straight part of bar A of sufficient length to allow the hand of the gauge to make one revolution, when spindle B is pressed against the quadrant C, a small steel pin is passed through the slot, which it fits loosely, and made fast in spindle B. A small spiral spring is wound around the larger part of spindle, and bearing on the shoulder holds the indicator hand of gauge at O when no pressure is applied to small wheel in end of bar A. A sharp-pointed indicator was then attached to small pin in spindle B and the indicator hand of gauge placed at O, a scale was then clamped on top of bar A and the spindle was pushed in 1/16 inch and the position of indicator-hand marked on gauge dial; fifty of these spaces thus indicated were then marked on the dial.

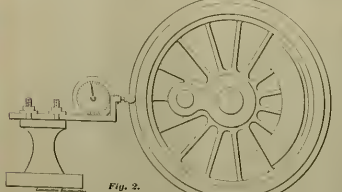


*Fig. 2.*

After placing this arrangement in the lathe as shown by Fig. 2, the driving-wheel is stopped when mark No. 1 on tire is opposite small wheel in spindle. The small wheel is then pressed against the tire until the gauge-hand is at No. 20. Then, as the driver revolves, mark in a column on a piece of paper each number that the gauge indicates. The smallest number indicated is the lowest spot in the tire, and (calling the head of the column of figures No. 1) its position in the column will correspond with the number of the chalk line across the face of tire at which the low spot occurs.

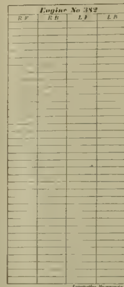



*Fig. 3.*

Now, to correctly determine the difference in wear at the various points around the tire a chart represented by Fig. 3 is used. (This is a rough chart made by the lathe man.) Horizontal lines divide this chart into 36 spaces, corresponding with the chalk lines across the tire. Perpendicular lines divide it into columns, one of which is used for each driving-wheel. Now the position of the smallest number in the column of figures first made is marked O in a corresponding position in the proper column on the chart. For instance, should the smallest number in the column be the fifteenth number from the top then the O is placed in space No. 15 on the chart, and the driver is revolved, and stopped when line No. 15 is opposite the gauge-wheel. The gauge is then run forward until the wheel just touches the tire, but not hard enough to move the indicator hand. The lathe is then started, and as each line on tire passes under the gauge-wheel the number indicated by the hand is written on the chart in the space corresponding with the number of the line passing under the gauge-wheel. We thus correctly obtain the difference of wear from line to line expressed in one hundredths of an inch.

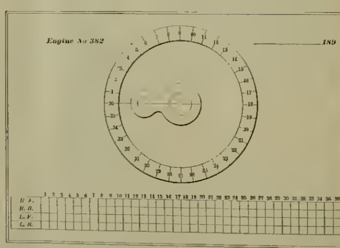



*Fig. 4.*

For an office record Mr. T. A. Fogue (our engineer of tests) has a goodly number of printed charts, Fig. 4, and when the shop foreman hands in his charts (Fig. 3) Mr. Fogue transfers the numbers to chart No. 4, and keeps them for reference, so that at a glance one may see the position of the low spot relative to the pin, and can also see the difference of wear between any two points.

To ascertain the thickness of the tire in the tread at point O, or thinnest point, I made a gauge of which the following is a description. Take a block of brass or iron, A, Fig. 5, and cut a slot in it through which pass a square, B, which is held in any desired position by thumb-screw at back (not shown), the slot should be cut about ½-inch from face C. This square is made of ⅛x1-inch steel. In the top arm of the square cut a slot ½x2 inches, into which fit a brass piece, D; this piece carries a 5/16x3/16x4-inch scale, E, which passes freely through piece D, when the thumb-nut at back is loosened. When the nut is tightened both the brass piece and scale are clamped firmly to the square blade. This blade is 3¼ inches long, and the upright part of square is 5¼ inches in length. A square groove ¼x1-inch is planed in the upper surface of block A, into which fits a hinged piece P which is ¼x1 5/16x4¾ inches. The hinged end of this piece is left 1 inch wide, so that when it is placed in the position shown by Fig. 5 the upper edge of it is in line with the upper surface of block A. The piece P has lugs riveted to the under side of it which forms a slot through which a ⅛x1x5¼-inch scale, G, passes. The edge of this slot is ½ inch from end of piece P.

To obtain the thickness of a tire with this gauge you throw the piece F into the position shown by the dotted lines, and press face C of block A firmly against the turned rim of wheel center, at the same time pressing the upper edge of block A against that part of the tire which overlaps the wheel-center (see Fig. 6). Now loosen the thumb-screw H, and the square will drop through block A until the blade touches the tire at high point 1. Tighten thumb-screw and loosen thumb-nut at back of square blade; this allows scale E to drop to wearing surface of tire. Now move brass piece D in the slot in blade until the end of scale reaches the lowest point of wearing surface of tire. Then tighten the thumb-nut and remove the apparatus. Now drop piece F, Fig. 5, into the position shown, and pass scale G upward until its upper end touches the lower end of scale E. The distance from block D indicated by lower end of scale E is the amount the tire is worn hollowing. The distance from upper edge of piece P on scale G is the thickness of tire at thinnest point.

Now, the gauge could have been made by leaving off piece F and graduating the upright part of the square. Then the difference indicated by scale and square would be the thickness of tire. But, while finding the difference is where mistakes would be liable to occur, and I consider that the expense of putting in piece F is overcome by the benefit derived from having the scales show exactly the amount of wear and the thickness of tire.

S. C. Hitchcock

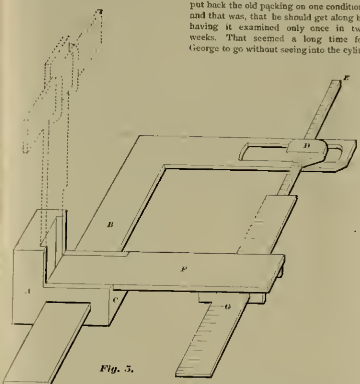


Fig. 5.

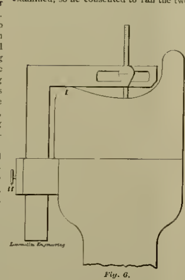


Fig. 6.

## Trouble with Spring Packing.

One of the greatest difficulties that I ever encountered in railroad life, remarked Mr. Morris Sellers, was in getting the men to agree to the change from spring to steam packing in the cylinders. The road had used from time immemorial common spring piston packing, and it seemed as if all the engineers imagined that their packing should be set out every time their engines were three hours in the roundhouse. The expense for piston work was enormous, and I determined to end it by employing steam packing in the form of plain cast-iron rings.

There was an old engineer on the road named George Mason, who was justly regarded as one of the best runners on the road, but he was violently tortured by a chronic belief that his piston packing was blowing. I resolved to give him the first set of the new packing. On mentioning to him what I intended doing he was very indignant, indeed, and guessed he was not going to have his engine ruined by any such nonsense. That was precisely the way he spoke. I did not get mad, as I had good cause to do, but reasoned with him that the new packing did very well on other roads, and I felt assured that he would like it if he once had a trial of it. So the new packing was put into the 66 and George took out his train but got nowhere, and come in next day with three cars short of a full train.

I asked what the matter was and was told it was that new packing. The engine blowed through so badly that she would not pull the full train. I had the cylinder heads taken off and the packing examined, and, as I expected, it looked in perfect order. Next day, when George was ready to go out, I went on the engine and rode out with him ten miles. The engine was working as well as George would permit her, but he was nervous, and kept saying he could hear the steam blowing through, and on this account he could not do the engine justice. He believed the engine was working badly and that she would lose time, and his belief contributed to bring about delay. As I expected, he returned late with a reduced train.

I felt assured that the man was trying to do his best, but he had made up his mind that the packing would not work and he was unconsciously working against it.

Mason reported to me on his arrival with the old story, so I said to him I would put back the old packing on one condition, and that was, that he should get along by having it examined only once in two weeks. That seemed a long time for George to go without seeing into the cylinders, but I told him I could not keep the work going at the rate packing was being examined, so he consented to run the two weeks. With this agreement made I walked with George to the roundhouse and gave the foreman, Mr. Power, orders to change the packing. The engineer was so delighted that he waited around till the machinists finished the job and then went home happy.

In the meantime I told Mr. Power to get reliable men round after night and put the steam packing back into the cylinders of the 66, which was done, and none of the enginemen knew anything about the change.

George Mason got around in the morning and went out like a man with a burden lifted off his back. The conductor, on seeing the engine, asked if he would lay out two or three cars, but George answered that old 66 was herself again, and could take a full train with the best of them.

The next time I saw him I asked how the engine did now, and he answered "splendidly," and went on with a tirade against steam packing.

When Mason had been running about a week without his packing being examined, which was an unprecedented length of time with him, he came into the roundhouse and told the foreman that she was blowing a little, but he guessed he could make out the two weeks. At the end of next trip, however he wanted to have the packing examined, but Mr. Power refused to touch it, reminding him of the agreement made with me. Mason came to me then and said he would like the two weeks to begin from that day. He knew the packing was not blowing much, but he was beginning to hear it, and he thought perhaps the steam packing had put the pistons a little out of shape and felt confident there would be no trouble in getting them to run the two weeks after they were once put just right.

I consented to have the packing examined and told him to wait and see how it looked. When the machinist got the followers off, the engineer looked at the piston, rubbed his eyes and looked again, then made a rush to the cab for his coat and hurried home.

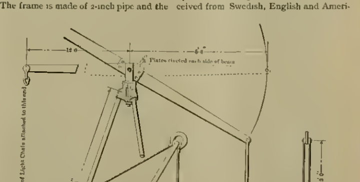
I directed Mr. Power to have another man ready in the morning to take the engine out if Mason did not get around, but he was there on time and took his train over the road on time also. On returning he came to me with tears in his eyes and protested that he was the worst idiot out of the county lunatic asylum. There never was any more trouble with his packing and the lesson had a very beneficial effect upon the rest of the engineers. No more objection was made to the steam packing as it was introduced.

## Coolidge's Car-Wheel Lifter.

The engraving on this page shows a very handy little rig for lifting car-wheels on and off cars, the design of F. H. Coolidge, agent for the American Brake Co. at Atlanta, Ga.

There are only two small castings, the top of the tripod and the foot piece, of which there are three used.

The frame is made of 2-inch pipe and the



lever is made of 6 x 1-inch bar-iron or can be drawn from an old axle—in fact, the whole thing can generally be made of scrap material, and the designer says the cost is not above $40 when new material is used.

Eighty wheels have been loaded on a car in thirty-five minutes and with fifty per cent. of the labor required to load by hand.

Mr. Coolidge has taken out no patent, but says he will be glad to furnish blue prints to any road that wishes to build one. Several roads in the South are now using this device.

The cut explains the lifter better than words can.

## One Wheel Slid Flat and the Other Not.

The general foreman of locomotives and cars at a division point on an Iowa railroad writes us. "I have something about a car that I think will cause quite a little discussion among the readers of Locomotive Engineering. I received a car the other day and the car repairer reported to me that there was a card on the car for one flat wheel, slid flat 3½ inches, while the other wheel was all right and was not scratched on the tread at all. The wheels were under an air-brake car which was empty when I received it. I have been trying to find out how one wheel could slide flat 3½ inches and wheel on opposite end of axle could be all right. The chill seemed to be all right. Wheels were both tight on axle.

"I have asked several different ones and all say they never before heard of such a thing happening. John Burns (traveling engineer) did not want to believe it, but I took him and showed him the wheels. The only way I can account for it is that the road that the car was on took off one wheel and put a new one on and let the other one go as it was."

We have heard before of cases of one wheel being slid flat while the other on the same axle was not damaged. Perhaps some of our car builder readers will help our correspondent to an explanation of the phenomenon.

A Swedish paper announces that the Baldwin Locomotive Works have delivered a locomotive to the Borringe Ostratorps Railway. This locomotive was designed by a Swedish engineer and bids were received from Swedish, English and American builders. The American manufacturers received the contract, not only on account of being the lowest bidders, but also on account of the time required for delivery. Other bidders required a year's time, while the Baldwins delivered the engine within ten weeks after receiving the order.

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## Special Notice.

We have to announce that the May edition is entirely exhausted and no more subscriptions can commence with that number. The June issue is the farthest back we can go now. Agents will please have all subscriptions begin with June until further notice. We don't intend to do much back-number business but to make a live paper, covering our field up to the month of publication, and to deserve the reputation given us by the general manager who wrote, "It is the most interesting railway paper published."

ANGUS SINCLAIR.
JOHN A. HILL.

## Some Sensible Laws in the Interests of Railroad Men.

The railroad men of the State of Ohio long ago realized that if they wanted any laws passed favorable to themselves, or wished to prevent the passage of laws detrimental to their interests, that the way to go about it was the way corporations or organizations of politicians did.

They elected a legislative committee and sent them to the capitol to lobby.

There are 35,000 organized railroad men in the State, and the balance of power is but 10,000, so the members of the orders agreed to drop politics and use their ballots to enforce fair laws.

S. D. Hutchins, one of the best engineers on the "Big-Four" road was put at the head of this committee, and their work was done so fairly, so honestly, and the demands made were so just and so manifestly in the interests of the whole people of the State, that not even the officials of the roads could enter a protest.

They have secured the passage of a law that prohibits the signing away of any rights of an individual, that prevents the withholding of any part of a man's pay for insurance, hospital funds, watch inspection, color-blind tests or what not; which makes every man with authority to give any orders to another his superior officer, and not his co-employé, which prevents the "baby act" crawfishing from responsibility and charging it to negligence of a co-employé.

Another law limits the hours of service on railroads to ten hours, prevents the use of men who have worked for 24 hours and demands extra pay above the *per diem* extra for over-work.

A law has been passed that prevents the employment as engineers or conductors of any person who has not had an experience of at least two years. This prevents the equipment of the road with dangerous men in case of a dispute between the men and the company.

A sensible color-blind law provides that each company shall, at its own expense examine the eyesight of its engine and train men at least every two years, and especially provides that the examination be "in the distinct colors in actual use by such road"—no optical delusion tests of shades as an excuse to get rid of men who are not wanted.

An effectual Anti-Pinkerton law has been devised and passed.

One new law is in force that should be universal, and that is the compelling of the transmission of messages on the occasion of a wreck. All people are made to suffer painful suspense when a wreck has occurred when friends are on the road, but the wives and mothers of the railroad suffer the most. How often does it happen that a dozen women stand for hours around a telegraph office waiting with tearful eyes and breaking hearts for the forbidden news from the wreck, knowing that on one or more of them the blow must fall, and each apprehensive for the safety of some loved one. Preventing the transmission of news to these women, these wives and mothers, is the refinement of torture and it ought to be a crime. It can hurt the road no more for the truth to be known one time than another.

Most of the railroad men are unwilling to support a good committee to shape legislation, and then curse the unfair laws enforced upon them.

When broad-minded men are sent, not the blatant talkers, but the solid thinking men, men who know their own rights, and the rights of others—aye, there's the rub, *the rights of others*. It can do no good and will always do harm in the end to be unfair. When good men are sent, well backed up, good, fair laws can be placed upon the statute books of any State, and certain rights and certain protection afforded thereby that could never be secured by all the grievance committees in the land.

The railroad men of the country can well afford to profit by the example of the men of Ohio; there is reason and sense in their work.

## Locomotive Tests.

The Railway Master Mechanics' Association and the American Society of Mechanical Engineers have both had committees during the last year investigating the practicability of establishing a standard method of conducting locomotive tests. The committee of the Master Mechanics' Association reported progress, and that of the Mechanical Engineers submitted a preliminary report in which certain recommendations were made. In the beginning of this report allusion is made to the necessity for conducting locomotive tests so that accurate results may be secured, and the difficulties encountered in doing this are dwelt upon. The fact is conceded that locomotive testing is conducted under such unfavorable circumstances and surroundings that many of the exact methods employed in testing stationary engines or boilers cannot be used. Locomotive tests should therefore be always made with a special train when possible, so that the same cars are used for the different trips and the weight of train is uniform. The committee then proceeded to give particulars of how the coal measurements should be made. They favor having the coal placed on the tender in weighed sacks, and a weighed quantity which will first be used placed on the tender. There appears to be uncertainty as to how the weight of ashes and cinders should be ascertained when it becomes necessary to clean the fire on the road.

Detailed particulars are given of how the indicator should be applied, and the kind of reducing motion to be employed. Three forms of motion are illustrated, a pantagraph motion, a swinging pendulum and a parallel motion. The most approved means should be employed to find the speed of the engine at the time indicator diagrams are taken, and these should be taken at mile posts.

The following is a synopsis of the general directions recommended. A drawing of the boiler should be supplied, giving all particulars of heating surface, grate area, the openings in the grates, volume of smoke-box, arrangement of draft appliances, etc. Boilers should be thoroughly cleaned before tests are made. The capacity of the boiler for steam-making should be measured by the number of British thermal units taken up every hour by the water and steam in the boiler. The temperature of the air should be noted. A good water meter should be employed to determine the amount of water fed to the boiler. The coal should be dry when used. A record of the temperature of the smoke-box gases should be made by a good pyrometer placed near the flue-sheet. The exhaustion of the smoke-box should be shown by a mernometer gauge. The quality of steam furnished should be determined. Samples of gases passing from the flues to the smoke-box should be analyzed.

The committee publish drawings of some of the apparatus they consider best for ascertaining the information referred to, and give particulars of the methods to be followed. The report does not assume to be final, and therefore does not propose a standard method of tests. It gives many valuable suggestions that will, no doubt, be of service to those making locomotive tests, more especially to beginners at this kind of work. We doubt, however, if it is practicable to establish a hard-and-fast set of rules for the testing of locomotives. The engines and boilers are operated under such varying conditions that, in securing accurate results, very much will always depend upon the skill, judgment and experience of the man in charge of the tests. We consider that the line of tests followed by Mr George Gibbs in testing the compound locomotives on the Chicago, Milwaukee & St. Paul Railway, and described in the report on Compound Locomotives, read at the Master Mechanics' Association, as being superior to the methods recommended by the committee of the Society of Mechanical Engineers.

## Deserve Promotion.

"There is no chance for a man to get on on railroads without he has some friend to push him," writes a correspondent who tells that he has gone through the course of machinist apprentice, fireman and engineer and is again working at the machinist trade. In a badly spelled, wretched written epistle, he goes on at considerable length abusing railroad officials for habitually suppressing men of ability. Some people appear to derive peculiar consolation from emptying the vials of their discontent and bitterness upon the devoted head of an unoffending editor, and the letter quoted from is representative of a class. Very often the complaints are carried to the editorial sanctum and poured forth there. We have great sympathy with men aspiring to rise above the rank of an ordinary workman, and, therefore, we listen as patiently as we can to all those who feel constrained to complain about obstacles being thrown in their way. It is sad to tell, however, that the greater portion of the men with grievances are themselves the greatest obstacles to their own success in life. Most of the men complaining about not getting on do nothing whatever to recommend themselves from being taken out of the ranks.

In the mechanical department of railroads the first upward move that a man receives is usually to be appointed a foreman or a traveling engineer. If the officer making these appointments is wise and has the interests of his employers at heart he will select men who have striven by acquiring knowledge to equip themselves for higher positions. It is not enough that a man is a first-class machinist or carpenter or engineer that he should be selected for promotion. If he has worked for promotion he has acquired all the knowledge within his reach of the science of his business. These are the kind of men who have led the armies in the industrial campaign that has reared the great industries of this country, and it is only such men who will continue to come to the front. A man who is the best machinist in a shop, but has no conception of how to speed a shaft or how to figure on the strength of a bolt, has no right to expect to be made a foreman. Ignorant and inefficient men are sometimes selected for promotion, but it is not the rule, and their employers are to be commiserated. To the ignorant grumbler and complainer that we are best acquainted with we would say, you are receiving the treatment you have earned. If you have sound ambition you will try to do something to prove that you are more worthy of promotion than the others around you. Those who have not the stamina to qualify themselves as leaders have the right to remain followers.

## The Art of Molding.

Of all the mechanical arts, that of molding has been the most difficult to formulate and to reduce to a system. Since the origin of metal-founding the molder has been pleased to shroud his methods in certain mysteries, which, to him at least, seem essential to perfect castings. It may be said of this trade, more than any other, that the traditions of generations cling to it. Like the good housewife of the olden time whose bread was often sweet and delicious and occasionally intolerable, the man of rammer and trowel will alternately score success and failure under apparently the same conditions. He can always tell why his casting is good, but can rarely give a reason when it is bad. There is much which can be accounted for in this; perhaps, more that cannot be.

In all other industrial branches the senses of touch and sight are always at the command of judgment. In the machine-shop, contact between the workman and his work is always possible; an error may be detected as soon as made, and corrected at once; there are no final chances upon which the success of the machinist's job depends. With the molder, it is different. The conditions which insure bad work, and cannot be anticipated, are numerous. There may have been a bar in the "cope" under enough tension to induce a "drop" when the additional "strain" of clamping was put on, the core, with which he had nothing to do beyond setting, may have been made with no reference to free "venting," and a "blow" follows pouring. His troubles do not end here; the melter may have been in a careless mood to the extent of dull iron, and a casting with "cold-shuts" is his reward; if his foreman make a wrong estimate on the amount of iron necessary to "pour" his mold, and give him too little, another loss will be charged to his account. There is much beyond the control of the molder, in the art of metal-founding, which tends to make bad castings. His strongest influence upon the quality of his work lies in skill which cannot be verified by caliper, gauge, or rule.

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The Long Island are changing from vacuum to automatic air, but it is rather a slow job, none of their suburban cars had been changed yet when the seashore business broke out anew and ten new suburban engines had to be equipped with vacuum. The Westinghouse was used.

## Hard on the Wheel Makers.

Several years ago the Master Car Builders' and Master Mechanics' Associations agreed upon a guarantee for cast-iron wheels which has been working considerable injustice to the car-wheel makers. Where a wheel fails to perform the guaranteed mileage the maker has to credit the user with a sum representing the loss due to the shortcoming of the wheel. There are a few causes of failure specified, such as sliding, etc., for which the maker is not held responsible. The maker is, however, held responsible for sharp flanges, cracked hubs and several other common causes of failure that may very readily be due to circumstances over which the maker has no control. This source of injustice has been discussed very freely at various meetings lately, and it was investigated and reported on by a committee of the Master Car Builders' Association. There is some disposition to relieve the wheel makers from part of the unfair responsibility attached to them, but railroad men are very much inclined to act on the knowledge that they have got the wheel makers under the harrow, and that it is best to keep them there.

## Wellington on Train Resistance.

The account which appeared in our June issue of the run made by Mr. Angus Sinclair with the locomotive pulling the Empire State Express has been made the subject of an exhaustive analytical article by the *Engineering News*. Mr. A. M. Wellington, author of the well known book, "Economic Theory of Railway Location," is one of the editors of the *Engineering News*. He has devoted more attention and investigation to the subject of train resistances than any other engineer known to the public, so that the remarks of his paper on the part of our article relating to train resistance are of peculiar value. We regret that want of space prevents us from reproducing the whole article. Referring to the tests recorded in our article it begins:

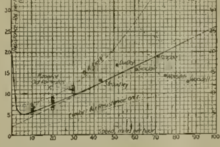
"The observations are among the most important evidences on record of the actual resistance of trains at high speeds. Perhaps we might even go farther, and say that they are the most important, especially as they are reasonably consistent with the mean of the few other records which have been obtained for speeds of 50 to 75 miles per hour, while presumably far more trustworthy and decisive than any of these prior records. As such they are a real contribution to technical knowledge. We trust, though we hardly expect, that they will attract the attention they deserve, and we recommend electrical journals, especially, to reproduce them, as having an important bearing on pending efforts to obtain very high speeds by electric power, and going far to indicate that those efforts may be successful."

After giving the leading particulars about the route, the train, the speed and the resistance recorded, *Engineering News* makes comparisons of the data with those of a famous run made by Mr. Wm. Stroudley on the London, Brighton & South Coast Railway, and published in the Transactions of the Institute of Civil Engineers, 1885, with the figures of train resistance found by Mr. P. H. Dudley in his tests with dynamometer car, and with the discoveries made on air resistance alone by Mr. O. T. Crosby in experiments with a high speed electrical driven car. It is demonstrated by figures that Mr. Sinclair's record agrees substantially with the most reliable data relating to train resistances and the annexed diagram, for which we are indebted to *Engineering News*, has been plotted to give a graphic illustration of the rate of train resistance in pounds per ton.

On this subject our contemporary says "The element of axle friction only in train resistance is fairly determined at about 4 pounds per ton for passenger and loaded freight cars, and 6 lbs. per ton for empty freight cars at a speed of 10 to 30 miles per hour. The general law of friction is also well determined that at very high journal speeds the lubricants are so well carried around between the metallic surfaces that the friction is greatly reduced, and may almost become evanescent. Mr John W. Cloud and others have directly observed this fact in railway service that at high speeds the journal friction proper may be less even than 2 lbs. per ton.

"It is now an admitted fact that the axle friction at the instant of starting is now many times greater than after the vehicle is once under way, and that the drop from this high resistance, while very rapid, is by no means instantaneous, but requires a speed of from 5 to 10 miles per hour before the normal rate is attained. The starting resistance at times rises considerably above 20 lbs. per ton, *i. e.*, a car on a 1% down grade, which gives an accelerating force of 20 lbs. per ton, will not always start of itself without aid. A force of 16 lbs. per ton will very rarely start a car in motion. A fair average is about 20 lbs.

"All these various data we have plotted on a little diagram reproduced herewith, to which we have added a solid black line to show what the evidence at hand appears to indicate as to the true rate of train resistance in pounds per ton. The six observations on high speed trains are shown by small circles with the name of each observer attached. Above and below these are shown by dotted lines (1) the old Clark formula as one extreme and (2) the Crosby formula for air resistance as the other. The range of the older formu-




las at 10, 20 and 30 miles per hour is shown at the left. There have been some showing still higher resistances than Clark's, but they have not met general acceptance For the most part they fall below Clark's at low speeds.

"Considering that the Worsdell observations are known to need small correction at least, Mr. Sinclair's two records come extraordinarily near to giving the mean of the four others. If we add to the Worsdell observations 6 lbs. and 10 lbs. per ton respectively, which would be the effects of a 0.3% and a 0.5% grade (15 and 26 ft. per mile), they would fall exactly on the line which we have drawn as the "weighted mean" of the six, allowing most weight to Mr. Sinclair's observations.

"Is it possible to find in this diagram any support for the theory that train resistance varies as the square of the velocity? We are unable to do so; especially as it is easy to see how the facts which we have narrated should make resistance observations within a narrow range of low speeds only appear to indicate that the velocity resistances vary as the square or even a higher power, when they really varied directly with the velocity. We by no means give our adhesion to the latter theory. We are merely weighing evidence. We do say that so far as the existing evidence as to high speeds goes, all of it supports the latter theory and none of it the older and heretofore accepted theory. If the solid line on the diagram gives a true mean of trustworthy experiments, then the resistance of passenger trains at speed is given by the equation

$$R = 0.24\ V + 2,$$

or perhaps as accurately and more simply:

$$R = \tfrac{1}{4}\ V + 2.$$

Both these forms are subject to a slight increment for difference in axle friction at speeds below 40 miles per hour, increasing as the speed falls, which is a more or less variable quantity and for practical purposes may be neglected.

We shall watch with much interest to see how further developments correspond with this formula It is entirely possible that they may discredit its form, or even its substance. But until they do, and for the present, experimenters at high velocities of over a mile a minute can have no better guides as to the true resistance, we think, than the above formula, and this fact at least seems to be now established beyond peradventure, that high-speed train resistances are very much lower than has been heretofore supposed, or than has even seemed possible.

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Men become awfully careless sometimes, and engineers should check themselves in the development of this fault, for fault it is. How often a slow flag is placed along the line on account of a bridge or something and left there indefinitely Men slow up at first, then the bridge is fixed and they run by the flag without seeing it. This is gross carelessness, the flag should be reported and then removed. Not long ago the citizens of Orange, N. J, noticed that the crossing gates of one of the important streets crossing the D., L. & W. tracks were not being closed, and an investigation showed that the watchman was dead in his shanty and had evidently died some days previous. More than one hundred passenger trains had passed this crossing, and not one engineer had reported the absence of the protection due himself and the public. This was carelessness. Yes, it was worse—a neglect of duty! There is a well-defined but unwritten law among railroad men that failure of orders or the use of safeguards must not be reported for fear some one will be blamed Safe operation of a railroad depends upon every link in the chain—each man doing his whole duty and neglecting none, and insisting upon every other man doing his. Take nothing for granted, run by rule and order, you are playing with human life—your own life.

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The Eugene V. Debs Publishing Co. is the name of a concern recently established at Terre Haute, Ind. That this house will put thousands of good books into the hands of the railroad men of this country goes without saying to those who know the untiring energy of the man at the head of the house. Eugene V. Debs is so well known to the workingmen of this continent that he will only need to announce his venture to have a thousand men come forward to help him. Mr Debs will hereafter publish J. E. Phelan's "Air-Brake Practice," formerly published by us, and "Progressive Examinations of Locomotive Engineers and Firemen," published by J. A. Hill. He will handle all books and pamphlets needed by railroad men and mechanics, but will make a specialty of good, cheap books. If energy, honesty and industry count for anything, the Eugene V. Debs Publishing Co. is sure of success.

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When this issue of LOCOMOTIVE ENGINEERING reaches its readers, one of its editors will be in mid-Atlantic, on his way to try and find something of interest in the shops and on the roads of the Old World. John A. Hill and wife sailed for Europe on June 25th, on the great German greyhound "Ems," of the North German Lloyds. Mr. Hill will be absent about two months, and it is hoped that he will find many interesting things to write about in the Old World. Germany, France, Switzerland, Holland, Belgium and Great Britain will be visited.

## PERSONALS.

The Roberts dummy hose coupler is meeting with quite a sale, it seems to be appreciated.

Mr. E. Evans, long master mechanic of the Baltimore & Ohio Southwestern lines, has resigned.

Mr. J. G. Neuffer has been appointed master mechanic of the Baltimore & Ohio Southwestern lines.

Mr. A. G. Stewart has been appointed master mechanic of the Pennsylvania Company at Wells, Pa.

Mr. Geo. W. Cook has been appointed roundhouse foreman of the Wisconsin Central, at Waukesha, Wis.

Mr. Geo S. McKee, master mechanic of the C C. C & St. Louis at Chicago, has been transferred to Mattoon.

Mr E. Harvey, a well-known engineer, has been promoted to the position of roundhouse foreman, at Calera, Mex.

Mr. W E Wallace has left the Gould Car Coupler Co to be chief draughtsman of the C B. & Q, at Aurora, Ill.

Mr Samuel Rea, a well-known civil engineer, has been appointed assistant to the president of the Pennsylvania railroad.

Mr. Geo. W Parker has been appointed road foreman of engineers of the Black Hills division of the F. & Elk H. Railroad.

Mr. J. H. Berry has been appointed master mechanic of the C. C. C. & St. Louis at Cincinnati. This is a new office there.

Mr. J W Roberts has been appointed master mechanic of the Chicago & Southeastern. He was formerly on the C. C. C & I. Railroad

Mr. J M Sheer, who has been acting as master of rolling stock for the Ohio & Mississippi for several years, has been appointed to the position.

Mr C H Platt, for several years general manager of the Grand Central Station, New York, has been appointed general superintendent of the New York, New Haven & Hartford.

Mr F M Lawler, for some time master mechanic of the Big Fours at Mattoon, Ill., has been transferred to Brightwood where he takes charge of the principal repair shops of the system.

W E Miller, one of the most experienced passenger engineers on the Vandalia line, has been appointed traveling engineer. We believe this is the first time the "Van" has had an officer in this position.

Mr. A. W. Gibbs has retired from the position of superintendent of motive power of the Georgia Central, and the mechanical department will in future be run by the general superintendent.

Mr. John Grace has been appointed superintendent of motive power and construction of the Pavenir de Matehuala Railroad of Mexico. He was formerly general superintendent of the Monterey & Gulf road.

Owen Owen, general foreman of the D. & R. G. shops at Salida, Col., has been made assistant master mechanic of the second division in charge of the west end. Owen came up from the ranks, and the sequel of his success is summed up in the remark of an official of the road when he said, "Owen Owen knows his business—and attends to it."

Mr H. L. Leach, Jr, master mechanic of the Cheshire Branch of the Pitchburgh Railroad, has been transferred to the Tunnel division of that road.

The office of master mechanic on the South Carolina road has been abolished and that of superintendent of machinery created. E. M Roberts will fill the higher office and draw the better salary as modestly and as regularly as he did in the old place.

A correspondent writes informing us that E Mills, Oil City, Pa., one of our subscribers, lost his life in the terrible disaster that overtook that place last month, and that every member of his family perished, consisting of himself, wife and five children.

Mr. George Gilmore has taken charge of the motive power and machinery of the railroads in Jamaica in place of Mr. Sague, who has gone to the Schenectady Locomotive Works as mechanical engineer. Mr. Gilmore was at one time in the service of the Erie

Among the members of the Railway Master Mechanics' Association who expect to send sons to compete for the scholarships at the Stevens Institute are W C Ennis, John Medway and J. D. McIlwain R W. Bushnell talks of sending his son, Edward, to try for one of the scholarships in the Stevens Preparatory School.

W D. Lee has been appointed superintendent of the Rio Grande Southern Railway, in addition to his other duties as assistant master mechanic, with headquarters at Ridgway Junction, Colo. Brother Lee is an old-time engineer of the D. & R. G., was traveling engineer of the third division for a long time, and is the right man in the right place.

Mr. Herbert Higgins, who has been connected with the Northern division of the Great Northern Railway for the past ten years as general foreman of machinery, resigned recently to accept a position on the A., T. & S. F. Railway at La Junta, Col. On his departure the employés presented him with several pieces of solid silver as a token of esteem.

A highly respected Western correspondent sends us a rather lengthy account of the life of Mr. A. D. Kilbourn, master mechanic of the Southern Pacific at Dunsmuir, Cal. From the account, we learn that Mr. Kilbourn rose from the footboard to his present position, and that he is one of the most efficient and popular master mechanics on the Pacific coast.

Mr. J. W Philbrick writes us, saying that the point in his biographical notice in the June number of LOCOMOTIVE ENGINEERING, crediting him with building in Waterville the first locomotive built in Maine, was not correct. The Portland works had been building locomotives for twenty years before that time. We might say that the mistake was not ours

Mr David Patterson, general foreman of the Union Pacific shops at Omaha, Neb., for the past year, has been appointed master mechanic of the Utah division of the U. P. with headquarters in Salt Lake City, *vice* A C. Hinckly, resigned Mr. Patterson has worked his way up, starting in as machinist apprentice at North Platte, Neb., in 1868, and is counted a good man in the motive power department. He has never worked for any other road.

General Manager Tucker, of the Phillips & Rangeley Ry., has posted the following notice "Mr. L. H. Wheaton having resigned the office of train master and track supervisor, Mr. George Phillips has been appointed superintendent, with office at Phillips. He will have charge of the motive power, maintenance of way, and car departments and train service, and his orders will be respected and obeyed accordingly Mr Phillips will report to the general manager."

On June 14th, Mr. Joel West, master mechanic at West Burlington, Iowa, for the C., B. & Q, was appointed master mechanic of the lines in Iowa for the same company, with headquarters at West Burlington, Iowa. Mr. West has been in charge of the machine shops at West Burlington since they were built, and has turned out a great many engines which give the best of satisfaction Mr. West has been master mechanic at different points of the "Q." system for the past twenty years.

Mr. J L. Greatsinger, who was lately elected president of the Duluth & Iron Range, rose through the mechanical stepladder He was successively fireman, engineer, engine-house foreman and master mechanic. Four years ago he went to be master mechanic of the road of which he is now president, then was promoted to be general superintendent, and subsequently made general manager. Mr. Greatsinger is a member of the Master Mechanics' Association, and takes a warm interest in the affairs of the organization.

Sydney Dillon, one of the oldest railroad managers in the country, died at New York, last month. Mr. Dillon is best known to railroad history as having been the leading manager in the building of the Union Pacific. The biographical sketches of his life say that he was born in 1812 and that he entered railroad life as an errand boy on the Mohawk & Hudson. As this road was opened about 1835 he was a fairly old boy, but it is certain that he did his first work on that road. Of late years Mr. Dillon has been closely identified with the Gould roads.

H M. Davis has resigned from the position of M M. of the Tunnel Division of the Fitchburg R. R. Mr. Davis has been connected with the road almost continuously since 1870, when, after serving his apprenticeship in Manchester, N H, he entered as a machinist in the shops in Fitchburg, Mass., and rose to the position of foreman under Master Mechanic W. A Foster. In 1884 he left the road for six months, going to Taunton, Mass, but the same year accepted the position of master mechanic of the State road under A W Locke, general manager He continued in that capacity until the Fitchburg took this road in 1887, when he became foreman of the shops, and later, when the new shops were built at Williamstown, he was transferred there to take charge. In November, 1890, he came back to Fitchburg as master mechanic of the Tunnel Division.

O. A. Haynes, formerly master mechanic of the St. Louis, Iron Mountain and Southern, died at Lebanon, Mo, May 20th, aged 64 years. He was born in Massachusetts, and in 1852 became superintendent of large locomotive works at Springfield, Mass. In the winter of 1854-55 he assisted in constructing the Providence & Bristol Railroad, and in 1856 he went to New York, being with the Rome, Watertown & Ogdensburg. In 1871 he became master mechanic of the Iron Mountain & Southern, and in 1882 went to Texas as superintendent of machinery for Gould's Southwestern system. In 1885 he returned to St. Louis as general inspector of locomotives and machinery, which position he held until 1888, when the office was abolished He was then agent for the Missouri Car and Foundry Company until January, 1891, at which time the Carondelet Electric Light & Power Company was organized, and he was elected general manager.—*Railway Age.*

Mr. Edwin M. Herr, for several years master mechanic of the Chicago, Milwaukee & St. Paul, with charge of the West Milwaukee shops, has been appointed superintendent of the Grant Locomotive Works, Chicago. Mr. Herr has had a varied and valuable railroad experience. When a lad he learned telegraphy and entered railroad service, rising to the position of station agent. Thinking that the mechanical department offered a better field for an ambitious young man, he left railroading for a time and entered an engineering school. After finishing this course he went into the West Milwaukee shops and worked as a machinist for a year or two. Then he accepted a position in the engineering laboratory of the C., B. & Q., which he left to become superintendent of telegraphs of that road. This position he held for several years, but his heart being in engineering work he left there to be master mechanic of the West Milwaukee shops. No man is more deserving of advancement in his chosen profession, and we congratulate the Grant Locomotive Works on their choice.

## CONVENTION NOTES.

The Shawnee & Hocking Valley Railroad have ordered fourteen engines from Baldwin's. They will be fitted with all the most approved appliances for convenience in handling and will have Jerome rod packing

The Brooklyn & Brighton Beach Railroad people have been experimenting with the Strohm Automatic Electric Block signal system and we have received very favorable reports. The system is so arranged that in case of two trains getting upon the same block, appliances are put in operation which automatically shut off the steam of the engine and apply the brakes. Several public trials of the apparatus were made and everything worked very satisfactorily.

Not long ago Superintendent of Motive Power Joseph McConnel, of the U. P., changed a 19x24-inch ten-wheeler with a 62-inch wheel, with the hope of getting better time out of her on grades and with heavy trains. He cut her wheels down to 51 inches and shortened her eccentric blades from $92^5_8$ inches to 45 inches. This made her valve motion quicker, and did away with a great deal of the tendency to tear the lever out when running shut off.

There was one thing left out by the committee appointed last year by the Master Mechanics' Association to investigate the subject of iron and steel which deserves to be considered. That is the form of test piece to be used. The form of test piece used very materially affects the results as to tensile strength and elongation. There is quite a diversity in the form of test pieces, and this is a point where there ought to be uniformity. We hope that in the report submitted next year this committee will recommend a standard form of test piece.

A very good point was made by Mr R. H. Soule during a discussion on air-brakes He quoted from a report, the words "When the construction of freight brake gear has become more uniform," and remarked As chairman of the committee on standards to report at the convention, he was prepared to report that there was hardly any standard of this association which commanded more respect and which had been adopted more fully than the standard freight brake gear. His report would also show that iron brake-beams were in almost general use.

On the 26th of April, engine 921, a Wootten firebox consolidation, 20x24-inch cylinders, weighing 100,000 pounds, took an immense train—the heaviest we have ever heard of—over the P. & R. road. There were 250 coal cars, four-wheeled, and a caboose behind the engine. The train was 2,566 feet long and weighed 860 tons; it was hauled 68 miles in eight hours, the engine burning seven tons of buckwheat coal, worth 35 cents per ton at the mines. The engine was fitted with the Smith triple expansion exhaust pipe, and carried 140 pounds of steam The road is practically level.

A very good practice has been adopted by Mr. John Mackenzie, of the N. Y., C. & St. L., with his car inspectors. When the new book of "Rules of Interchange of Cars" comes out, he subjects each inspector to an examination of how he understands the various rules. No inspector begins making decisions under the new rules until it is found that his interpretation of each article agrees with that of his chief. Under this system it is the head of the department who decides each case that arises. If this practice were generally followed there would be fewer disputes at interchange points.

The French Spring Co. are directing attention to the fact that the Morris V-shaped band has now been in use on locomotive springs for four years and is proving a very decided success. Its use improves the riding of the engines and makes the spring more durable. Among all the springs that are in use there has been no case of breakage reported. The reduction of band on the short plates imparts increased motion, and prevents the tendency to force the small plates against the band that so often leads to breakage and deficient elasticity when rectangular bands are used.

The Stow Manufacturing Co., Binghamton, N Y., has published an illustrated catalogue of their apparatus. Any one not perfectly familiar with the numerous ways that power can be transmitted by flexible shafts should send for this catalogue. Business is reported to be very brisk with this concern, which indicates that people are rapidly learning the advantage of using flexible shafts. The flexible shaft first took a place as a standard tool in dentistry, then gradually obtained a foothold among machinists, and at the present writing wherever, on account of weight or position, it is desirable to take the tool to the work instead of the work to the tool, the flexible shaft is considered almost indispensable in a well regulated shop.

During a discussion on cast-iron wheels at the Master Car Builders' Convention, Mr. J. N. Barr, of the Chicago, Milwaukee & St. Paul, surprised the members by making a statement that about 40 per cent. of the wheels in locomotive trucks failed by "shelling out," and that only 17 per cent. of wheels under cars failed from this cause. Mr. Barr had devoted careful attention to the subject and there was no question that his figures represented common practice. The tendency of those who heard the statement was at once to conclude that the action of the brake-shoes had the surprising effect of preventing the tread of the wheel from the defect called "shelling out." Reflection, however, brought to mind the fact that truck-wheels have never to be removed for the causes that lead other wheels to an end of their usefulness. Sliding flat spots and cutting of flanges send a great proportion of other wheels out of service Truck-wheels are entirely exempt from the trials of sliding and they are not removed very often for sharp flanges. When all the facts are considered, it is not surprising that such a large proportion of truck-wheels are removed for shelling out.

## Railroad Mechanical Conventions.

The friends of both the railroad mechanical associations have reason to be gratified with the work done at both the conventions held at Saratoga last month. The papers presented in the form of reports were unusually valuable and interesting, and the discussions that were excited by the various subjects introduced brought out much valuable information.

The address of President Kirby, of the Master Car Builders' Association, was full of congratulation of the good work performed by the association. No one is better able than Mr. Kirby to appreciate the condition of railroad rolling stock now as compared with what it was before the work of this association began. The work done was the arresting of individual movement toward a chaotic condition of cars that would have seriously retarded the free movement of freight. There is a great deal to be done to secure the desirable condition of uniformity, but there is great reason to be thankful for the work accomplished.

The most important work done by the M. C. B. Convention was the adoption of the recommendations of the committee which reported on Instructions for Air-brake and Train Signal. This was also adopted by the Master Mechanics' Convention, and there is now a uniform code of rules on this important subject.

As usual, a great part of the time devoted to the Master Car Builders' Convention was spent in discussing the Rules of Interchange of Cars. It seems a pity that a code of these rules cannot be adopted that would work without alteration for five or six years. The changes constantly introduced in these rules are very confusing to the men who are required to enforce them.

Unusual interest was manifested in the Master Mechanics' Convention, owing to the anticipated report on compound locomotives; many of the members having been instructed by their management to ascertain all they could on the subject. This probably helped to increase the attendance, for it was by fifty names the largest convention ever held.

The address of President Mackenzie indicated plainly the growing popularity of the association, which has doubled in membership within five years. While referring to President Mackenzie it seems merely justice to say that he made a remarkably able presiding officer, and that he has exerted a powerful influence in favor of the association of which he was president for two years.

The reports submitted were notable for the amount of original research represented, and they were all got out in a shape that was highly creditable to the committees. All the others were, however, overshadowed by the report on compound locomotives, the credit for which was due to the chairman, Mr. George Gibbs. This report is of a character that would excite the greatest attention in the highest engineering society in the world, and it is certainly the best paper that has ever been submitted to the Railway Master Mechanics' Association. It is a paper hard to condense, and we regret that time prevents us from giving extracts from it in this issue. We strongly advise those interested in compound locomotives to obtain a copy of the report and of the discussion that followed the reading of it. The report and discussion make a contribution to the literature on compound locomotives well worthy of being studied and preserved. The report was discussed for more than four hours, and at the end of that time the subject did not seem to be exhausted. The views expressed were highly diverse in character and it cannot be said that either side had much the advantage of the other. There were speakers who were very ardently in favor of compound locomotives for every species of service, and others who were strongly impressed with the belief that the movement in favor of that kind of engine is merely a popular fallacy likely soon to pass away. A great number of the speakers were able to judge respecting the merits of the question under discussion, for they either had compound locomotives in use or had enjoyed opportunities for watching the performance of that kind of engine. When we dispassionately weigh the evidence presented, it appears certain that the report of the committee and the discussion thereon have been favorable to the compound locomotive.

The report on tests of iron and steel elicited a lengthy discussion in which considerable information was imparted relating to steel. A departure from established practice was made by permitting steel experts who were not members of the association to express their views. The members present were certainly the gainers by the innovation. The report and the discussion thereon indicated that the steel used in fireboxes is by no means perfect for the purpose, but how the matter could be remedied was not clearly shown. There appears to have been more complaints within the last year of steel sheets failing than there have been since the material became recognized as the best metal for fireboxes. The probability is that the demand for cheap steel has a good deal to do with the failures.

After being on the roll of subjects for five years the question "Can we indorse, from a mechanical standpoint, the action of the Master Car Builders' Association in recommending the vertical plane type of coupler as a standard?" has been at last answered in the affirmative. It is satisfactory to find both associations agreeing on this important question.

The report on boilers for high-pressure locomotives and the discussion thereon strongly brought out the fact that radial stay boilers and the Belpaire boiler are making rapid progress into popular favor. They also showed that high-pressure steam or a pressure above 150 pounds to the square inch is getting to be very common. The line of weakness about boilers carrying steam of this tension is the stay-bolt. An interesting discussion arose on the methods of increasing the durability of stay-bolts, and numerous valuable suggestions were given.

The report on standard bolts and nuts was a paper of high value and is likely to exert a good influence in directing the attention of railroad men to the necessity for adhering to standards. There has been no endeavor in the interests of interchangeability and uniformity so important as the establishing of standard screw threads, and any tendency to depart from this standard is that of wandering into the wilderness of chaos. It is a common thing for parties ordering tops or screws to specify from $\frac{1}{64}$ to $\frac{1}{32}$ above the standard size. The men who do this kind of thing are the class that can never leave well enough alone. They are so overpowered with the importance of having ideas of their own that they will breed no end of confusion to ventilate their own egotism. When this report was under discussion a motion was adopted directing that a circular be sent out to railroad managers and others, urging the importance of keeping to standards when ordering rolling stock. We have no doubt that this action will be productive of good results.

The convention did a very graceful act in the finish of its work by electing as next President, Mr. John Hickey, who was prevented through a death in his family from being present.

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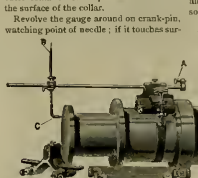
A number of tests were made lately at Cleveland with the Chapman jack which proved that the jack would bear an enormous pressure without failure. This jack has become exceedingly popular with engineers, because it is always clean, always oiled, and always ready for business, no matter how long it may be since it was last in use.

## Standard Crank-pin Gauge.

The standard crank-pin gauge illustrated in the annexed engraving is a tool that ought to be used in every engine house. It is applicable to any form of engine having a protruding crank-pin, but it is particularly useful for locomotives where bent crank-pins are extremely common. Besides indicating when crank-pins are bent this gauge shows when the pin is worn. Bent or distorted crank-pins are destructive to the machinery of the engine and dangerous, so that it is highly important to have an easy means of demonstrating whether or not they are all right. This is furnished by the gauge shown, and it will determine in a few minutes the existence of any defect.

To determine if crank-pins are at right angles with face of hub or disk, or parallel with crank-shaft, mount the gauge on crank-pin as shown in cut, set up testing-screw A until it touches the face of crank-pin hub, revolve gauge around on journal of crank-pin; watch point of testing-screw; if it touches face of pin-hub all around, the pin is at right angles. If it is open at one place on face of hub and touches at another, the pin is certainly bent. To determine if journal of crank-pin is round and true with center of crank-pin, mount gauge as shown in cut, excepting adjust the straight point of needle B to rim of outer collar of crank-pin until it touches the surface of the collar.

Revolve the gauge around on crank-pin, watching point of needle; if it touches surface of collar all around, the journal is round and true with center of crank-pin, but if the needle touches surface in places and shows open in other places, the journal is out of round or eccentric.




With a pair of hermaphrodite calipers, from the rim of collar on outer end of crank-pin scribe a center, then on outer end of crank-pin with a pair of dividers inscribe a circle on end of pin, draw diameter lines, mount gauge on crank-pin as shown in cut, set bent end C of needle B on intersection of circle and diameter line, revolve gauge around on journal of crank-pin, and the amount of eccentricity of journal of pin will be transferred at once from journal to outer end of crank-pin.

The gauge is manufactured by M. C. Hammett, Troy, N. Y.

## Stevens Preparatory School.

In the report submitted by Secretary Sinclair to the Master Mechanics' Association mention was made that an arrangement had been effected with the Trustees of the Stevens Institute of Technology, to admit scholars to the Stevens Preparatory School. There will be openings for two scholars in September next. This is an excellent school for youths preparing for college, and those passing through it receive training that enables them to enter an engineering college without difficulty. Members of the Master Mechanics Association would do well not to neglect the opportunity offered in connection with the Stevens School.

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The following are the officers elected by the Railway Master Mechanics' Association at the Saratoga Convention: President, John Hickey, superintendent of motive power Northern Pacific, St. Paul, Minn.; First Vice-President, William Garstang, superintendent of motive power Chesapeake & Ohio, Richmond, Va.; Second Vice-President, R. C. Blackall, superintendent of motive power Delaware & Hudson, Albany, N. Y.; Treasurer, Orlando Stewart, superintendent of motive power Fitchburg Railroad, Charlestown, Mass.; Secretary, Angus Sinclair, Editor Locomotive Engineering, New York.

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The recent orders received and shipment made of the Eberhardts' improved automatic tools for electrical and other work demonstrates very clearly that there is an increasing demand for good substantial tools which will stand the severe test of use in shops which are run to produce dividends on the money invested. Those who put their money in new enterprises should see to it that their plants are fitted up with tools of this character, which, although requiring a greater outlay in the start, will pay over and over again in the dividend-earning capacity of the plant.

---

We are in receipt of several letters from firemen telling what perfect idiots their engineers are, and stating their reasons for believing them such. As a rule, this is an indication of a young, fresh, throttle-struck fellow who thinks he knows all about locomotives three months after he sees one. Don't be too critical, boys, "keep cases" on the old man and see how it is that he gets along knowing so little—but don't give yourselves away as critics. We've all been there. You won't think you know so much in five years from now.

---

A friend of the paper writes:

We broke the flange on pony truck and got off track pretty bad. While we were working at the engine, Dennis, the fireman, was trying to get water in her, but both injectors declined to put water into boiler and furnish it at the same time. We were getting the jacks and frogs into shape for an effort when Dennis stuck his head out of the cab and said "If ye's don't git her on purty soon, we'll have to *cut and run* for wather." Dennis was a Spaniard.

---

The E. T. V. & G. have issued an order that conductors and engineers must pass a satisfactory examination on air-brakes to remain in the service. The boys are reported to be hunting information with a will now.

---

A new eight-wheel engine has lately been built in the Muskegan shops of the Chicago & West Michigan. She has cylinders 17x24 inches, 62-inch wheels, carries 160 pounds steam pressure and weighs 84,000 pounds.

---

There are some interesting special tools in the machine shops of the Cambria Iron Works. There are a great variety of multiple drills, one gang drill having twenty-four spindles. They have also planers cutting in both directions.

---

The Buffalo, Rochester and Pittsburg cars were let as follows 400 to the Berwick and 100 to the Buffalo Car Co.

---

The car shops of the N. C. & St. L. were burned on the 20th of June, together with seventeen cars that were undergoing repairs.

---

The Jacksonville, St. Augustine & Halifax River Railroad are about to contract for five locomotives, fifteen coaches and two drawing-room cars.

---

The Brooks Locomotive Works have taken an order from the Buffalo, Rochester & Pittsburgh Railroad for nine engines for delivery in September.

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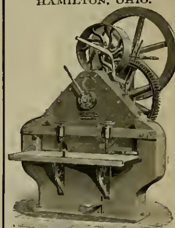

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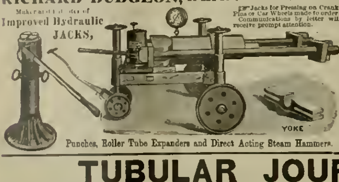


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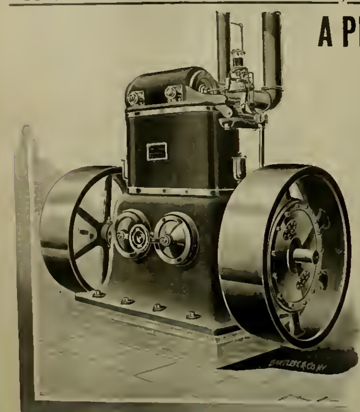
# A PLAIN STATEMENT OF FACT.



THE Compound Engine, when non-condensing, so far from possessing an economy superior to the simple engine, has been decisively proven, "much to the disgust of the stockholder," to show normal economy only at or about its rated power, and to fall off in economy faster than a simple engine as the load falls off; moreover, very much faster under the extreme light loads that are common at times in many industries. This point is at last reluctantly admitted by the more candid builders of such engines, most of whom now advise against compounding for variable loads. The reason is in their inability to divide the load and range of temperature proportionately and automatically between the cylinders at all points of cut-off. Hence, the low-pressure cylinder expands its steam below atmosphere under a moderately early cut-off, thus converting itself into an Air Pump, and becoming a load upon the high-pressure cylinder instead of a co-laborer with it. This point was distinctly foreseen by the designers of the Westinghouse Compound Engine, and an entirely new principle was worked out, making expansion below atmosphere impossible under any load, however light. **For the first time in the history of Steam Engineering, either Simple or Compound, is built an engine which maintains essentially uniform economy, irrespective of load,** and hence for the first time the Compound Non-condensing Engine has been made practicable. The results, demonstrated by test, show that where an ordinary Compound will range from 25 lbs. to 70 lbs. water per H. P. per hour from full to quarter load, the Westinghouse Compound, between the same limits, will range from 23 lbs. to 29 lbs. We have not deceived ourselves in this matter, and propose that the facts shall be understood. To those interested in the nicer points involved we will be pleased to send a reprint of the Paper read by Mr. F. M. Rites on this subject at the late meeting of the American Society of Mechanical Engineers at San Francisco.

# WESTINGHOUSE, CHURCH, KERR & Co.,

ENGINEERS

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## Furniture Car of 60,000 Pounds Capacity.

Mr. W. S. Morris, superintendent of motive power of the D., L. & N., C. & W. M. and S. V. & St. L. R. R. system of roads, has recently constructed at his Muskegon shops a furniture car possessing some novel features. Besides the admirable construction, as shown by the drawings, every possible inch of space for storage consistent with the height and width allowable, has been utilized. The inside finish is smooth and flush, and the height in the clear throughout (with a total height of 12 feet 3¾ inches from top of rail to top of running board) is 8 feet 7½ inches inside. This desirable gain of inside space is made possible, *first*, by the design of the truck (Fig. 1.) where the top of arch-bar is no higher than the top of the M. C. B. box plus the thickness of the arch-bars; *second*, the form of body bolster used being of iron and housed in the main timbers (Fig. 2) allowing the underside of the sills to come down to within 29¼ inches of top of rail; *third*, the last and most important feature is the "Morris Patented Roof," dispensing entirely with carlines and throwing into the interior of the car the space usually occupied by the carlines and the ceiling boards. This is a decided step in advance of present methods. To support the roof, taper sheathing (Fig. 3), or carline-shaped planks, form a self-supporting roof sheathing with roof slope on top, and their bottom side forming a continuous horizontal interior ceiling without carlines, rods or other obstruction. At each side-post a corner band of ½x2½-inch iron is screwed to outside of plate and to the underside of sheathing, being let in flush therewith. This taper sheathing is made from plank 3 inches thick sawed down to the desired thickness at the eaves. These are cut from a long plank, say 15 or 16 feet in length, from which are sawed out three 9-foot 6-inch roof pieces.

Comparing the dimensions of this car with the car recently adopted by the Pennsylvania Company, the difference is at once apparent:

| | Morris Car | Penn Car |
|---|---|---|
| Inside measurement in the clear: | | |
| Height. | 8' 7½" | 8' 7" |
| Length | 40' 0" | 40' 0¾" |
| Width | 8' 9" | 8' 6" |
| Outside over all: | | |
| Height | 12' 3¾" | 13' 0¼" |
| Length | 40' 8½" | 40' 11¼" |
| Width | 9' 4½" | 9' 3¾" |
| Cross sectional area. | 75 47 sq. ft. | 72 96 sq. ft. |
| Cubical contents. | 3,018 75 | 2,922 89 |

It will be noticed that the Pennsylvania Company's car is 8½ inches higher outside than the Morris car. Assuming that this height is the maximum allowable height and figuring the Morris car on the same basis of length and width inside, and the totol allowable height above the rail outside, then the two cars would compare as follows.

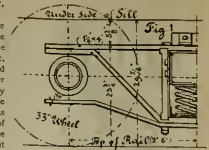
| | Sectional area in square ft | Cubical contents |
|---|---|---|
| Morris car | 79 33 | 3,178 29 |
| Pennsylvania Co. | 72 96 | 2,922 89 |
| In favor of Morris car. | 6.37 | 255 40 |

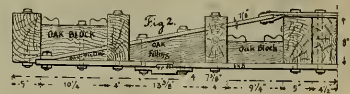
In furniture cars the net inside height is of every consequence, hence the plan is worthy of close scrutiny.

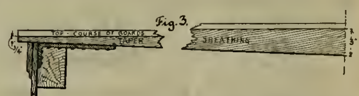
Engineer S. Harney has been promoted to be roundhouse foreman of the Florida Midland at Kissimmee, Fla.

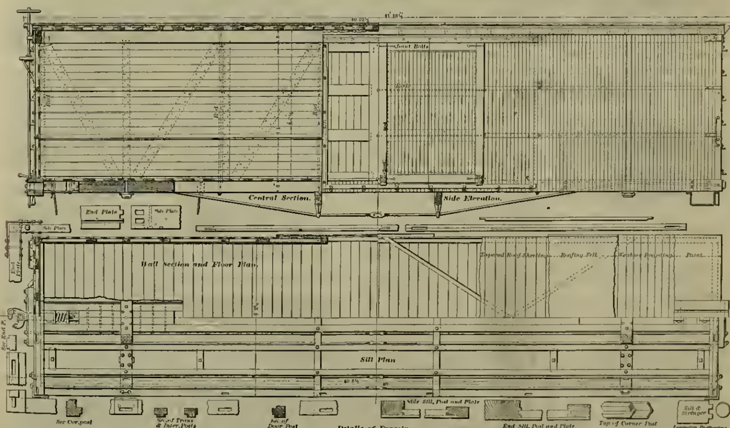
## Cars of Great Seating Capacity.

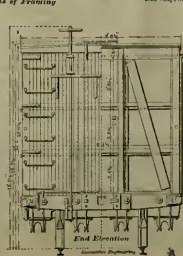
The annexed engraving represents the plan of cars that are in some respects the most extraordinary railroad cars in the world. They are run on the Quebec, Montgomery & Charlevoix Railway, and provide seating accommodation for over 100 persons. The cars were designed by Mr. W. R. Russell, superintendent of the road, and are intended to carry the crowds of pious pilgrims who visit the shrine of St. Ann at Beaupré, near Quebec. The pilgrims are mostly poor people who cannot afford to pay a high railway fare, and the company transporting them has gone to the limit of carrying the people comfortably at low cost.



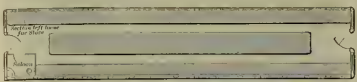

Mr Russell, writing to us about the cars, says "The plan of construction was carried out exactly as shown in the blue-print, with the exception that the width was increased to 9 feet and 10 inches. As regards the carrying capacity of the car, I have, as I told you when in Quebec, counted 135 seated in one car. On the 2d of August last, train No 35, with ten of these cars, carried 1,402 passengers, and a special, on the same date, carried 982 passengers in eight cars.

"On July 12th last, train No. 33 carried 1,428 passengers in eight of these cars and four regular cars, accommodation of the latter 56 seats each, and a special on same date carried 1,275 in eleven cars—eight pilgrim cars and three regular.

"Of course these are extreme cases, and

I would have put more cars on the trains had I been able, but the facts remain that these crowds were handled as above, and show the cars' suitability to our work. The car weighs about 36,000 pounds, is lightly framed and well built. We have twelve of them altogether, and I think from present indications we will have them all filled on many trains during the coming summer.

"The cars were built by Messrs. Jackson & Sharp, Wilmington, Del., and incidentally I will say that they were turned out with great rapidity—four of them were built, completed, painted and shipped between the 1st of July and the 21st of July, 1889. This is the more remarkable as the cars are, I think, four inches wider than the ordinary car built by this firm."



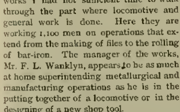
## Grand Trunk Shops at Montreal.

The shops of the Grand Trunk Railway at Montreal are in some respects different from any other establishment of the kind on this continent. The purpose of the works is not only to build and repair locomotives and cars, but to manufacture from the raw material many of the appliances used in all departments of the road. This is following the English practice and however wise, or otherwise, the policy may be, it requires a large establishment to carry on the work. During a brief visit to the works I had not sufficient time to walk through the part where locomotive and general work is done. Here they are working 1,100 men on operations that extend from the making of files to the rolling of bar-iron. The manager of the works, Mr. F. L. Wanklyn, appears to be as much at home superintending metallurgical and manufacturing operations as he is in the putting together of a locomotive or in the designing of a new shop tool.

The greater part of the shop tools used are of English make, but they are the best of their kind and are well placed and run with all the vigor that comes from the general use of contract work. There are many tools specially designed for certain operations, which they perform very expeditiously and accurately. The holes in the tumbling shafts are bored in their own centers in a special machine and they come out true every time. They are putting retaining rings on all their driving-wheels and have several special tools for performing the work of forcing in the bolts and riveting them. They have a form of quartering machine which was new to me. It has a milling attachment for cutting the key-seat in the axle.

The work of the different departments is grouped together and every facility provided for convenience in production in handling and in the distribution afterward. The tool-room of the works is one of the best in the country and is well furnished with all the small appliances necessary in a shop where accuracy of reproduction is rigidly enforced.

They have a peculiar way of weighing the engines and one that is well worthy of imitation by American roads. A fulcrumed lever is employed of the form illustrated in the annexed engraving. The toe of the lever is placed under the tire of each wheel and the weight extended on the long arm till the wheel is raised off the rail. One apparatus is required, of course, for each wheel. The expense of a set is not great and it supplies a highly convenient form of weighing apparatus that is always ready for use and easily applied.



The erecting shop for locomotives has a capacity of about 50 engines and is arranged in two rows on the stall plan, with a transfer table between the rows. There were about 40 engines in the shop, many of them undergoing very heavy repairs. The engines receiving heavy repairs are all grouped together in the place where material can best be moved to and from them. When I first visited these shops the locomotives were of rather mixed designs with a strong tendency toward the British forms with which the road was originally equipped. At that time the men in charge said that there were good points peculiar to the British and to the American locomotive, and that it was the intention of the Grand Trunk Railway to secure the benefit of both. When next I walked through the shops I found that the British features were becoming smaller; this time I found that the only English peculiarity left was the painting of engine and tender a bright color. They use straight boilers, but that is quite common among American locomotives.

Several peculiarities of the shop are well worthy of imitation. Great care is bestowed upon protecting the boilers and cylinders from climatic influences. The boilers are covered with mineral wool put on in a manner that insures the exclusion of coal. The cylinders and steam chests are cast with an outside casing, and this is filled with mineral wool. Those familiar with the enormous waste of heat due to inferior boiler and cylinder covering will agree that the Grand Trunk people follow a profitable practice in systematically providing the means to save heat.

Speaking of cylinders, I would say a word about the foundry, which is a pet of Mr. Wanklyn's, and is conducted with unusual skill. Their cylinders are rather a difficult pattern to cast, but they have not lost one for over a year. They are putting in a Tabor molding machine which is in line with their ordinary policy of having the most approved tools for producing work.

This company has long been an example to others in machinery for boiler-making work. Punching, shearing, flanging and riveting have all been done by hydraulic machinery for years, and the shop compares yet very favorably with the most modern American shops which have profited by the experience of two continents in selecting the most approved forms of boiler-making machinery.

A. S.

## Goldsboro Shops of the T. & P.

Opposite New Orleans a little above Algiers is the little town of Goldsboro, the terminal of the Texas & Pacific at the Gulf.

The shops are not large and show only too plainly to the initiated that the machinery department is subject to those depressing chills caused by some such order from Wall Street as "Cut down your pay-roll 80 per cent. on the 15th."

I didn't say a word to anyone there about it, but I would have been willing to gamble then and there, when I got into the shop, that the choking process had been going on for some time—it's just as plain to a railroad man as the symptoms of mumps to a doctor.

Master Mechanic Addis makes the best of everything and was bringing some engines through the shop, but everywhere was the evidence of lack of men and material.

A moderate-sized eight-wheeler seems to be the usual machine used; most of them have short fronts and the Brown stack, a huge cast-iron balloon with a six-inch pipe from the large part of stack back to the ash-pan. This affair the men call the "elephant trunk." Cinders are supposed to go back to the ash-pan and try it again, but very often the acre or so of fine netting in the stack stops up and then the gases ignite at the ash-pan end of the "trunk"; then the decks, cab, and, sometimes, the men take fire. Lately they have been amputating the trunk close up to the stack and turning it into the front end.

Formerly the blow-off pipe was carried to the ash-pan and this was cleaned out in this way, but they soon found that fire was often set by coals that escaped the blast and the pipes were taken out one side.

All around the shops are breastworks—not to keep out Yankees, but to keep out water; the Mississippi River is within a few feet of the shops.

Trains are ferried over the river to New Orleans on large transports. One of these boats was at the dock undergoing repairs. During the war this craft was a gunboat of the turtle-back type, her turrets having been removed and a couple of twenty-foot patches put over its holes. She was one of the iron gunboats made in such a hurry for river work, her plating being only ⅜ of an inch thick; the soldiers called them "tin-clads."

All the tools are in a part of the roundhouse, which is a very good building. I noticed that the stationary engine was set up very high and the big fly-wheel was entirely aboveboard; this was done to keep away from the water.

Up in Mr. Addis' office I observed a valve-motion model that had just arrived as a premium for a club of eighty-five subscribers to LOCOMOTIVE ENGINEERING, so it can be seen that the men on the road are anxious to keep abreast of the times, which, in fact, I find the rule rather than the exception in the South.

J. A. H.

## Locomotive Pattern Boiler with Extra Firebox for Burning Refuse.

At the shops of the Buffalo, Rochester & Pittsburgh road they have a locomotive boiler set up on an extra brick firebox long enough to take in anything likely to be thrown away at a planing mill. The box is big enough to burn shavings and saw-dust alone, and will take in ten-foot stuff; old cross-sills, car siding or ties without cutting.

## A Novel Car Coupler.

A new car coupler has been invented by Mr. William D. Williams, of Ogden, Utah. The inventing of a car coupler is not a rare event that would naturally call for special dispatches and the loud heralding through the land that something of a novel character is about to be submitted to the long-suffering race of railroad men, who have to give reasons why their companies should not patronize the newest invention. The inventing of car couplers is a monument to the fertility of American inventive genius, and shows the infinite resources of the human mind in producing diversities of forms designed to perform uniform functions. To be sure there are many of the patented car couplers that are curious, principally on account of the mystery that enshrouds "the new and valuable part" on which a patent is supposed to hang.

But there is no mystery as to the novel features of Mr. Williams' car coupler. The drawbar consists essentially of a head with two horns, a big teat and a jaw. One horn bends gracefully upward and the other is set downward. There is a movable strap which in action falls down and embraces the upper horn. When two heads of this kind are butting against each other, both the upper horns are embraced by the straps and the teats are pushed into the open jaws. It would be certain to make a secure coupling if the heads were of the same height.

---

A paper was lately read by Mr. A. H. Bauer, electrician of the Pullman Car Co., on "The Lighting of Railway Cars by Electricity," which gave particulars of no end of difficulties encountered in keeping an electric system in good working order on railroad trains. The expense is very great, and the system of depending on the locomotive for power is not considered reliable. He considers that some practical method of driving the dynamos by the car axle essential to the permanent success of electric lighting of railroad cars.

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When a committee of one technical society is co-operating with a committee of another society, it might be considered common courtesy to ascertain the exact name of the organization if it is mentioned in print. A committee of the American Society of Mechanical Engineers, co-operating with a committee of the American Railway Master Mechanics' Association in regard to locomotive tests, writes about the "American Association of Railway Master Mechanics."

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There seems to be a queer state of affairs existing on the Northern Railway of Spain, says the *Railway Herald*. It is stated that at Barcelona two thousand of the company's employés struck work last Saturday for an increase of working hours. They worked nine hours a day, but demanded longer hours with a proportionate increase of wages. At the same time a number of men employed at the same company's shops at Valladolid are reported to have struck for a reduction of hours. Why don't they change places, and so settle the difficulty?

---

A terrible accident happened on the C. C. C. & St. L. last month through the failure of an engineer or a telegraph operator to remember a change of time due to a new time card. The result was a head collision, causing the death of seven men and the injury of several others.


## Safe Railway Working on the New South Wales Railways.

*Editors* :

In reading the back numbers of the Locomotive Engineering, I came across some able articles on safe railway working, with regard to proper signaling of trains, and as your journal advocates any system of signaling that will keep trains apart, I will give you an insight to the different systems adopted on the New South Wales Railways.

When the present commissioners, Messrs. Eddy, Oliver and Fehon took over the New South Wales Railways there was not 30 miles of block signaling, and what there was, was confined to the suburban lines in and about Sydney and Newcastle.

I now give you the last return to July, 1891, showing number of miles of line in which the traffic is worked under the absolute block system; also, number and percentage of places which have or have not points or signals interlocked, since the commissioners took control of our railways:

| Date to end of | Number of miles of line opened for traffic. | | | Number of miles of line on which the traffic is worked under the *Absolute Block System* | | |
|---|---|---|---|---|---|---|
| | Double. | Single | Total. | Double | Single | Total. |
| Oct., 1888. | 71½ | 2,042½ | 2,114 | 28 | Nil. | 28 |
| July, 1890. | 78 | 2,103 | 2,181 | 72¾ | 189¼ | 262 |
| July, 1891. | 124 | 2,058¼ | 2,182¼ | 118¾ | 207½ | 326¼ |

| Date to end of | Number and Percentage of Places which have or have not *Points and Signals Interlocked* | | | | |
|---|---|---|---|---|---|
| | Number of Places. | | | Percentage. | |
| | Interlocked | Not Interlocked | Total. | Interlocked. | Not Interlocked. |
| Oct., 1888. | 104 | 318 | 422 | 24.63 | 75.36 |
| July, 1890. | 176 | 294 | 470 | 37.45 | 62.55 |
| July, 1891. | 234 | 262 | 496 | 47.17 | 52.83 |

The quadruple and double line out of Sydney are worked by Tryer's three-wire block instruments from signal-boxes about a mile apart. The greater portion of single lines are worked by the electric staff and tablet systems. To give a minute description of the different systems would take up too much of your columns. The commissioners are doing away with the old staff and ticket system, and where it is necessary are putting down crossing stations seven to nine miles apart and working it under the electric staff system; by so doing they get less stoppages and faster running—because the drivers know, when they get a staff or tablet, that they have a clear road, and if they have to stop or they break down there is no flagging to be done. For it is an impossibility to have two staffs out at the one time without breaking open the electric machine column, and I believe that when the commissioners' term of office expires in three and a half years, our New South Wales railways will be among the safest in the world with regard to safe railway working.

Our new South Wales signals say go or stop. The drivers have the biggest say as to where and how the signals are faced, by order of the commissioners, taking care at the same time to have the back light of the signals in view of the signalman.

Quick Action.

*Newcastle, N. S. W., Australia.*

## Another Air-Brake Puzzle.

*Editors* :

The following is not intended for the columns of the Ananias Club, but relates to an actual occurrence. A fast mail train was within one mile of a regular stopping point when the train parted. The air-brake applied automatically on the detached section and stopped it, but brakes on engine and forward cars were not affected. The engineer made the station stop, his brakes applying and releasing all right. It was night, and while waiting for the conductor's signal to start, he noticed there were no markers showing at rear end of train and investigating, found he had but three cars, two express and a P. R. R. box-car. The section that had broken away consisted of three postal-cars and a combination coach, the train parting between the box-car and first postal-car. Every stop-cock was open in the whole length of train pipe, excepting, of course, the one at the rear end of the last car. It was before the road had adopted the train air signal and the line of bell-cord had been passed up over the roof of the box-car; when the train parted the signal bell did not ring, and this fact, in connection with the peculiar action of the brake, furnishes material for a first rate air-brake puzzle.

Will W. Wood.

*Terre Haute, Ind.*

## Air-Brake Talk.

*Editors* :

In discussing the matter of plugging service exhaust the fact seems to be lost sight of that the equalizing feature would then be completely destroyed, while, if preliminary exhaust-port were plugged instead, there would, in case of passenger trains, be less liability of brakes being disturbed should a Frost light, or other reservoir on train, leak back into train-pipe after air on space above piston 17, plate D 8, had balanced by leaking through packing ring, and beside the train hand would not be subjected to so great a strain. It is also less work to plug the small port for this accident occurs so seldom that no one would want to carry anything specially for this purpose if it can be avoided.

In the same article Brother Desoe is called down in his statement about braking successfully on service-stop with small reservoir cut out; now, when two old air men disagree about such things each must have reasons for it, and I wish to try and explain, if I can, why such differences are not contradictory. The hole in preliminary exhaust bush in the latest brake-valves furnished measures $\frac{1}{16}$-inch, while on an occasional old one the hole will be as small as one-sixteenth, and besides has often accumulated scale or gum, thus contracting this opening, and it is my experience that such valves can be used in service-stop in this case and the difference hardly noticed on train. As to reservoirs with too great a volume there is, I believe, a tradition about pouring in melted rosin to reduce space.

About the stop-cock business, same page, the only explanation that seems at all reasonable is that, if used as shifting engines, main reservoir could control air governor through this cock, or brakes could be applied, and by cutting out the A stop-cock, and opening the B, the brake could be left on without getting too much air on short trains. In this connection, I would ask if experience does not prove it unwise to carry reserve pressure on two or three car trains when brakes are in good order.

I have often watched engineers do the one-second act and then put brake handle on lap and the change of expression in their faces when they roll by always puts me in mind of a little boy who is going to get an apple which he hid, but which some other boy has stolen. Probably friend Kidder knows something about this also.

I will try to make this clear, as I am often asked about it on the road. To illustrate, if we were to pour water through a bung-hole into a barrel until it is full and then roll the barrel over till the hole was underneath, then have a brick for a stop (or on lap) a few inches back and return the barrel to it, the hole would still be at the bottom and the water would all run out, and the same thing occurs with air in brake-cylinder in like case. When brakes are applied the pistons in triple valves are pulled down and air is admitted to brake-cylinder through graduating port in slide valves. With the release the piston is pushed up and as soon as it reaches the top begins to supply air to the auxiliary reservoir while air escapes from the brake-cylinder through exhaust port in slide-valve and will until brake-cylinder is empty. Now, if the engineer in this case would note the position of train hand, release his brakes *and immediately reduce train-pipe pressure again* until it was a few pounds below what it was before, he would have let *some of the air* out of his brake-cylinders and then *pulled* the triple-valve pistons down again so *air could not exhaust* from port in slide-valve. There is here and there a man who eases off the other way in stopping when his brakes are on too hard, but it will be found if investigated that he has merely kicked off the first couple of brakes.

Another point that I should like to mention in this article is, would it be considered the wisest course to pursue in case of possible accident to use the emergency stop on short passenger trains when brakes are working well? I have known cases where they would have stopped in a shorter distance in service-stop. The wheels would not have been slid and the terrible blow struck against the rails (*especially on curves*) would have been distributed more evenly and with less danger. How would such emergency stops compare with hammer blows or cannon shot? Is there not some air man who has made this his hobby and who could furnish us with his conclusions which would make very interesting reading, and which would be of great benefit to such emergency men as go to extremes unnecessarily?

George Holmes.

*Roanoke, Va.*

## That Gauge-Pipe Puzzle.

*Editor* :

Will W. Wood, Terre Haute, Ind., asks why the two gauge-pipes shown in the cut are connected. I will say this cock is placed there to enable the engineer to run either automatic or straight-air. In running straight-air this stop-cock connecting the two pipes should be open and cock (*a*) closed. By so doing the pressure will show on gauge whether brakes are on or off. The "pump regulator" or governor and both hands on the duplex-gauges will all work together. In running with automatic air this cock must be closed and stop-cock (*a*) open, this will allow one pointer on the gauge to work, also allow train-pipe pressure to governor when running; but when pressure is reduced in train-pipe by applying brakes the pump will pump an excess of air, thus insuring a quick release of the brakes. On three-way cocks a single gauge is mostly used, with two cocks, near three-way cock, in two gauge-pipes that run into one, this runs to gauge, with a branch running to governor.

The brakes should work all right in either case, either automatic or straight air.

Fred B. Armstrong.

*Camden, N. J.*

## Obstacles to High Piston Speed.

*Editors* :

One of the great difficulties of obtaining high speed with the locomotive, and the small load possible to haul, is due to the immense power necessary to keep the engine alone in motion. If we assume an 18x24-inch engine with 69-inch wheels, at sixty miles per hour, we find that the piston has to start from a state of rest at each stroke, and reach a speed of 30.6 feet per second at the middle of the stroke, and this in the space of one-twentieth of a second.

A falling body having the speed of 30.6 feet per second will have dropped through 14.6 feet as per the formula:

$$8\sqrt{h};$$

hence the work of each stroke of getting up this speed in the piston (and which must be done before a pound of careful hauling work is performed, and neglecting entirely the resistance of the wind, friction of balance of engine, etc.) is equal to lifting the piston, crownhead, part of main rod, etc., through a space of 14.6 feet.

If we assume this weight to be 650 pounds, we have $650 \times 14.6 = 9400$ foot-pounds. The pressure per square inch of piston necessary to accomplish this would be $\frac{9490}{252.7} = 37.5$ pounds.

The engine would make 292.5 revolutions per minute, and at each revolution the work of 9,490 foot-pounds would have to be performed twice in each cylinder; that is $292.5 \times 2 = 585$ feet that this weight would have to be lifted through in one minute for one cylinder.

Then the horse-power would be

$$\frac{585 \times 9490 \times 2}{33000} = 336.4 \text{ horse-power,}$$

which is alone consumed in keeping the two pistons up to speed.

It is clear that the average pressure of 37½ pounds per square inch, necessary to accomplish the work, is only necessary to be maintained through the first half of each stroke, so that the useful work performed is largely that due alone to the average pressure in the cylinder for the last half of the stroke, which is manifestly much less than that for the first half. This will be quite clear if we take an indicator card, and divide it centrally in its length and compare the area of the half due to the first half of the stroke with that due to the last half.

Frank Corbett.

*Brooklyn, N. Y.*

## That Bent Side Rod.

*Editors* :

My idea as to cause of bent side rod of the engine of I. F. Wallace is, that either wedges were down or there was considerable lost motion between driving journal and brass (the latter of which is hardly probable, as he says the engine was out of the shop only six months), and perhaps the engine slipped and caught the rail again at about lower quarter on right side, the engine on left side just passing forward dead center. Side rods are always freest on the dead centers. He says that he found everything all right on left side. I think he could not have moved left side rod laterally on pins. I also fail to understand how he did not detect bent side rod as soon as it occurred.

W. M. McKenzie.

*Superior, Neb.*

## Trainmen vs. Train Robbers.

*Editors:*

Your clipping from *The Railway Conductor* and comment on the same in the April issue of your paper aroused an echoing sentiment in my heart, and I thought that the relation of a personal experience would prove interesting to your readers.

On the night of September 23, 1889, about the hour of ten, the north-bound passenger train on the Gulf, Colorado & Santa Fé R. R. was held up in true Jesse James style about ten miles south of Fort Worth, Tex. The night was dark and starless—just such a night as would suit the most scrupulous or fastidious train robber—and I knew instinctively just as soon as the train commenced to slow up in that gloomy, desolate section, that the knights of the road were at hand, for I knew we had no more stops before reaching Fort Worth, and we didn't need either fuel or water, but soon we were at a dead stand, and almost instantly the word was passed back, "Train robbers!" Then several rifle shots rang out ominously on the calm night air; this was a warning to the too adventurously inclined to keep their heads in and not endeavor to see too much. Then there was hustling to secrete valuables and money, and the passengers in the forward car did a very sensible thing in extinguishing the lights; we in the second car didn't think of this. I was accompanied by my wife and two children. I remember very distinctly that my hope was that no "big brave" or ex-desperado would be senseless enough to show fight and thus draw the fire of the robbers on the crowded and frightened women and children—and men too—in the coach.

I had a pistol, but it was snugly packed away in my valise in the very box that contained it when I purchased it, on first taking up my abode in Texas, but I had long before given up the idea that there was any use for such a weapon in that good State; in fact, I never once thought pistol till some minutes after the stoppage the conductor came in the car and asked if any one could spare him a revolver or two, several gentlemen present spared him their guns very willingly and promptly.

But previous to this, while the passengers were hiding their wealth I was getting in my work, too. I had about $40 in silver, which was stowed away in the valise by the side of the unerring pistol, which I thought was safe enough; then I had a roll of currency in my inside pocket, not a very large amount, to be sure, but more than I would care to give away for charity's sake, much less willingly to our present interviewers. So I seized a pliant moment to transfer this roll from my inside pocket to that of my little boy (aged about four), taking care not to let him know what I was doing, so that he couldn't give the "snap" away when the robbers tackled us. But our precautions were in vain; the road agents had larger game in sight than the passengers. It seems there was a large consignment of silver in Mexican dollars in transit that night, and that is what the brigands were after, and got, though exactly how much is not known, such things being only known to the two interested parties—the robbers and the robbed.

It is safe to say, however, that several thousand dollars were secured. The mode of procedure in this case was the popular one; two robbers got on between the engine and express car at the last station passed, and when their rendezvous was neared they "took care" of the engineer and fireman and persuaded them to stop; the express car was then detached, and the engineer induced to pull it down the track a mile or so, where they looted the car at their leisure and then decamped, leaving the enginemen to find their way back without an escort. We got to Fort Worth about two hours late, the heroes and heroines of a thrilling experience. No clue to the perpetrators of this robbery was discovered till some eighteen months after its occurrence, and then, through the medium of an old letter that came into the hands of the police of Fort Worth, some of the robbers were brought to justice.

Now, for the benefit of those who have never experienced a train robbery, and feel very heroic when they hear of one, and wish that they had been there so that they could show the world how the "truly brave" would resist such unlawful acts, I will say that there are two very discouraging circumstances connected with affairs of this kind that tend to throw a damper as it were on any ebullition of personal courage; one is, you never knew how many of the robbers you may have to contend with; and the other is, a sort of vague realization that the robber is not out on this expedition just for fun, but if necessary to his ends he will shoot; and further, you see, and have to acknowledge that he "has the drop."

I remember a young fellow-townsman of mine, Henry Brown, a son of one of Tennessee's ex-Governors, who gave up his young life to this mistaken idea of chivalry—one man resisting unknown odds. It was on one of the railroads in New Mexico some years ago. Young Brown was express messenger, and sealed his devotion to what he considered his duty with his blood and life. Again, more recently, a train was held up on the Illinois Central at Duck Hill, Miss. There was on board (as passenger) a young engineer of the road (Chester Clark, I think his name was), who could not brook the idea of sitting idly in the car and allowing the train to be robbed, so he borrowed a Winchester from another passenger and got out to have a pop at the robbers. The usual result—the robbers popped first, and Mr. Clark was a dead man. Now these two men virtually threw their lives away for a mere sentiment. I mention these two incidents to rather impress on the minds of those who are not familiar with this particular development of our civilization, that if they imagine for a moment that the average train robber will not back up his arguments to the death, they are wofully mistaken; therefore, it is better to suffer the temporary embarrassment of being robbed of a few dollars than risking the certainty (almost) of being killed, and also jeopardizing the lives of others in an indiscriminate fusillade.

W. H. Wesley.

*Nashville, Tenn.*

## Be Exact About Your Statements in Air-Brake Puzzles.

*Editors:*

Regarding those technical queries presented to the readers of this paper, why are not the propounders of air-brake puzzles, etc., more accurate in their statements? In attempting an answer, one must not presume anything, but accept the facts exactly as given. One of Tink's letters in the May number is an example. Engine and tender-brakes were operated by a single triple-valve. When the pump was started, the "brakes" applied. Now the possibility of the hose being cross-coupled between engine and tender undoubtedly occurred to every air-brake expert who read his letter; but the idea was rejected, owing to the inference drawn from his use of the word "brakes," for, in the case in question, the tender-brake only could apply.

Another correspondent knew of a three-car train with quick-action triples, the third one being defective. The pin controlling the opening of graduating-valve was broken, the valve holding shut. If he had said that this triple went full on shortly after the other brakes had applied, there would not have been space in this paper for all the correct answers, as this pin is the weakest point and really the only weak point about the Westinghouse triple-valve. With nearly every passenger train in the country, a half-minute sometimes means a half-mile, and his statement that after an 8-pound reduction a train could possibly run a half-minute before a triple with this defect would operate is decidedly an exaggeration. Westinghouse triple-valves are not built that way.

An error occurs in my article in the May number referring to the emergency-piston as being 1½ inches, when it should have been printed 2½ inches in diameter.

Will W. Wood.

*Terre Haute, Ind.*

## Lining by Counter-bore of Cylinder.

*Editors:*

I have been asked several times within the last few months by engineers and young mechanics if the method laid down by P. H. Zwicker in his *Revised Practical Instructor* for machinists, engineers and firemen is correct and practical.

In giving directions how to line an engine, Zwicker says "that the counter-bore should always be used in centering the line." This is erroneous, as the piston in operation bears no relation to the counter-bore. When an engine has been in use for several years, the cylinders are often found very much out of round. I have found cylinders worn to an oval, being worn out at the bottom, so that the vertical diameter would measure from $\frac{1}{32}$ to ⅛ of an inch larger than the horizontal diameter.

To set a line in a cylinder worn the least possible measurement out of truth by the counter-bore is a delusion and a snare. One object in setting a line is to get the center of crosshead directly in line with center of cylinder, and if the crosshead guides are set with a line centered from counter-bore, they will be found too high when piston-rod is keyed to crosshead.

Hugh R. Crawford.

*New York.*

## Air-Brake that Set in Full Release.

*Editors:*

Having gone wide of the mark in trying to answer one of the problems in the last issue of your paper, permit me to propound one myself for some one else to stumble over, and also, of course, for the general information of your readers. It is taken from actual experience on the road, and is warranted genuine.

A train composed of an engine and eight coaches was running up a slight grade at about twenty-five miles an hour. The handle of the engineer's valve stood in the running position, when the engineer thought he felt the brakes dragging. From force of habit he tried to let them off by pushing the handle to release position, when they immediately set so hard as to nearly stall the train, releasing, however, before coming to a complete stop. What was the cause, both of the application and release?

The engineer's valve was one of the improved Westinghouse pattern, and in good condition. There were other conditions noted by the engineer which showed the writer very clearly just what was the cause of the trouble, but as these might make the solution too easy, they will be omitted in the hope of stimulating the thinking faculties of our well-known air-brake men.

Paul Synnestvedt.

*Chicago.*

## Lubricator Experience in Australia.

*Editors:*

In answer to Mr. D. B. Hutchin's sight-feed lubricator puzzle in March issue, I beg to state I was running a passenger engine with Detroit improved-pattern sight-feed lubricator. I filled the lubricator and closed all the valves till starting time, when I opened them myself, and they worked all right to the end of the division. The fireman banked the fire, steam-gauge showing 130 pounds of steam, closed all valves on and to lubricator. Drained lubricator and refilled it with oil. Stood for four hours and could see the oil was going out of lubricator; tried valves and found they were shut; when starting time came opened all valves and then the oil did not work through the feed glasses, and I could not make out where the oil was going to until I got to the locomotive depot, when I found it was in the boiler, so I came to the conclusion the lubricator valves were not steam tight. The pressure of steam when fire was banked was 130 pounds, and when the fire was turned over for return trip the steam-gauge showed 90 pounds. Now, did the reduction from 130 pounds to 90 pounds cause a vacuum in the steam passage from lubricator to boiler, which I believe it did? Will some one else give their opinion, and why it did not work right on the return trip? I worked the valves just the same as when I came out on the first trip.

Thos. Hays.

*Wickham, New South Wales.*

## Oil Can's "Nut."

*Editors:*

June issue, page 213, Oil Can gives us a "nut to crack." He does not say which eccentric—back or forward—that was bound in strap. If it was a back-up eccentric, I will say that he took down back eccentric, rod and strap.

Sink.

*Durham, N. C.*

## Relyea's Brake Puzzle.

*Editors:*

It is a long time since I gave the readers of the Locomotive Engineering a "conundrum" on air-brake difficulties, and having "resumed business at the old stand" after a satisfactory trial of dissipating, I thought I would give the boys a little one to study on for a while. So here goes.

One of our engines has been giving a great deal of trouble on account of tender-brake setting while running along, and sometimes it would set while standing in the house, but the driver-brake would not set every time the tender-brake did, only once in a while, when maximum pressure was up.

Now, the natural conclusion was that there must be a leak in train-pipe or its connections, that caused the brake to set, so I had the pipes examined thoroughly, but found no leaks. I then examined triple-valves on both tender and driver brake, and they were found to be in perfect working order. The brake-valve was the next thing to examine. I did so, but found nothing there. I scratched my head with both hands, and even then I found nothing wrong. Well, she made another trip and when she came back the same report came of the tender brake "going on."

Now, while this engine was making this last trip, I remembered that a long time ago I had the same thing occur on an engine equipped the same as the one I am writing about. So when she came back I went to work where I had located the "troublesome trouble," and sure enough there it was. This engine is equipped with latest style of engineers' brake-valve and governor standard triple-valves and push down driver-brake cylinder. Now, what made this brake set when there were no leaks in any joint of any pipe, and triple-valves all right, also engineer's valve?

W. F. Relyea.

*Syracuse, N. Y.*

We will have to ask all correspondents to send, on a separate sheet, an answer to their puzzles in practice. These will be kept until the next paper and published with the answers. The third month is too far away for an answer—readers lose interest. Another thing; many may feel hurt because their answers do not appear, we only publish one answer the same; there has probably been twenty answers to Oil Can's puzzle practically like the one published.

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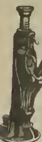

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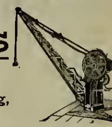

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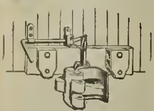

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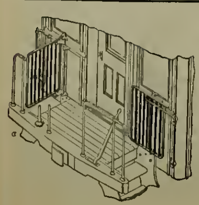

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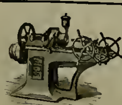

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## Train-Running for the Confederacy.

By Carter S. Anderson.

When you ask me for something interesting from our side of the fence during the war, for 20,000 railroad men to read, you touch a very tender chord in my heart. With railroad men there is a brotherhood which lives and operates without organization, and which knows no State limits nor party lines. Railroads have the lead of all the many improvements in the present fast and enlightened age; they will likely continue ahead and distance their rivals. Electricity is cutting a mighty dash and doing all the talking, but the steam horse does nearly all the work.

But to comply with your request: I wish I could recall the scenes of thirty years ago and paint them life-size for all railroad and American brothers to see, and humbly ask them not "to do so any more." Do not let us haul any more "troop trains" internally, but let us in future head them all toward our borders.

Well, I will try to tell you something of the part the Virginia Central R. R. men (now Chesapeake & Ohio) performed in 1862 in moving a division of General Lee's army from Richmond to join General Jackson in the valley of Virginia, and then bringing the whole army thus combined under Jackson along down and placing it in the rear of General McClellan.

To commence: General McClellan had swung around in the Chickahominy until he tapped our Virginia Central and R. F. & P. Railroads, and had destroyed the South Anna River bridges on both roads. This caught some of our railroad men in Richmond, and a good many of our engines, cars and men were out on the long end. Those of us who were caught in Richmond were at once put into the militia, doing local duty about the city.

I remember the first day we were out we came in sight of the Blue as we were stationed on Strawberry Hill. Then we were put at Young's Mill, and then east of Richmond, where we were put on picket duty on the Darbytown road. My beat was right alongside of the road, and from 6 to 12, the pass-word being "Geo. Washington."

Everything was quiet until about 9 o'clock, when I heard a footstep firm and regular. My musket was at once brought to bear in that direction, when I remembered just in time that my first duty was to call, "Halt! and give the pass-word!" Which I now did with all the dignity of a railroad Confederate soldier.

The traveler, who was an old darky, replied:

"Hy! What this gwine on here now? Dis de fust time I been ever ax fur a pass sence I been had Liddy at Miss Jane Darby's, and dat been ever sence four years arter de stars fell in '33 and two years arter Mass Josephus brought Miss Delia home. Young boss, is y'awl our folks or is y'awl de Yankees?"

I answered him that he couldn't see Liddy that night, but to go home.

The old fellow retraced his steps muttering that "'twas a mighty bad sign." I never saw him again. My time was out at 12 o'clock and I very soon, without any preliminaries, such as devotions, etc., measured my full length on the soft, wet pine tags, and resting my weary head between the projecting roots of a pine tree, was soon sleeping soundly and sweetly as those alone can sleep who have nobly saved their country (!) Some great man once said that the three noblest words in our language were "Do your duty;" but I, as well as our great men, do my own thinking, and there are only two plain little words I like better: "Duty done."

I awoke to hear the news that we were ordered to town and that all Virginia Central Railroad men must report at once to our superintendent. Upon reaching our office, corner 17th and Broad streets, we received orders from Col. H. D. Whitcomb, our general superintendent, who had preceded us to Charlottesville, to report to him there, having left passes for us via the R. & D., South Side & Orange, Alexandria & Manassas Railroads. We arranged accordingly and left early the next morning, having as our fellow passengers, on our and other sections of the R. & D. troop trains, about 12,000 of Lee's men. When we reached Charlottesville we found that Col. Whitcomb had already collected there everything that could turn a wheel on that end of the road, and ordered us to arrange crews to suit ourselves, remarking that, in consideration of the enormous task of moving such an army with so limited a power, he would be glad to have one sober man in each crew, and that he had best not put all the whisky men together. The solid, firm and feeling manner in which he said this had the effect he doubtless desired. The detachment sent from Lee to Jackson had no time to lose and demanded immediate transportation and listened to no excuses.

I remember well that hot June day we loaded the troops at the old Lynchburg Junction of the C. & O. R. R., near the University of Virginia. Our cars were very rough, the most of our coaches were in Richmond and we had only freight cars, work-train flats, caboose cars and such as were scattered about on that portion of the road. The soldiers, and officers especially, complained heavily, and curses thick and fast fell upon us as we worked and sweat to get them loaded. All at once in a loud tone bawled out a Confederate officer to our superintendent: "You railroad men are a set of blockheads." It fired my young blood. Col. Whitcomb's answer was indeed like "apples of gold in pitchers of silver." Said he, as he stood, coat off, in the broiling sun: "Well, sir; if we *are* blockheads, we are trying to do our duty." His noble answer satisfied the brave Confederate, who returned the soft answer: "Well, then go ahead and nobody shall interfere."

This little spat made us all, soldiers and railroad men, friends together, and we soon had everything on board and moving along our serpentine track about the base of those little ragged mountains between the University and Ivy Creek. Everything was serene, and not a murmur did we hear as the cool and refreshing mountain breezes fanned our heated, weary and hungry bodies. In a few hours the whole detachment was with General Jackson, who had reached Mechum's River with a large part of his Valley army. We received orders from General Jackson at once, after unloading our Richmond troops, to run through the Blue Ridge tunnel and bring him the remainder of his army. We had to go right on, and about day-break the next morning we ran out of Blue Ridge tunnel and discovered at once our passengers as they lay along the little valley that runs parallel to the C. & O. R. R. between the Blue Ridge tunnel and where Basic City now stands. We whistled and rang in order to wake the soldiers and get them aboard, which they very gladly and promptly did. We took them on, carefully running our trains back to Mechum's River. As soon as we reached there we found that everything there was on the move back to Charlottesville, which we had so hurriedly left. Then commenced the funniest experience of my life, for about two or three weeks, as well as I remember (I am writing entirely from memory).

All was curiosity and speculation as to the movement of the army. We had thought that Lee was re-enforcing Jackson in the Valley so that he could go on to Washington, a belief which lost but little force when we turned back from Mechum's River, as we concluded that Washington could be reached more easily from Charlottesville than from the Valley. All the cavalry and artillery took the county roads, and a large part of the infantry. The army used our trains to their fullest capacity, "riding and tiring" fashion.

When we reached Charlottesville we had orders to unload, but very soon those we unloaded going on and those in rear coming walking up, we reloaded the tired ones and got orders to take them to Gordonsville. "Ah! I told you so," was in every mouth. "To Washington from Gordonsville is the nearest route of all." So it was. Well, the whole army got together there, or nearly all of it. It seems to me we stayed at Gordonsville a day or two. While there we received orders to head our trains all toward Washington and load them. Of course, then all doubts were removed, and all the subordinate officers, soldiers and railroad men fully believed that Jackson was going to Washington. The trains stood loaded all day, some of us pulled down a mile or two toward Orange C. H. Toward night, however, we got orders to unload and get our trains all back to Gordonsville.

Suddenly, very early the next morning, we were aroused by our agent, Mr. Addison Gooch, rattling his stick along the outside of the cars in which we slept. He informed us that he had orders to tell the men that every engineer who was not ready to move his train in 45 minutes would be shot. The wood which we used was very sorry stuff with which to start a fire, being not much more than half seasoned and four-foot wood at that, which we had loaded on our tenders from the ricks as we came along on the road. But of all the impromptu inventions to increase heat and make the "pot boil," that morning's experience took the "rag off the bush." In making up our crews at Charlottesville, it fell to my lot to have for my engineer John W. Whally, running the little Roger engine named "Monroe." John Wesley, a ginger-bread free negro, was firing for him. Mr. Whally could not get steam on Monroe, all he could do. He got mad with John Wesley, and it got John out of sorts, and it looked as though the Monroe got mad too, and would not burn her wood nor steam at all. It began to be serious.

Every other train but ours was ready, and the officers gathered around watching anxiously and very supiciously our movements, and I found out that some suspicion had arisen as to Whally's loyalty, his pedigree not being known to any of our people. I felt sorry for Whally. He and I had made many a trip together under trying circumstances, and he had many a time saved me from a whipping by taking my part. He was a powerfully built man and fully 6 feet 6 inches high. I hunted around and found some old barrels in the rear of the depot, one of them an old tar barrel. I knocked them to pieces, and Samuel Wood, brakeman, and myself got the barrels on the engine. Just as I stepped on the footboard I saw Mr. Whally open his box and get all of his waste and pour on it all the oil he had and put it in. He then rolled in the old barrel staves. She began to roar. He took courage and looked around for any and every thing that would make the fire burn the wood which was choked into the firebox. I saw Whally take up the cushion, on which he sat when running, and poke it into the firebox. It was very greasy and added much to the fire. Whally then seemed to forget himself. He had as fine clothes as any man on the road, but when he was running on his engine he did undoubtedly wear the greasiest clothes any mortal ever saw. Whally had taken off his coat and laid it on the box in place of the cushion which he had burned. He snatched the coat up and rolled it into the firebox and commenced to unbutton his pants to follow suit. But John Wesley, his fireman, said, "Mars Whally, don't do dat; here's my coat," and in he dashed it. When the gauge of the Monroe in a few minutes showed 140 pounds of steam, the officers took off their hats and waved them and shouted: "Hurrah for Whally and Monroe!"

Our trains were now all ready loaded and headed eastwardly. Orders came to go to Louisa C. H., and no further unless ordered by the Government and on their own responsibility. Then began again speculation, betting and arguments indescribable as to what Jackson was going to do or where on earth he was going. We reached Louisa in a few hours and unloaded all the troops. In fact, it seems that nearly all the army there got together and lay encamped around and below Louisa C. H. The opinion seemed to prevail that it was nearer from Louisa C. H. to Washington than from Gordonsville (and, by the way, there is not much difference), and that Jackson had decided to come down from Gordonsville to Louisa C. H. and to go from there to Washington. This was the prevailing belief among the subordinate officers, soldiers and railroad men.

We remained at Louisa C. H. several days, including one Sunday, and a memorable Sunday it was. Our trains lay east and west of Louisa, covering about four miles of main track. We had to leave space between trains in those days to pump up, the valuable injectors we now use not then being known, or rather we had none. Everything was quiet; nothing seemed to be going on except there was reported a great religious revival among the soldiers who were then encamped in the groves below the C. H. Sunday morning all of us railroad men gathered around the telegraph office at Louisa to try to hear what would be done. We had no rations, scarcely, and there were so many soldiers about that it was impossible to buy anything to eat. By 12 o'clock noon more than half of the railroad men were drunk. We drank during the war mostly new apple brandy, and it is a very hot and fiery dram. A great many of the soldiers and the subordinate officers had come to town too and gotten drunk, and it was the jolliest crowd at the depot you ever saw. All at once—Squeel! squeel! loud, long and distressingly, we heard an engine coming from toward Richmond. We could not understand what on earth it could be, as we had with us every engine we had. "It must be a Yankee engine pulling McClellan's troops," said every one. It was soon found out, however, that some official had run the gauntlet from Richmond and had gotten a little R., F. & P. engine that happened to be outside of Richmond, and a little coach, and was making his way to Charlottesville.

The urgent request came to us to move all of our trains far enough to allow the little courier train to take the siding at Louisa, and then to back down east of Louisa until she could run out of the west end of the switch. But, "here's the rub!" More than half of us drunk, every engine cold, nobody knew anything, nor had anybody seen anybody else. It was with the greatest effort on the part of all who had sense enough to appreciate our situation, that we got the trains far enough west to let the courier train in, and then about the same trials to get them back down below the Court House, so that the little courier train could run out the west end and go on to Charlottesville. It took the best part of the day to get the track clear. In the meantime, it took so long for us to get the track open that the messenger man had either gone to see some of the officers or was getting his dinner, so that all of the railroad men and thousands of idle soldiers had gathered around to examine, criticise and find out all about this crew and its errand. My engineer, Whally, was pretty drunk.

He went around and *chinned* the little engine, made a great many ridiculous remarks about her, and finally bet $20 that he could hold the little engine with ten men and could thus prevent her moving until he said so. Knowing the importance of the occasion, I begged Whally not to attempt such a thing, it was too serious, but the soldiers told him to go ahead. Somebody took the bet and Whally selected his men.

Presently here came the messenger, got upon the coach and told his engineer, "Go to Charlottesville; minutes are hours!" About twenty strong men dropped their strength against the coach, "Chow, chow,

chow, spow, spow, spow," went the little engine. I feared every minute that I would hear a shot. The engineer made several vain trials, and seeing his point gained Whally said, "Give her a push, boys, and let her go," and off she shot amid the loud cheers of the soldiers. It was the most ridiculous sight I ever witnessed.

I have taken so many sidings that I have failed to make my terminal, and will have to stop and wait until you give me right of track to finish my trip. How we took those 30,000 troops and placed them within a day's march of McClellan's rear, moving with muffled whistles and bells off the engines—of this I will tell you in another letter if I can find time.

*Richmond, Va.*

## Machine Molding.

At the San Francisco meeting of the Society of Mechanical Engineers, a highly interesting paper was read on "Machine Molding" by Mr. Harris Tabor. The paper contains many interesting facts about the molders' art generally, the difficulties that are encountered in making good castings, and apathy of many foundry proprietors concerning the needs and comfort of molders. The growth of the aids to molding that have culminated in the molding machine are traced, and then a great portion of the paper is devoted to describing the design and working of the molding machine invented by Mr. Tabor, which was illustrated in LOCOMOTIVE ENGINEERING of February last. The paper concludes:

"The absorbing question, What is the economy in machine molding? is very difficult to answer. The product of machines will vary in different foundries, as much as the product of the molder. What may be called a fair day's work is an unsettled question. From the standpoint of manufacturer and workman, it is too small in some localities and too great in others. A machine that will mold 175 flasks, 16x16x10 inches deep, with two men to operate it, in one foundry, would, under precisely the same conditions, mold 250 in another. One manager may surround his machine with little conveniences for handling work, and thus increase his product, while another would compel his machine men to work under disadvantages. The treasurer and practical shop-man of a foundry were observing the operation of an automatic machine, with watch in hand; a complete half mold in 16-inch nowel, or as they would say out West, drag, 5 inches deep, had just been made and turned on the floor for inspection in ten seconds after the sand was put in the flask, when the treasurer asked the question, 'How many molds can be made in a day?' Before the writer could reply the shop-man said, 'That is not the question; the question is, How many molds can we take care of?' A better answer could not have been given.

"The first machine of our automatic type has been in use about a year. The conditions are not favorable, all the sand is handled by shovels, and the flasks and molds are carried to and from the machine by hand. The flasks used in this case are 14x17x10 inches deep, and weigh 70 lbs. The sand in flask, when rammed, weighs 156 lbs. Two men on this machine make 200 molds per day, and average during the working hours from 27 to 34 molds per hour. These men have made and carried away 158 nowels in one hour and thirty-five minutes, and have made 200 complete molds, ready for clamping, in less than five hours. We must keep in mind that these two men must shovel into flasks over 31,000 lbs. of sand, and carry off the same amount, in making 200 molds; they must also handle twice 14,000 lbs. of iron in flasks. Two hundred molds, under these conditions, is too much for five hours' work. But this number is not too much for a day's work for two men. A greater product might be obtained from an additional man, or from a conveyor for elevating sand to a hopper over the machine. A system of handling the molds after they are made would also add to the machine's capacity."

On June 10th, C., R. I. & P. engine No. 901, engineer F. T. Holland, ran from Goodland to Jennings, Kansas, a distance of 82½ miles, in 87 minutes. The 901 is one of the new express engines built at the company's shop at Chicago, and it was illustrated in the *Locomotive Engineer* in September, 1891.

## A Fast Run on One Side.

On May 27 Engineer William Laster, of the E. T., V. & G., ran engine "21" from Birmingham, Ala., to Selma, Ala., with one side disconnected, a distance of 104 miles, in two hours and forty minutes, making twenty stops.

## My Grief With a Big Smoke Stack.

BY SAM SHORT.

I handle the best article of its kind for railroad use, but, strange to relate, I sometimes hear of cases where my goods do not give satisfaction. The cause, of course, is pure prejudice. The careful nursing that the best thing in the market requires to maintain popularity naturally makes me watchful of the influences that work sometimes to condemn a good thing offered for railroad use. When a manufacturer who feels sure that he has a good thing finds that it fails to give satisfaction to railroad men, he naturally feels aggrieved and says hard things about the men who failed to make the thing a success. Sometimes he may have just ground for complaint but as a rule he has not.

It is undoubtedly true, however, that things are sometimes forced upon railroad men that have no merit and are floated entirely by proprietary interests. Compelling the use or protracted trial of these things is an annoyance to the individuals who are in charge, and loss to the company trying them.

When I was master mechanic of the Prairie Southern, we had no end of trouble with fires from spark-throwing. We were using the ordinary diamond-stack, but all the engines had very small boilers and small nozzles had to be employed to make steam, with the result that the engines all threw sparks. There was no mistake about that. My general officers tortured me with complaints about fire-raising, and annoyed me with impracticable proposals of remedies. Sparks and fire made my life a burden. Those who complained took no share of the blame to themselves, although they had stocked the road with small boilered engines without consulting with me.

Well, our G. M. called me to his office one day and informed me that he had ordered half a dozen of the Duplex Down-Draft Patent Stack that was said to be doing wonders as a spark-arrester on the road where its inventor was superintendent. The stacks were duly delivered. There was nothing striking about them except their size. The diameter of the diamond was greater than the diameter of the boiler, and the diamond was well filled up with a cone. The first of the stacks to be tried was put on the 87, one of our best steaming engines on the road. During the first trip she lost two hours with a through train on the first division from want of steam. I was duly roasted by the G. M., and told to get all the stacks put on the engines without delay, and to make sure that there be no more loss of time on the road.

I ignored the order about putting on the other stacks and went out on a local next day with the 87. The engine steamed very badly. About half our time was spent in the smoke-box trying to get the lift-pipe in a position that would improve matters, but it was no use. We returned the blackest and bluest party that ever had started out to make an engine steam. My foreman boiler-maker, a very good workman and ingenious man, expressed the belief that he could make the engine steam if I would let him make a peculiar petticoat pipe. I was in the humor to agree to anything, even if the article were made with a bustle. He produced a pipe that was fearfully and wonderfully made. No improvement in steaming resulted. Smaller nozzles were tried with some improvement. Still smaller with the result that the engine got the train over the road on time with a large increase in the coal used.

The other stacks were put on freight engines. By reducing the nozzles, steam was made after a fashion, but the engines would not pull the trains they had formerly handled with ease. The next complaint made to me was that the engines were stalling on every hill. Then I was told in a stinging telegram that the engines were causing delays by leaving their trains to run for coal.

Finally the G. M. sent for me and expressed his disapprobation of my conduct toward the improved smokestacks. It was painfully evident to him that I had opposed these stacks through personal prejudice. The result was that the stacks were throwing about as much fire as the old ones, and the engines having them on were disorganizing the train service. He expressed the highest personal regard for me. It pained him to know that I was more obstinate than an army mule, but he hoped that I was not beyond the influence of reason. (He is an all-fired, bitter-sweet talker.) Those engines had to be made a success, and all the power was to be equipped with them.

It was a hard dose to swallow, and I was in a hole. I had moved my family from the East just six months before; had furnished a comfortable home and was still in debt. To pull up again was to be a great hardship on others besides myself. I considered the situation for a day or two, wishing to do the manly part, yet reluctant to break up the home nest.

Spark-arresting and smokestacks had been an absorbing theme of conversation between me and the different railroad men who dropped into my home of an evening. When I went home one evening, shortly after receiving what I considered my ultimatum from the G. M., Mrs. Short was unusually patronizing, and had the air of being burdened with suppressed wisdom. I know, from experience, that this betokened some impending domestic revelation of great importance. After supper the revelation came in the form of facts about spark-arresters.

Mrs Short was always an interested listener of our shop talk, and had been in the habit of posting herself through the books in my library on the topics discussed. It seemed she had been studying spark-arresting as revealed in the Master Mechanics' Reports, and she had prepared a whole bureau of information on the subject for my benefit. She had marked a number of reports and discussions on the subject, and believed that the facts and theories advanced would solve my difficulties. This was the surprise she had prepared for me. I was less sanguine, but I spent the evening reading up the experience of others with spark-arresters of all kinds.

Next day the purchasing agent sent me a requisition for drawings of the stack saddles of all the engines, so that the new stacks might be ordered. I spent the evening writing an essay on smokestacks and spark-arresters, using the Master Mechanics' Reports as reference, and sent it to the G. M., with my resignation annexed. I did not forget to mention that the real trouble with the Prairie Southern engines was that the boilers were too small, and that spark-throwing was caused by forcing the fires; a thing that must be done to generate the steam required by the big cylinders.

That afternoon the G. M. surprised me by walking into my office. He was inclined to talk spark-arresting, and fortunately I was fresh from the best authorities, like a boy crammed for a college examination. The result of the interview was that the order for the new smokestacks was countermanded, and I was directed to send the brightest engineer in the employ of the company to the home of the big smokestack on a mission of investigation. His report settled the stack question to my satisfaction.

Nothing was ever said about my resignation, except by Mrs. Short. She claimed the credit of straightening out the kink in my affairs, and insisted on getting the full reward. She expects still to be rewarded every time the fashion in women's garments changes.

The moral of the story to me is, never tell your wife the whole truth when she does you a good turn, or you will hear from it even after many days.

## Three-Cylinder Locomotives.

Mr. John Riekie, locomotive superintendent of the Northwestern Railway of India, whose triple-expansion locomotive we commented on in our May issue, writes to the *Engineering News*:

"I have read the note in your issue of February 20 on my three-cylinder locomotive, based upon a description in a European paper, and regret very much that my proposed system has not been correctly reported. The engine is not at work, and the design is for three single-acting cylinders with cranks at 120°. My twenty-five years of locomotive practice have caused me to consider that the pulling of the locomotive-wheels in turns by cylinder and piston is wrong in principle, causing heavy wear and tear, and setting up an ugly surging, sinuous motion, resulting in a waste of power. Were we to turn the wheel by pulling or pushing at a constant point, we should, I think, have a more steady running engine, and my proposed single-acting engine was designed to meet this. The compound system I advocate is also unique, and is designed to use the steam up by continuous expansion. Converting the high-pressure cylinder into a steam-chest during the return stroke of the piston enables this to be accomplished. I have a steam-pump working on this system, and it is a great success, giving a gain of nearly 100 per cent.

"We use chocolate-color paint for our locomotives, and white, green and yellow for the first, second and third-class cars. I have for many years advocated Russia iron for boiler-covering, but we are fully twenty years behind England in all we do in this country, and another generation must spring up before we can expect India to be as go-ahead a nation as America."

Good molding machines in a foundry where there is a fair amount of duplicate work may be made as profitable as the turret lathe has been in the machine shop. It has been said of the turret lathe that its limit is set by the ingenuity of the tool-maker. If pattern-maker be substituted for tool-maker, and a fair amount of "nerve" in foreman be added, the same may be said of the molding machine. Like the turret lathe, its best results are obtained when operated by unskilled labor, or men trained only in the use of the machine. When the foreman has a reasonable amount of patience at the start, coupled with a disposition to make good castings cheaply, there is no doubt of his success in machine molding. If these qualities are lacking, it is better to defer the introduction of machines until the foreman has been brought to see their advantages, or has been supplanted by a more progressive man. — *Harris Tabor, in paper on Machine Molding.*

Supt. Wightman, of the Pittsburgh Locomotive Works, has recently patented a boiler-head brace that has many advantages. The ends are made separate from the rod proper, the latter being threaded at each end, right and left, the fork end for the head and the lug to rivet to the sheet of boiler are drop-forged and then threaded, the rod being upset at each end and threaded; thus the whole brace is made in the machine-shop and without welds. It requires no measuring and fitting, and when put up exactly the same tension is put upon each brace in a set. The Pittsburgh shops almost make a boiler by machinery now, their hydraulic flanging-machines doing especially nice and fast work.

There are over 3,000 locomotives in service in the United States that are not on regular railroads, but are on plantations, in the pineries, around mines and mills. There are over 6,000 cars owned by private roads.

## Earliest Instructions for Enginemen.

In an English industrial magazine, dated 1846, there is published a series of instructions for locomotive enginemen, which we believe were the first directions put in print. The following are the principal parts.

The most important part of the engine-driver's duty is the observance of signals, respecting which no general rules can be given, as the systems of signals vary upon different railways; but a strict attention to the signals fixed upon and a constant watchfulness to see that the rail is free from obstruction, constitute the most important part of the duty the engine-driver has to perform. He should constantly be upon the foot-board of the engine, so that the regulator, the whistle or the reversing handle, may be used instantly if necessary; at the same time he must see that the level of the water in the boiler is duly maintained, and that the steam is kept at a uniform pressure. In feeding the boiler with water and the furnaces with fuel, a good deal of care and some tact are necessary, as irregularity in the production of steam will often occasion priming, even though the water be maintained at a uniform level, and an excess of water will of itself occasion priming, while a deficiency is a source of obvious danger. The engine is generally furnished with three gauge-cocks, and water should always come out of the second cock and steam out of the top one when the engine is running, but when the engine is at rest the water in the boiler is rather lower than when it is in motion, so that when the engine is at rest the water will be high enough if it just reaches to the middle gauge-cock. The boiler should be well filled with water on approaching a station, as there is then steam to spare, and additional water cannot be conveniently supplied when the engine is stationary. The furnace should be fed with small quantities of fuel at a time, and the feed should be turned off just before a fresh supply of fuel is introduced. The regulator may at the same time be partially closed, and if the blast-pipe be a variable one it will be expedient to open it widely while the fuel is being introduced, to check the rush of air in through the furnace door, and then to contract it very much as soon as the furnace door is closed, in order to recover the fire sooner.

The proper thickness of coke upon the grate depends upon the intensity of the draft, but in heavily loaded engines it is usually kept up to the bottom of the fire door. Care, however, must be taken that the coke does not reach up to the bottom row of tubes so as to choke them up. The fuel is usually disposed of on the grate like a vault, and if the firebox be a square one, it is heaped high in the corners the better to maintain the combustion. In starting from a station and also in ascending inclined planes, the feed-water is generally shut off, and, therefore, before stopping or ascending inclined planes the boiler should be well filled up with water. In descending inclined planes an extra supply of water may be introduced into the boiler, and the fire may be fed, as there is at such times a superfluity of steam. In descending inclined planes, the regulator must be partly closed, and it should be entirely closed if the plane is very steep. The same precaution should be observed in the case of sharp curves or rough places on the line, and in passing over points and crossings.

To ascertain whether the pumps are acting well the pet-cock must be turned, and if any of the valves stick they will sometimes be induced to act again by working with the pet-cock open, or alternately open and shut. Should the defect arise from a leakage of steam into the pump, which prevents the pump from drawing, opening the pet-cock remedies the evil by permitting the steam to escape. Should priming occur from the water in the boiler being dirty, a portion of it may be blown out, and should there be much boiling down through the glass gauge-tube the top cock may be partially closed. The water should be wholly blown out of the locomotive boilers three times a week, and at those times two mudholes at opposite corners of the firebox should be opened, and the boiler be washed internally by means of a hose.

On approaching a station the regulator should be gradually closed, and it should be completely shut at about half a mile from the station if the train be a heavy one, and the train may then be brought to rest by means of the brakes. Too much reliance, however, must not be put upon the brakes, as they sometimes give way, and in frosty weather are nearly inoperative; in cases of urgency the steam may be thrown upon the reverse side of the piston, but it is desirable to obviate this necessity as far as possible. At terminal stations the steam should be shut off earlier than at roadside stations, as a collision will take place at terminal stations if the train overshoots the place at which it ought to stop.

There should always be a good supply of water when the engine stops, but the fire may be suffered gradually to burn low towards the conclusion of the journey. So soon as the engine stops it should be wiped down, and be then carefully examined. The brasses should be examined occasionally, to ascertain whether the wheels are square on their axles, by the application of a gauge, and whether the axles have any play, which should be prevented. The stuffing-boxes must be tightened, the valve gear examined, and the eccentrics be occasionally looked at, to see that they have not shifted on the axle, though this defect will generally be intimated by the irregular beating of the engine; the tubes should also be examined and cleaned out, and the ashes emptied out of the smoke-box through the small ash-door. If the engine be a six-wheeled one, it will be liable to pitch and oscillate if too much weight be thrown on the driving-wheels, and where such faults are found to exist, the weight upon the driving-wheels should be diminished. The practice of blowing-off the boiler by the steam, as is always done in marine boilers, should not be permitted as a general rule in locomotive boilers when the tubes are of brass and the firebox of copper, but when the tubes and fireboxes are of iron it may safely be done. Before starting on a journey the engineman should take a summary glance beneath the engine, but ought first to assure himself that no other engine is coming up at the time. The regulator, when the engine is standing, should be closed and locked, the eccentric-rods be fixed out of gear and the tender-brake screwed down. The cocks of the oil vessels should at the same time be shut, but should all be opened a short time before the train starts.

Most of the accidents attended with loss of life upon railways have been occasioned by persons jumping on or off the train whilst in motion, and many cases might be cited of engine-drivers and stokers having been killed by falling off the engine—in some cases from the coupling of the engine and tender suddenly giving away. The most frequent causes of collisions are fogs, and the absence of a uniformity of time at the different stations along the line in consequence of their difference of longitude. Collisions have sometimes occurred from carriages having been blown from a siding upon the rails by a high wind; and the slippery state of the rails, or the fracture of a brake, has in some cases caused collision at a terminal station. Collision has also taken place from one engine having overtaken another, in consequence of the imperfect condition of the first engine from a leaky tube or otherwise.

When a tube bursts, a wooden or iron plug must be driven into each end of it, and if the water or steam be rushing out so fiercely that the exact position of the imperfection cannot be discovered, it will be advisable to diminish the pressure by increasing the supply of feed-water. Should the leak be so great that the level of the water in the boiler cannot be maintained, it will be expedient to drop the bars and quench the fire, so as to preserve the tubes and firebox from injury. Should the wooden casing of the boiler catch fire, it may be extinguished by throwing a few buckets of water upon it, or if the engine is at a station, it may be brought under the water crane. Should the piston-rod or connecting-rod break, or the cutters fall out, or be clipped off as sometimes happens to the piston-cutter when the engine is suddenly reversed upon a heavy train, the parts should be disconnected; if the connection cannot be restored so as to enable one engine to work, of course the valve of the faulty engine must be kept closed. If one engine has not power enough to enable the train to proceed with the blast-pipe full open, the engine may perhaps be able to take on a part of the carriages, or it may run on by itself to fetch assistance. The same course must be pursued if any of the valve gearing becomes deranged and can not be rectified upon the spot.

Before leaving a station the engine-driver should always assure himself that he has the requisite supply of coke and water, and should not trust to the attention of the stoker respecting such matters. Besides the firing tools and rakes for cleaning the tubes, he should have with him in the tender a small oil tank and a small tallow chest, a bag of waste, some rope yarn, gasket, canvas, and white lead, two small oil cans, an oil syringe, spanners, and one shifting key, a chipping hammer, chipping chisels and a file, a coal hammer, some wooden and iron plugs, and an iron plug-holder, a sheet-iron bucket, a screw-jack, two crowbars, a chain and some wooden wedges. The whole of these articles should be arranged in the tender in suitable places, so that the engine-driver may know where to put his hand upon any article, and can see at a glance whether any of them are missing. A few spare bolts of different sizes should also be carried. To economize fuel in locomotives a variable expansion gear is very desirable, which may be adjusted to the load, and the blast-pipe must be worked with the least possible contraction. At stations the damper should be closed to prevent the dissipation of the heat. Anthracite has been tried for locomotives instead of coke, but it crumbles down into a powder and forms a compact mass upon the bars, which prevents the admission of an adequate supply of air to the furnace. If the area of grate be enlarged, however, it appears probable that anthracite may be used if mixed, for economizing fuel. The practice appears to us to be commendable enough, but it should be coupled with the publication of the consumption of the locomotives of different makers, as no amount of care on the part of the engine-driver will suffice to correct the vices of an imperfect machine.

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The general manager of a stock-car line some time ago was getting a large number of new cars built and he decided to use elliptic springs under the whole of them. The extra cost was a heavy item, but he says that the cars rode so much better that the company was more than repaid in six months for the extra expense by the improved condition of the stock carried. In connection with this subject a good authority on springs says that a spiral spring is cheaper at first and will be more durable and will ride better than a short elliptic spring, but a long elliptic spring is the ideal cushion to absorb the jar of the cars. If a little more attention were bestowed on trucks to enable elliptic springs of proper length to be applied, that form of spring would push all others out of the market for cars carrying material liable to suffer from rough riding.

## Activity at the Cooke Shops.

The Cooke Locomotive & Machine Co. have just completed an order for twenty-two ten-wheel engines for the Houston & Texas Central Railroad Co. They have 19x24-inch cylinders and 54-inch driving-wheels. Weight of engine, light, is 96,500 lbs. Equipped with Richardson-Allen balanced valves and Westinghouse brake equipment, schedule W M.

The Cooke works are now engaged on three fast passenger anthracite coal-burning engines for the Delaware, Lackawanna & Western R. R. Co.'s main line. Cylinders, 19x24 inches, drivers, 64½ inches diameter, Krupp tires, Boies wheels on both engines and tenders, Richardson-Allen balanced valves and Westinghouse brakes, schedule W.

Also three large ten-wheel engines, having cylinders 21x26 inches, drivers 56 inches diameter, for the Everett & Monte Cristo Railway, Washington.

Delivery of the twenty consolidation and five ten-wheel passenger engines for the Louisville & Nashville R. R. will commence this month, and continue throughout July and August, 1892.

Orders have lately been booked as follows:

One mogul switching and three additional eight-wheel passenger engines for Delaware, Lackawanna & Western R. R. Co.

Three eight-wheel passenger engines, with 18x24-inch cylinders, for the Evansville & Terre Haute R. R. Co.

One eight-wheel passenger engine, anthracite coal burning, with 18x24-inch cylinders, 66-inch drivers, for the Lehigh & Hudson River R. R. Co.

Their two-cylinder compound locomotive engine is being tested on the N. Y., L. E. & W. R. R. between Port Jervis and Susquehanna, and, if it proves economical with fuel, it will no doubt meet with favor from railroad men, on account of the extreme simplicity of all its parts.

## To Light the World's Fair.

There was a vigorous fight among the different electric lighting companies to secure the contract for lighting the World's Fair, and Mr. George Westinghouse, president of the Westinghouse Electric Co., has obtained the contract for furnishing the incandescent electric lighting plant, and is to install 92,622 lamps, alternating current, for $399,000, under a bond of $1,000,000, and is given until June 10 to file his bond and close the contract. This makes Mr. Westinghouse the winner in a big fight against the electrical combine, consisting of the Edison General, Thomson-Houston, and allied electric companies. When the bids for furnishing the plant were opened, the trust proposal was $18.50 per lamp capacity, or $1,713,567. Several smaller concerns submitted greatly lower bids, so much so that the management thought the combine was trying to "squeeze" the Exposition. While these bids were being considered, the La Roche Co., of Philadelphia, backed by Mr. Westinghouse, came forward with a bid of something like $7 a lamp. The trust met this reduction with a bid of $5.95 a lamp. Then Mr. Westinghouse told the directors if they would advertise for new bids he would submit a proposal agreeing to furnish the lights at an average of $5.38 each, or a total of $499,319. He executed a bond in the sum of $500,000, supplemented with a cash deposit of $50,000, to carry out his agreement. Accordingly new bids were advertised for, and when they were opened it was found that the combine had not lowered its proposal, while Mr. Westinghouse dropped down to $399,000, or $4.25 per lamp capacity. He bid on an alternating current alone.

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The next meeting of the Grand Lodge of the Brotherhood of Locomotive Engineers will be held at St. Paul, Minn., in May, 1894.

## Running at the Rate of 115 Miles per Hour.

At the Convention of the American Society of Mechanical Engineers, held at San Francisco in May, there was a paper read on the Electric Railway as applied to Steam Roads, by B. J. Dashiell, in which some interesting particulars were given of experiments with a high-speed electric locomotive. A circular track nearly two miles in length and 28-inch gauge was built and a motor run on it as fast as the power would propel the machine. The motor rested on four wheels 28 inches diameter and had a wheel-base of 9 feet. Each axle carried a gearless motor. The extreme length of the machine was 21½ feet, and it was built with pyramidal ends to reduce the air resistance. The weight of the motor was not given, but we think it probably weighed about two tons. The propelling power was supplied by a high-speed automatic engine of 100 horse-power, running at 300 revolutions per minute, and driving an Edison electric dynamo. The electric current was taken from an overhead T-rail.

The performance is thus described by the author. During these experiments we experienced only three derailments, two of which occurred at 45 and 80 miles respectively, and were due to a portion of the road being poorly ballasted. These two derailments were toward the center of the circle, the car leaving the rail only, and running along the guard rail. In the third derailment, which was due to not enough elevation in the outer rail at the place of derailment, the car, following the well-known law, went off at a tangent, climbing the guard rail and running along a six-foot fill, and then out in a field a distance of about 1,000 feet from the place of derailment. The car at this place was going at a speed of 115 miles per hour; the highest speed made, as taken between by two of the five observers stationed at intervals along the track, according to grade, being 118 miles. The longest continuous run was 22 minutes at various speeds, with a mean of 68 miles per hour; another run of 9½ minutes averaged nearly 80 miles per hour.

## A Rotary Spark-Arrester.

The inventors of the spark-arresters that call into requisition fearfully and wonderfully made smokestacks have been taking a rest lately, but this line of invention is

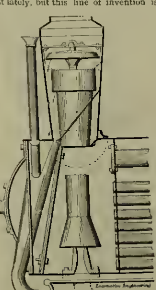
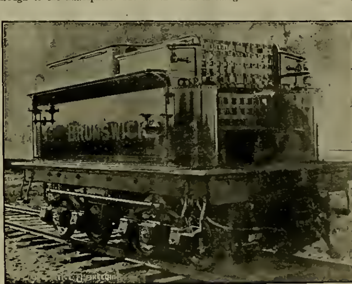


Fig. 1.

not entirely abandoned. Less than a month ago a patent was granted to Mr. L. C. Mabie, of Richmond, Va., for a form of spark-arresting stack that throws most of those who have gone before entirely into the shade. We illustrate Mr. Mabie's invention. It is surprisingly ambitious. The mechanism seen in Fig. 2 are revolving turbines with the hot air and gases as motive power. One revolves to the right and the other to the left and they are expected to keep whirling all the time when hot air is passing into the stack. Their functions are to jerk all sparks into the side recesses of the stack and also to take out of the gases the minute particles of carbon that constitute smoke. We do not just see how the gases are going to get through to the atmosphere, but the inventor, no doubt, has settled that in his own mind. The plan is not absolutely original, but it is worked out in greater detail than anything in this rotary spark-arresting line has been done before.



New Brunswick Tender.

## New Brunswick Tender.

Our engraving shows the standard form of tender used on the New Brunswick Railway before the road was absorbed by the Canadian Pacific. It was designed by Mr. G. A. Haggerty, master mechanic. The water is beneath the coal, except a small coal space in the front. An attractive feature about the tender is the substantial and convenient form of coal boards. The frame is wood and the body of the tender of steel.

Fig. 6.

There is a very fair Ananias Club reporter on the Chicago *Herald* who devotes himself to concocting railroad lies. The man has a fertile imagination that may gain its owner reputation should he drift into a department of literature where the free-play of fancy would not make the writer ridiculous. One of his latest efforts is the working up of a story to the effect that N. G. French, superintendent of bridges of the Illinois Central, whittles out the design of his bridges. The story as told combines the amusing and the ridiculous very artistically. We have no doubt whatever that all the bridges designed by Mr. French are whittled into shape. There is an engineering department of the road which attends to that business.

The Chicago & Northwestern Railway people are remodeling their yards at the Chicago passenger depot and putting in a new central electric and heating plant. The main pipe of the heating plant will be 1,500 feet long. For the electric plant 250 horse-power engines will be put in and five boilers will be provided to supply steam for the engines and for heating purposes.

## Mysterious Failure of Steel Sheets.

The mechanical department of one of our principal railroads had a curious and edifying experience lately with the failure of steel sheets. Sheets from one of the best steel makers cracked badly on being flanged. Other sheets were put into the heating furnace and on the attempt to flange them being made, cracking and fraying of the worst kind resulted. The men in charge concluded that something of an intensely serious nature was the matter with the steel and they were about to report the failure to the maker when someone suggested that they try heating the same steel in a blacksmith's fire. This was done and the steel showed the very finest flanging qualities.

There was considerable mystery about how the heating furnace made the steel brittle, and the lining was cleaned out and rebuilt, after which the sheets came out and flanged without showing any defect. The question then arose, what was the matter with the furnace before it was relined? The question could not well be left unanswered, because the causes that were at work to deteriorate the sheets might become active again. An investigation was instituted. The furnace had been used occasionally for other purposes than heating plates, and it was remembered that phosphor bronze driving-boxes, about to be broken up for melting, had occasionally been heated in the furnace where they could readily be broken. No doubt, pieces of these boxes had accumulated in the furnace.

To find out whether or not this substance would exert a prejudicial effect upon steel, a piece of good steel was heated and ground phosphor bronze sprinkled over it. The steel acted then as if it was rotten. It had absorbed sufficient phosphorus to destroy the metal. This railroad company are now very careful to keep phosphor bronze away from all fires and furnaces where steel is heated.

## A New Throttle Valve.

A new double throttle valve is shown herewith that has recently been brought out by the Schenectady Locomotive Works.

As will be seen at a glance, two small, double-seated balanced valves are used instead of one large one; the levers are so arranged that one valve is opened entirely before the other one leaves its seats.

The picture shows the right hand valve wide open, the left one closed. It will be seen that the cross-arm connecting the two valves is not lifted from the center, but from a point nearer the right valve; when this valve is opened, the cross-arm strikes a lug on the valve casing, and a further movement of the throttle will open the left valve.

This admits of a very slight opening of the throttle to move the engine, etc.

It is hoped that this valve will be easier to keep tight than the usual one of large diameter, and be much easier handled.

New Throttle.

The Philadelphia & Reading road have in service at the present time a number of locomotives which have nozzles equal in opening to a single tip 10¼ inches in diameter. These engines are fitted with the Smith triple-expansion exhaust-nozzle of the improved form. Mr. Smith's original nozzle had twenty-four passages in it—the new one has but four—two for air and two for steam. These pipes were put on the Reading road solely to prevent fire and this is accomplished to a wonderful degree. Mr. Paxton, superintendent of motive power, says he has personally investigated the matter and gone out on the engines at night to try and find fire, but has failed to do so. One of the engines fitted with this pipe has recently pulled the heaviest train ever hauled over the road. The opening of the nozzle was larger than the passage through the saddle. From a number of experiments that we have seen recently we are satisfied that there is something in the principle on which Mr. Smith makes his pipe that deserves a thorough trial at the hands of our best railroad men. The original pipe did good work but stopped up badly—we know of pipes that have been running ten months now without clogging

The Eugene V. Debs Publishing Co., of Terre Haute, Ind., will soon bring out in book form, "Simple Lessons in Drawing for the Shop," by Orville H. Reynolds, mechanical engineer of the N. P. Ry., formerly contributed to the columns of this paper. These articles tell in plain language how to learn to make good working drawings with a ten-dollar set of instruments, and ought to meet with an immense sale in this country where there is a chance for every shop man and apprentice who tries to get up. The same concern will also publish "Locomotive Running Repairs," by L. C. Hitchcock, general foreman of the "Soo" shops at Minneapolis, the last article of which appears in this paper. There has never been a practical book on running repairs gotten out, and this work from the hands of a practical man has been highly appreciated and will doubtless meet with a large sale. Both books will be fully illustrated and gotten out in a substantial but cheap form.

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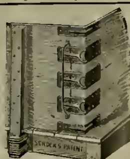


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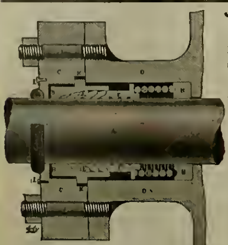

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**Inventor and Proprietor.**

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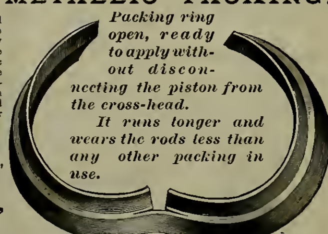


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(Patented June 1, 18[illegible].)
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(The Original Ring Packing.)
In ordering give exact diameter of Stuffing Box and Valve Stem.
None genuine without this trade mark.
THE GOULD PACKING CO.,
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New York, Chicago, and London, England.

## A New Method of Keeping Up Air-Brakes.

The Boston & Albany is one of the few roads in the country that tries to get the best results, regardless of expense. When anything is proven to be best for their conditions it is adopted then and there.

Recently, the motive-power department has been trying to devise a system of air-brake inspection and reports that would prevent a road failure of the brake, and require the least work and trouble of those who were responsible for its success.

To this end an air-brake inspector was appointed, who had authority to order all needed repairs and changes, and provision was made for a report to the superintendent of motive power of all defects, no matter how slight.

A list of the usual ailments was prepared, and each disease numbered. This sheet reads as follows:

WESTINGHOUSE AIR-BRAKE EQUIPMENT.

It is very important that the air-brake equipment on locomotives should be maintained in the best possible manner. To accomplish this, the standard of inspection must necessarily be high; therefore, to help you to bring the equipment up to this standard, the following defects, when they exist, must be reported by engineers and inspector of air-brakes on blanks furnished them for that purpose.

1. When, with 125 pounds steam pressure, the 8-inch pump will not compress from 20 to 70 pounds pressure of air in main reservoir at the rate of 200 cubic inches per second.
2. When air-valves have not proper lift.
3. When lubricator is not working properly.
4. When the brake-valve handle is not working easily, and the stops, for various positions of handle, cannot be readily distinguished by feeling, as the spring on the handle approaches them.
5. When the engine is not coupled to cars, and the main reservoir pressure equalized with auxiliaries, the brake-valve handle cannot be placed in "running position" and left in this position without the brake setting.
6. When, on account of leaks, a reserve pressure of 15 pounds cannot be maintained with brake-valve handle in "running position."
7. When feed-valve spring does not hold a reserve pressure of 15 to 25 pounds in main reservoir.
8. When rotary-valve leaks so, with brake-valve handle on "lap," that it will release the brake after it has been applied, with a reduction of 10 pounds or less. This applies to engine alone.
9. When the piston-valve does not move freely, and close tight, with handle on "lap," after applying brake with a train.
10. When locomotive brakes are applied, with a reduction of 20 pounds of air, and will not stay on at least five minutes and hold the shoes rigid against the wheels.
11. When the driver-brake piston travel is less than 2 or more than 5 inches.
12. When the tender-brake piston travel is less than 6 or more than 10 inches.
13. When any of the levers strike or catch on tender or truck frame, or the levers or pistons do not return promptly to their place after air is released.
14. When any of the brake-shoes, heads, rods, hangers, levers, safety-chains or hooks are lost or broken.
15. When steel brake-beams are bent more than 1 inch out of horizontal line either way.
16. When the black hand of air-gauge is at 70 pounds, and the brake-valve handle in full release position, the red hand shows a difference of 5 pounds or more.
17. When governor stops the pump 3 pounds either above or below 70 pounds.
18. When the governor requires a reduction of more than 5 pounds before admitting steam to pump.
19. When there is not a plug-cock in brake-pipe to cut out engineer's valve, when more than one engine is used.
20. When there is no drain-cock in main or auxiliary reservoirs.
21. When a pipe and cock are not provided from tender cylinder to foot-board of engine for releasing tender-brake.
22. When there is no oil-cup on those driver-brake cylinders placed next to the firebox.
23. When the rear end of tender is not supplied with a hose having a good gasket, also a dummy coupling.
24. When the forward end of engine is not supplied with same equipment as rear of tender.
25. When a spare hose is not carried, and in good condition.
26. When safety-valves are used on the main reservoir, or any part of the piping.

A. B. UNDERHILL,
Supt. Motive Power.

*Springfield, March 1, 1892.*

Now, when a train comes in with any defect, say, 11 and 17, the air-brake inspector fills out a blank furnished, as follows:

DAILY REPORT OF AIR-BRAKE SERVICE.

.......... ..........189

To A. B. Underhill, Sup't Motive Power,
Springfield, Mass.

Number of engine.......................
Engineer.......................
No. of cars in train.......................
No. handled by engineer.......................
Left.......................M.
Arrived.......................M.
Condition of brake on engine, "*Defects 11–17.*"
Remarks.......................
.......................
.......................
Inspector of Air-Brake.

This goes to the superintendent of motive power, and is a short and complete report, easily filed and taken care of.

Blanks are furnished for engineers to report the condition of their brakes, and it is not necessary to describe the defect, but to simply put an X opposite the printed report of work needed. Here is this blank complete, it is the best thing of the kind we have seen

BOSTON & ALBANY RAILROAD.
*Motive-Power Department.*
REPAIRS TO AIR-BRAKE EQUIPMENT.

To foreman of engine house at..........

Pump.—
- Will not run.
- Will not compress air fast enough.
- Pack upper stuffing-box.
- Pack lower stuffing-box.
- Does not get oil enough.

Throttle-valve.—
- Needs grinding.
- Needs packing.

Regulator.—
- Needs to be adjusted. X
- Requires too great a reduction of air.

Air-gauge.—
- Needs to be tested.

Engineer's brake-valve.—
- Handle moves hard.
- Rotary-valve leaks
- Piston-valve leaks.
- Feed-valve leaks.
- Handle spring is weak or broken.
- Reserve pressure is not right.

Piston travel.—
- Too much—tender-brake cylinder.
- Too much—driver-brake cylinder. X

Leaks.—
- Driver-brake leaks off.
- Tender-brake leaks off.
- In brake-pipe—train line.
- Between pump and engineer's valve.

Hose.—
- Defective at rear end of tender.
- Defective at forward end of engine.
- Defective between engine and tender.

New shoes.—
- On driver-brake.
- On tender-brake.

Brake cut-out.—
- On tender, on account of..........
- On engine, on account of..........

Miscellaneous.—

Engineer.................. Engine, No..........
Date..................189

Note.—Mark X in margin opposite repairs needed.

Tired runners will appreciate the X scheme. What is the matter with a report of engine-work on the same plan, especially where they are chain-ganged?

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A special train of vestibuled cars designed throughout on the American plan has been built for the Emperor of Germany. Some of the German roads are also introducing vestibule trains and dining-cars for ordinary passengers. This is likely to lead to a revolution in the design of European cars, for a dining-car is of little use if the passengers from the whole train cannot obtain access to it while the train is in motion, and the American plan of car construction is the only one that provides means of free intercommunication throughout the train.

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At the annual meeting of the directors of the Consolidated Car-Heating Co., at Albany, on June 7th, the secretary reported large sales of heating equipment, averaging $1,000 per day for the year, and a dividend of 1½ per cent. was declared.

## Driving-Box Brass Jack.

The engraving shown herewith represents a new tool just put on the market by Watson & Stillman, of this city. It was especially designed for putting in and taking out brasses of locomotive driving-boxes, but is admirably adapted to a large variety of railroad work. The operating power is a 20-ton base-style hydraulic jack of special make, mounted in the upper platen, with the cylinder and base counterbalanced; and, as the operating lever in regular jack would be too high for convenient manipulation, a special jack is used and a device is attached to the rods, and at this position the jack is operated the same as it would be at the jack proper. The movement is 12 inches and the full opening between the lower platen and the bars is regularly 18 inches. The lower platen is made 30x48 inches and has a hole 4 inches in diameter through its center for forcing work through when the plug which fills it is removed. The counterweight is so situated that it is not in the way, and is held in place when moving the press around the shop. The truck-wheels are 8 and 10 inches in diameter by 3 inches face.

The Long Island have just put into service ten new suburban and three switching engines. The suburbans are Baldwin compounds.

## Wanted—A Better Paper.

The demand for educational mechanical papers is well illustrated in the following letter from Mississippi. It is published *verbatim*:

WATER VALLEY, MISS,
May The 16 | 92

Edctors and Propriter off the LocomotiVe engineer Sirs

I Cannot Say that your Paper has Ben Interesting to us at All and Can say that we learnt But little from its Collumons while you Publish Some facts that is wourth while Reading thare is the Biggist Potion of your littel Paper Dewelling on the Most Commo news In the Countery from the Rio grand to Paciffic slope

And thare has Ben lots of articils Published & your Paper that was not admired By Rail-Rood employes through out the land and you Mintion In your notice of Renewal that Rail Road men Seldom Read nothing Bitter than the Police Gazett and I for one look upon the Paper Spoken of far Superor to the Locomotive Engineer for it is knowen By all that the Police news is one of the Beast Spoarting In the Continent and spoart is all that is Expected of it while you Claim that your Paper is the Beast mecanical Paper out and for the Past months your Paper has Ben full of Artecils that was a shame to waste good Paper with Print So now I wish that I Could Sit Down and have a long talk with you and Refreash your memory of the Past and show you whare you have taken the wrong steap In life that is what of out your Publication matters I do not like your style of writing at all as for me I dont want to hear you Discuss nothing like you have Ben Discussing I should think If you would Discuss matters on the Political matters of the Day and lit By gons Reast you you would Come a Grade deal Better In the futher So we do not want your Paper no more, feeling sorry for the field you have Ben laboring In for the Pas year

We Remain Truley
J. R GOFFENY
W. G. RAY
JAS. B. TUCKER
Water Valley Miss

This trio have their names all signed by one hand, but evidently don't appreciate this paper. If they can be induced to even read a good "spoarting" paper, the company ought to buy it for them. We were awfully broken up when we got this withering letter and have worried about it nights for fear it would get out that three such men washed their hands of us, the only thing we can do in the case is to publish the paper for the thousands who do appreciate it (devoid of *spoart* or politics) and patiently wait for the Kintergarden to get in its work on these truants.

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Engineers know something once in a while: they know a thing when they see it and feel it, anyway. Not long ago, Supt. Vreeland, of the N. Y. C. & N., bought a carload of Wyoming coal of good quality, but had it shipped in the same cars as the cheaper grade in use. He did not even tell the master mechanic. It was carefully watched and noted what engines were equipped with it. The next day he met one of the engineers, who said "Say, Mr. Vreeland, I got a tank of mighty good coal yesterday—best I ever saw you buy. Made a round trip with the tank and had some left. I could run on two tons a day less with that kind of truck." "You're off," said the super., "just cleaned your nozzles, or the fireman was careful, or something; there's no record of any different coal than usual being bought." "I don't care for the record; that coal was better; it burned something like Wyoming we used to get on the Delaware in '67." During the week every man but one who had tried the coal came and spoke about it, and that one gave the coal-heaver a cigar and asked if he didn't have some more of that coal with the little red streaks in it.

## NEW BOOKS.

BOYD'S BUSINESS DIRECTORY OF PHILADELPHIA FOR 1892. C. E. Howe Co., 234 South 8th st., Philadelphia, Pa.

This is the usual business directory with the addition that it contains the residence of all the business men as well as their office address. It contains upward of 1,500 pages.

## Trip Reports in New South Wales.

Some of the men in this country think they are bandaged with too much red tape, but they can thank their lucky stars that they are not the worst off in this respect. One of our interested subscribers in Australia sends us a blank trip report used on the road on which he is employed.

x
213
St. 2206.

NEW SOUTH WALES GOVERNMENT RAILWAYS.

NOTE.—Every Driver must hand one of these forms to the Guard of the Train before starting, and the Guard must fill in the running, and hand the report back to the Driver, before the Engine is detached from the Train.

Engineman's Daily Report for ............ 189 .

Engine No.............Train ............ Driver ............ Fireman............

| TIME. | FROM ........ TO ........ | Hours. | Minutes | | Actual Train Miles. | | No. of Miles. | Coal. cwts. | Wood. cwts. | Castor. pints | Colza. pints. | Kerosene. pints. | Tallow. lbs. |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| On duty...... | | | | Passenger.... | | Assisting.... | ........ | | | | | | |
| | Standing.... | | | Goods ....... | | Attached .... | .... | | | | | | |
| Off duty... | Shunting .... | | | Minerals..... | | Shunting ....... | | | | | | | |
| | Running .... | | | Loco. Coal.... | | Ballasting... | | | | | | | |
| On duty—Hours.... Minutes..... | | | | | | Light ..... | | | | | | | |
| | | | | | | Water......... | | | | | | | |
| | Total... | | | Total. | | Total. . | | | | | | | |

REMARKS.

[Here follow ten blank lines.]

(Driver's Signature)

(Fireman's Signature)

N.B.—The causes of delay, accidents, defective fuel, &c., must be fully reported in the above space for remarks. This Report must be filled up, and the driver must deposit it in the appointed place before leaving the shed at the Home Depôt. When drivers engaged on special work, ballasting, &c., go off duty away from their Home depôts the Report sheet is to be enclosed in an envelope addressed to their Inspector, and left with the Station Master to be forwarded by first train.

4M 1115—90

St. 2226

NEW SOUTH WALES GOVERNMENT RAILWAYS.

Guard's Statement for Engine-driver.

From ............ to ............ Miles

Engine No............Driver............Fireman............

| STATIONS. | Miles. | Arr. H. | Arr. M. | Dep. H. | Dep. M. | Particulars of Time Lost. At Stations | By Signals. | By Loco. | Other Causes. | Load. Attached. Wagons. Empty. | Loaded. | Carriages | Detached. Wagons. Empty. | Loaded. | Carriages |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|

[Here follow thirty-four blank lines.]

Time lost by Locomotive

(Date)............189 . (Signed)............Guard.

NOTE.—The Guard must fill in this Statement of the running of his Train, and at the end of his journey hand it back to the Driver.

The sheet is 8¼ x 13¼ inches, with a form on each side.

Observe that the driver must hand the blank to the guard before starting and receive it before detaching his engine from the train. This seems a very cumbersome document compared with our neat little bound slips 3 x 5 inches.

But the Australian is noted for his fair and square dealing—he is the inventor of the best mode of balloting—and this document prevents conductors and engineers lying about the delays. The guard is not going to put down delays to "engine not steaming" unless it is true—for the engineer sees his report. We have reproduced both sides of the blank, full size, leaving out the blank lines.

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The pamphlet on "Economy of Way," by Benjamin Reece, has been in such demand by a great many railroad officials for distribution amongst their trackmen, that a very large second edition has been ordered, and the Q. & C. Company, 703 Phœnix Building, Chicago, Ill., will send them to any officials desiring copies that have so far not been provided with a sufficient quantity.

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Pedrick & Ayer, of Philadelphia, are busy at present on several larger sizes of the Richards open side-planer. They are making one for Geo. B. Cresson, of Philadelphia, that is to plane a piece 42 inches wide and 12 feet long. They are also building one for the Detroit Electric Works, to plane 30 inches by 10 feet.

A two-car special was recently taken over the Chicago & Northwestern pretty lively. From Chicago to Cedar Rapids, 220 miles, was made in 4 hours and 30 minutes; 3 hours and 54 minutes actual running time, or at the rate of 56 miles per hour. This work was done from Chicago to Clinton, 138 miles, by engine 274, an 8-wheeled 18x24 engine, with 68-inch wheels, built at the company's shops. Engineer Geo. Murdock had hold of her crank. From Clinton to Cedar Rapids, 82 miles, the train was pulled by engine 663, a Schenectady, same size as the 274, in charge of Engineer "Andy" Sloan and Fireman C. M. Goodrich. The men on the road give these crews great credit for their run. Murdock had not been over the division on which he ran for 13 years, and Sloan had made 113 miles on freight with the same engine that day. Part of the track was new and soft from the rains. Andy says he will throw the 663 over this 82 miles of road in 75 minutes just as soon as it is in good shape and they give him a show.

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A committee of the Master Car Builders' Association, appointed to investigate the steel-tired car wheels and report on the same, made a report that about 25,000 of such wheels are in service. Most of the information received relating to defects of the wheels was about the tires. There was little said about defective centers, but the committee found that none of the bolted centers are entirely free from trouble with loose bolts.


## The Oirish Debater.

"Years ago, when I was running on the Little Miami," said the visiting member from the South, "we had a green brakeman in our crew.

"One dark night he had to go back and flag in a piece of dense woods, and as he stood among the shadows, a little uncomfortable for the gloom, an old-man-owl sitting on a limb near by called out:

"'Whoo, whoo?'

"'Patsy Considine, sorr,' answered the gafter, promptly.

"'Whoo, whoo?' inquired the owl.

"'Oi'm brakin' behind for Jerry Patterson.'

"'Whoo, whoo?'

"'Oi live in Xenia, if that's phwat ye want to know.'

"'Whoo, whoo?'

"'Me father woorks in the gas house.'

"'Whoo, whoo?'

"'Oi'm a brakeman, Oi tell ye, an' Oi haven't a dommed cint, so there.'

"'Whoo, whoo?'

"'Howly Mother, phwat is it ye're hunting for. Oi belong to Father Ryan's —'

"'Whoo, whoo?'

"'Well, be jabbers, if ye want to git me bio-graphy yez can inquire of the trainmasther, who kapes tab on me purson-nal ree-cord; dommed little information ye'll be gittin' from Patsy Consi—'

"'Whoo, whoo?'

"'Ah, go t' th' divil wid ye. Phy don't yez come down forninst me loike a man, an' Oi'll—'

"'Whoo, whoo?'

"'"Hoo, hoo" yersel', ye dorty backbither of a —'

"'Whoo, whoo?'

"'Ax me back.'

"'Whoo, whoo?'

"'Oh, go to hill; Oi'll answer no more of yer foolish questions. If Oi cud git me two oyes on yer durthy mug, Oi'd putt ye in mournin', so Oi would.'

"'Whoo, whoo?'

"'Phwat's der matter wid yer, Patsy?' yelled Patterson, as he came up with his lamp, 'phwat are ye doin' talkin' to yersel' an' quarrelin' wid owls an' bats; come along wid ye, we've bin phwistlin' yez in for the past quarther-hour!'

"After that the boys called Patsy the Oirish debater,' and finally shortened it to 'Parnell,' and 'Parnell' he is to this day."

## Doc. Kellgore—Swiper.

'Talkin' o' liars," said the old-timer, borrowing a sniff of snuff from Pap Snow, "Talkin' o' liars makes me think o a thief I had onct out at the front on the 'Park.' He watched the engine nights. He were a youngish cuss from Kansas City, an' his dad bein' a doctor we called him Doc. He was the worst thief I ever see. He stole handkerchiefs from every passenger conductor on the road—'swiping a wipe,' he called it.

"The canaries (we had about sixty of 'em) used to wash their clothes on Sunday, and Doc never failed to get the best pair o' socks that were hung out. They would put 'em on the bushes to dry, and Doc would look down there and say:

"''Pears to me I see red socks on them vines, when socks is red they is ripe. I gather my fruit when ripe. Swipes, old boy' (he allus called hisself Swipes) 'git in yer work.'

"An' I want to take an' tell you right now, that it didn't make any difference how many 'tarriers' was a watchin', he'd get the socks all hunky.

"We were at the end of the road, and not in a very good position to draw supplies, but Doc 'found' the 30 and her crew. Every day or two we would find new oil cans, a new scoop or a new slash bar. We had an old, small-sized headlight, and Doc tried every reflector on the road in it, but couldn't make it go. This was one of the sad things of his life.

"Onct I had to go to the shop, and the machinists found thirteen packing wrenches on her. I come near gettin' fired for that.

"One day when we were about a mile from Buena Vista, Doc he says to me, says he, 'Baldy, old man, I'm a-going to walk up to the city; is there anything your heart desires for the 30, for if there is you know that Swipes will reach for it?'

"'Well,' says I, lookin' down outen the cab, 'yes; I think it's a sorter an ornery, no-'count watchman that can't git a lookin'-glass for the engine he takes keer of.' Dock went off laffin'—he was a norffel good-natured soul.

"Well, gentlemen, that evening I were sittin' on the front buffer readin' a week-old paper an' a pryin' up a hunk o' bull beef from between my molars, when Doc showed up with a big bundle.

"'Now let up on yer darn kickin' about a lookin'-glass to admire your whiskers in,' says he, 'here you are: compliments o' Swipes.'

"That young cuss had a lookin'-glass about fourteen by thirty inches square, a soap dish, bar of soap, four towels, a comb and brush with about four feet of brass chain fast to each, and one of them foldin' hat racks.

"'I'd a got the tub, Baldy, but she was fast to the wall, but I hope you wont hold that out against me,' says he.

"The young villain had taken a bath and then threw everything out of the window but the tub. He felt kinder beat out about not gettin' that, and was minded to go back for it, but I talked him out of it."

## The Change that would Make Her Steam.

Ed. Woods is an engineer on a northwestern railroad. He is one of the men who knows his business and runs his engine with full authority over the whole machine. Ed. is a good engineer to fire for, but he quietly asserts his authority when it comes in question, and there is never any mistake as to who is running things on the machine when Ed. is at the throttle. Things were rushing on the road some years ago, and the master mechanic was hiring nearly everything that came along calling itself an engineman.

A fireman of the genus tramp was assigned to Ed. Many tramp firemen are first-class men if they can be induced to let whisky alone, but this Abe Funk was of the kind who have to go searching for jobs because no man will put up with them for more than two trips.

After they started out the engine steamed badly. The fireman was one of the class that fill up the firebox and then climb on to the seat for twenty minutes' devotion to the god of idleness. Ed. several times stopped the over-loading of the firebox and gave directions how he wanted the engine fired, but Abe paid little attention. He had points that might have made him a success in a political-run town, but as a fireman he was a failure.

As the steam pointer crawled steadily toward zero, Abe appeared bound to make some remarks, so he went over to the right-hand side and made some disparaging remarks about the engine and the engineer.

"If Neil Blount, of the Wabash, was running this scrap heap, you bet your best brogans he would make her steam. There was never no busted kettle got away with Neil. Why, pard, Neil would make an engine steam when the biler was so full of mud an' scale that ten buckets of water would choke her to the whistle"

"Won't you add about two buckets to that count?"

"Nary a bucket."

"How did Neil manage?"

"Manage to make a bloomin' washtub steam? He was up to all kinds of tricks. No cripple mill could get ahead of Neil. He'd change the petticoat pipe, and if that didn't work he'd change the traps, and if the trap didn't steam after that he'd change the smokestack. You bet, Neil would change things till they were just right."

"Well, I can make this engine steam with very little change."

"Is that so, pard? I wish you would do it right away."

"Yes, I shall do it when I get in. It is a very simple job. I shall change the fireman."

## A Limerick Engine.

One evening last winter the pay-car of the Lake Shore & Michigan Southern arrived at Adrian and the venerable paymaster sent out notice that he would hand out the greenbacks to engineers, firemen and other trainmen. In the line that formed outside the pay-car was Tim Gaffney, an old engine-house sweeper. When he reached the inside, the paymaster objected.

"Why, Gaffney, you are not an engineer."

"Beggin' yer pardin," said Gaffney, "it's meeself as is the furst kind av an engineer."

"What kind of an engine do you run, Gaffney?"

"Well, sur, Oi run a Limerick engine, wid two stharting-bars and ime whale."

Gaffney got his money.

## How Revolutionizing Inventions Worry Railroad Officials.

A wild-eyed inventor of a life-saving (?) and train-paralyzing device recently sat in the holy of holies and told us that the measly railroad officials of this country would rather go howling down the grade of time a menace to the traveling public than to make everybody as safe as Pike's Peak by adopting his calamity-coupler. He said railroad men didn't appreciate the inventors of the day, and he said he was an inventor.

We were painfully reminded of the foundation upon which this man's charges were made a few days ago, when there fell into our hands some correspondence between the motive power officials of two big roads:

R. D. W., S. M. P.:

Please note inclosed clipping from the technical column of one of the New York papers.

Its simplicity will commend itself to your mechanical sense of fitness. Now, as one of the traveling public, I have noticed great clouds of smoke from R. & D. engines. If they could all be converted upon this principle, think what a boon you would confer by feeding them on pure, hot oxygen!

In another paper I find the following explanation of the benefits of such treatment. "Oxygen is to hydrogen as pure gin is to water and gin."

Hoping and trusting that I shall soon see all of the smoky, dirty R. & D. engines altered on this principle, I remain,

Yours truly, A. W. G.

*Savannah, Ga.*

THE ITEM.

Another arrangement for securing a smokeless locomotive is announced, there being no smokestack, but the exhaust opening is left full open to the area in the saddle casting, the stack and saddle are taken off, and the stack opening increased to twenty inches in diameter. There is placed over the exhaust and lifting-pipe, twelve inches at the bottom and end, tapering to fifteen at the top, and forty inches long, a sheet-iron pipe, and this pipe, twenty inches in diameter, sets over that resting on top of the extension front. Over this is the ordinary dome-casting. This casting is perforated with 2,000 $\frac{1}{16}$-inch holes extending half around the casting, and in the forward compartment is located a pressure-blower in such position as to admit free action to the flue-sheet; the pressure-blower is connected by direct friction to a small rotary engine, and is also connected direct by an air-pipe extending from the front end of the engine back under the truck of the locomotive to the ash-pan—the ash-pan and dumpers having asbestos joints and shutting firmly, thus making the ash-pan air-tight. The air from the fan, drawn down through the perforations, is heated to a high temperature by exhaust-steam and heated gases. The result is, by this method, a fire is fanned by a constant blast of pure, heated oxygen of seven-ounce pressure, this air being made hot by the heat that would otherwise be wasted. Circling the firebox door are innumerable small holes or air-jets. Hot oxygen uniting with carbon forms a gas, completes the combustion, and prevents all smoke

E. M. R., L. M.

Inclosed find clipping from the technical column of a New York paper, by which you will see that the problem is solved—at last the smokeless locomotive is born! Your attention is called to the singularly clear and full explanation of the devices for preventing smoke. The writer is a genius.

A. W. G., as you will notice from his screed inclosed, discovered this measure, and now that he flocks by himself, makes this audacious fling at his old nest. I think he is brooding over the recollection of an inspection which was made over his road, and the comments thereon, when the smoke was so bad that the sky was darkened and the chickens went to roost.

Yours truly, R. D. W.

*Atlanta, Ga.*

There were some queer rules and practices in the early history of railroading in this country, but there were few oddities that beat the old wrecked-coal law of the D., L. & W., done away with but a few years ago. By this finding, all coal spilled off cars in transit, by wreck or otherwise, belonged to the train dispatcher. If a car pointed its nose down the bank, the dispatcher assisted it all he could, and dispatchers managed to get to wrecks and have their say. After a while the dispatcher was required to "divvy" with the operator, and finally the company took the whole business.

The electric traction people are after the New York Elevated Railroad Company again. Several years ago the Field crowd tried to substitute their motors for the locomotives, and they were followed by the Daft Co. and then by the Sprague Co. Other interests are now trying to obtain the opportunity of demonstrating what they can do to operate the elevated railroad trains by electricity. If they can prove and guarantee that the cost of operating would be less, and that the work can be done expeditiously and with perfect reliability, they are likely to have the opportunity of operating the trains.

On June 11th, Richard Tremain, government boiler inspector in New York City, died. "Dick" Tremain was for many years general foreman of the N. Y. C. & H. R. shops in Syracuse, to which city his remains were sent for interment.


(62) J. T. W., Willard, Texas, asks.

"Do very loose side rods have any effect on the power of locomotives?" *A.*—No.

(63) M. M. & M., New York, asks.

What is the correct spelling of the word spelled pein, peen, pene, etc.? What does the word come from? *A.*—The correct spelling of the word is pene. It is derived from the root *pen* to thrust in, and belongs to the same class of words as penetrate.

(64) J. A. C., Nashville, Tenn.

No; an advertisement in this or any other paper for a position as locomotive fireman, you being inexperienced, would do you no good. There are too many men applying direct for the work. Reach the M.M. of some road through an engineer or shopman.

(65) C. A. M., Paterson, N. J., asks:

What is the rule for figuring the horse-power of a boiler? *A.*—In stationary boiler practice with ordinary draft it is usual to figure about 15 square feet of heating surface to the horse-power. With forced draft much less surface will represent the steam-making capacity for a horse-power.

(66) W. W. Clements, Raleigh, N. C., asks:

What keeps piston 17 in engineer's brake and equalizing-valve on its seat? *A.*—More air-pressure above than below seat; the valve of its own weight and the friction in its case prevents its rattling around. In order to lift it the pressure below must be enough greater than that above to overcome this weight and friction.

(67) J. A. N., Northampton, Mass., writes:

We had a steam-pipe collapse on this road; the engineer had the throttle open when it was done; it flattened it the whole length. What caused it? *A.*—Pressure was greater than the strength of the pipe, which had probably been weakened in some way. It often happens that the pipe flattens the whole length, as when any part loses its round and strong shape it is shut up in a wave.

(68) J. A. M., Albany, N. Y., says

Is there any State in the Union where locomotive engineers are required to have a certificate before they can run, and would a man smart on figures, be likely to get along quickly in such States? *A.*—We believe that a certificate is required in Alabama, and perhaps in other States. We should not advise any one to go expecting a job on the grounds of being able to pass the examination required.

(69) A. M. R., Brooklyn, N. Y., writes.

I have been in charge of stationary engines for three years, and always used tallow for valves and cylinders, and I never found any thing better. I am now firing a locomotive and find that they use oil which is not nearly so good a lubricant as tallow and is more expensive. Why do railroad companies pay more for an inferior material? *A.*—Tallow was abandoned by most railroad companies because it contains an acid which corrodes the cylinders. Good valve oil is as economical for lubrication as tallow.

(70) A. C. G., Beatrice, Neb., asks:

Please let me know through your valuable paper how much difference one notch in the quadrant makes in the admission of steam? In other words, if the reverse-lever is placed one notch back on the quadrant, how much difference will it make; at what point of the stroke will the steam be cut off, in inches or fractions of an inch? *A.*—There is no fixed rule; it used to be customary for builders to mark the quadrant; the point of cut-off for each notch. Most builders now make as many notches in the quadrant as can be gotten in. An extra notch on the quadrant may mean almost anything—depends on the make of the engine.

(71) J. L. R., Terre Haute, Ind., writes:

I want to know something about metals that melt at low temperature. I am told that some metals melt below the boiling point, and if that is so it would interest several of your readers to hear about them. *A.*—A variety of alloys melt about the boiling point of water or lower. Mercury is a metal which does not become solid until the temperature is 39 degrees below zero. Bismuth 8 parts, lead 5 parts, and tin 3 parts, makes an alloy which melts at about the boiling point of water at sea level. Bismuth 5 parts, lead 3 parts, tin 2 parts and 1 part of hot mercury added makes a metal that solidifies only at 140 degrees Fahr. A mixture of bismuth, tin, lead and cadmium can be made which softens by the heat of the hand.

(72) G. G., Bakersfield, Cal., asks.

1. What is meant by inside clearance? *A.*—When cavity in valve is wider than exhaust-port and both bridges. 2. Which takes place first, compression or expansion? *A.*—Depends upon what part of stroke you commence to count it at; expansion follows admission. 3. What is meant by back-pressure? *A.*—Pressure that retards the piston; compression is back-pressure. 4. What causes an engine's cylinders to squeak hooked up with a very light throttle (more throttle will stop it)? *A.*—When hooked up there is an excessive compression that lifts the valve at each end of stroke; it is higher than chest pressure. 5. Why does the cross-head not occupy the same position in the guides when pin is on the top and bottom quarter? *A.*—It does if cylinder and wheel centers are in line; when cylinders are above the wheel center, the cross-head is pulled back on lower quarter by the increased angle of the main rod. 6. Is it necessary to disconnect an engine with a broken frame? *A.*—Depends on how and where broken.

## Tests of Iron and Steel.

A very valuable report was submitted to the Master Mechanics' Association by the committee appointed to investigate the critical temperature of iron and steel and other questions relating to iron and steel considered of value. The report is peculiarly valuable because its conclusions are drawn from facts ascertained by original investigation. A great many tests were conducted under the supervision of the chairman of the committee, Mr. William Smith, superintendent of motive power of the Chicago & Northwestern. The scope of investigation aimed at demonstrating what was in the claim that iron and steel were brittle at a certain temperature; what were the causes at work leading to the failure of firebox sheets; what is the best material for tubes, and the principal causes of stay-bolts breaking.

The claim that iron and steel are dangerously brittle at a temperature varying from 500 to 800 Fahr., was clearly proved by numerous experiments. It was also shown that iron is fully as brittle as steel at the critical temperatures.

In the examination of firebox sheets it was found that the center of the plate becomes spongy, and that a thin surface next to the fire and one next to the water assumes a consistency different from the center. It was concluded that the part next the fire became permanently expanded, and that this action had something to do with the breaking of stay-bolts.

"It has been claimed that annealing a sheet would restore it to its original condition; with this object in view your committee took a piece of such a sheet, carefully annealed it by heating to a red heat, then placing it between two pine boards and allowing it to remain until cold. The center was then cut out as in the other cases, and the result was the same as with the piece not annealed. This apparently clearly demonstrates the fact that annealing an old sheet of steel does not restore it to its original condition.

"In order to determine the temperature of a sheet in a firebox when the engine is being fired up, an experiment was made with two thermometers located as shown by the accompanying engraving.

"One thermometer was placed in the water space and the other in a drilled stay-bolt, with the bulb at the inner sheet, as shown. The boiler was a stationary vertical one, and was fired with oil and rosin wood. The maximum difference in temperature between the water and firebox sheet, as shown by the thermometers, was about twenty-five degrees.

"An endeavor was made to devise an apparatus that would represent a stay-bolt riveted into the sheet, to be subjected to vibrations in order to determine which material would resist the greatest amount of vibration. The apparatus in which the test was made is shown in Figure 4. This arrangement gives in vibration a full motion of three thirty-seconds of an inch at the end of the stay-bolt, and at the same time allows a stress in the direction of the length of the stay-bolt somewhat similar to that which occurs in boilers, the strain put on the stay-bolt being equivalent to a pressure in the boiler of 150 pounds per square inch. A test was made in this way of four pieces of mild machinery steel; the average number of vibrations before breakage was 21,539, the pieces standing respectively 7,950, 96,060, 14,168 and 54,358 vibrations before breaking.

"Eleven samples of iron were tested in the same way, the average number of vibrations before breaking being 6,568, the lowest being 3,120, the greatest 12,480. The result of these tests would indicate that steel is a better material for stay-bolts than iron; at the same time the experience of a number of members of your committee with steel stay-bolts has been seriously against them. They failed in service, and deductions drawn from the test, as made, are entirely misleading.

"The investigation, as described above, is not sufficient to enable your committee to offer any specific directions for drawing up specifications for iron and steel for firebox purposes, and they therefore have in this particular no definite recommendations to make.

"The results of the investigations so far may be summarized as follows:

"1st. Steel or iron should not be worked at a temperature between a normal temperature and a perceptible red heat.

"2d. So-called 'blue heat' makes steels and irons more brittle, but some are apparently less affected by the 'blue heat' than others.

"3d. The test of steel or iron at a 'blue heat' is not a criterion by which to judge of the action of the same in the firebox.

"4th. Iron at a blue heat is more seriously affected than steel.

"5th. There is apparently a mechanical disintegration going on in plates exposed to the action of fire, water and scale in a firebox.

"6th. Steel tubes do not seem to be as durable as iron tubes."

---

In the Cambria Iron and Steel Works they turn all the crank-pins from solid bars, five or six pins being made from one blank. They have very powerful axles for doing the work, and finish the crank-pinks ready for fitting.

## Various Uses of Compressed Air in Train Service.

By Paul Synnestvedt.

On looking over the pages of one of our leading railroad papers the other day, the writer noticed a number of devices to be used in train service, operated by compressed air from the brake system. Amongst these were train signals, bell ringers, smoke consumers, headlight covers, sand-feeding apparatus, and a device for opening and shutting the firebox door, all of them supplied from the main drum, besides which there were several drawing their supply from the train-pipe, such as car lighting and water-raising apparatus, used on many sleepers, and signal whistles attached to rear-end hose.

The constant increase in the number of such mechanisms brought up the question as to whether this heavy drain on the air-brake system will interfere in any way with the action of the brake itself. One result already apparent is the additional emphasis it gives to the need of a large capacity pump even on passenger trains. Another result is that more knowledge is required on the part of the engineer to avoid difficulty with his brake. These devices are no doubt a great convenience, but the statement of the inventors that they do not take sufficient air to cause a noticeable effect on the brake is not strictly correct, even if, as they say, all that is necessary is to "just break the joint of the valve."

No one has any adequate conception of the amount of air that will escape from such a broken joint until he has experimented with a smoke consumer, that delivers air to the firebox from the main drum through a number of 16-inch nozzles. It takes a pretty good pump to hold the pressure to or above 20 pounds against such an escape port, even with a high steam-pressure, and it would not require many more patent appliances auxiliary to the air-brake to produce nearly as great a leakage from the drum as this.

The next thing in order now is an automatic coal-heaver and apparatus for moving the reverse lever and throttle, and who knows but before long even engineers and firemen will be superfluous?

The amount of air used by these applianres is practically just so much *leakage*, and whether the difficulty encountered as a result of this will be great enough to cause serious trouble with the brake, depends on the amount of the leakage. No engineer need be told that leakage in the air-brake is a bad thing, and if of any considerable extent may cause much trouble. However, it is also known that if an engine is supplied with a pump of large capacity and an accurately working governor, quite a leakage may be permitted without interfering to any great extent with the action of the brake.

I have heard many well-posted men say that a moderate leak was of very little moment, provided it was from the main drum and its connections, and not from the train pipe, but it will be seen on reflection that this is an error, for it is not only a constant drain on the pump, but it will, under certain conditions, result in dragging the brakes.

The moral of this is, not that these conveniences should be done away with, but that when they are used it should be with a pump of large capacity, and a governor in good working order.

---

The "Railway Officials' Directory" is a neat little pocket list of the railroads and railroad men of the country; it is in very compact form, and much prized by supply men who do not want to carry around an immense book loaded down with advertisements. It is published by the *Railway Age*, of Chicago.

---

The C., B. & Q. have ordered 54 locomotives of the Rogers Works. Fifty of them will be moguls.

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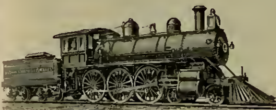

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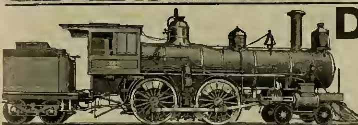

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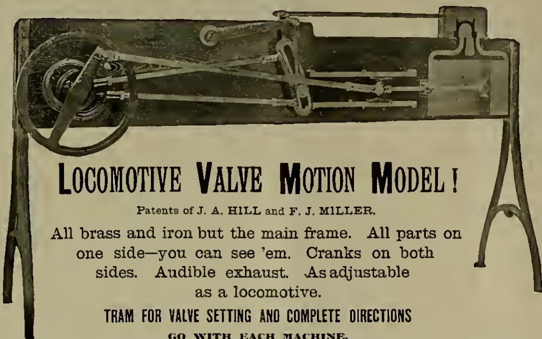

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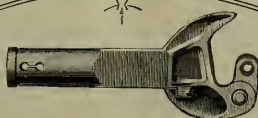

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# LOCOMOTIVE ENGINEERING.

A Practical Journal of Railway Motive Power and Rolling Stock.

VOL. V, No. 8. | NEW YORK, AUGUST, 1892. | PRICE, { 20 Cts. Monthly. $2 00 per Year.




## Run of the Cooke Compound Locomotive on the Erie Railroad.

By ANGUS SINCLAIR.

For several weeks during the months of June and July, the compound locomotive recently built by the Cooke Locomotive Works was pulling freight trains on the New York, Lake Erie & Western. The engine was in charge of Mr. Charles D. Cooke, superintendent of the works, and was run by Mr Sam Dunning, the engineer for the builders, taking turns on freight service with other engines. As this was the first compound locomotive built by the Cooke Locomotive & Machine Co., they were naturally anxious to learn how the engine compared in service with other compound locomotives. With the view of getting the opinion of one who has had considerable experience with compound locomotives, President Cooke requested that the writer should watch the working of the engine during some runs, and make whatever tests might be thought necessary in order to find out the capacity and efficiency of the engine

The engine, as may be seen by the annexed engraving, is of the ten-wheel two-cylinder type of compound. The cylinders are 19 and 27 inches diameter, with a stroke of 24 inches. The exhaust steam from the high-pressure cylinder passes through a pipe in the smokebox to the steam-chest of the low-pressure cylinder, the pipe and steam-chest forming a receiver, which has a cubical content about equal to the volume of the high-pressure cylinder. No intercepting-valve is employed, but means are provided for admitting steam from the boiler direct to the receiver, to assist in starting. The device that admits this steam is operated by the throttle-valve, and closes automatically when the throttle-lever is pulled out about 2 inches.

Excepting the arrangements for compounding, the engine is in all respects the same as a group of ten-wheel engines recently built for the Illinois Central Railroad, and conforms to that company's standard. It is a well proportioned engine for cylinders 19 x 24 inches, and 64-inch driving wheels, with a steam pressure of 150 pounds on the boiler As a compound, steam of 165 pounds pressure is carried, but she is not as powerful as the simple engine would be at the lower steam pressure. The boiler is of the wagon top, firebox variety, with radial stays binding the outside and inside shells. The diameter of the boiler at the smallest ring is 58 inches, and a total heating surface of 1766.6 square feet is provided. The firebox is 96 inches long and 42 inches wide, set with the mud-ring above the frames. There is a grate area of 28 square feet.

The valve arrangements are about the same as they would be for a simple engine. The travel is 5$\frac{5}{16}$ inches. The high pressure valve has $\frac{3}{4}$-inch outside lap, and the low pressure valve $\frac{15}{16}$ outside lap. Both valves are line and line inside. The high-pressure valve is set with $\frac{1}{16}$ inch lead, and the low-pressure valve with $\frac{1}{8}$ inch The piston clearance of the high-pressure cylinder is 6.75 per cent., and that of the low-pressure cylinder 11.8 per cent.

On June 29 the writer accompanied Mr. A. E. Mitchell, superintendent of motive power of the New York, Lake Erie and Western, to Hornellsville, N Y., and the following day took part in a test of the Cooke compound locomotive, in the course of a run of 140 miles from Hornellsville to Susquehanna. The work was done under the immediate charge of Mr P. N. Hibbits, mechanical engineer for the railroad company. A record of the coal and water consumed was kept and indicator diagrams were taken at intervals.

A train of seventy-six empty cars was hauled all the way, the total tonnage including engine being 881.1. The road is nearly level all the way and the train was considerably within the capacity of the engine. A number of diagrams were taken when the engine was starting the train, the pencil having been pressed to the drum at the time the throttle was opened and kept on till a good start was made From these we found that the method of admitting boiler steam to the receiver worked satisfactorily. This direct pressure was reduced down to about half the pressure of the boiler, so that no excessive back-pressure was encountered by the high-pressure piston. The high and low-pressure diagrams, Nos. 1 and 1a, were taken in starting, and show the maximum tractive-power developed by the engine. This is a little over 12,000 pounds. The simple engine carrying 150 pounds boiler-pressure would exert more than 1,000 pounds additional traction, which shows the necessity for a compound locomotive carrying extremely high-boiler pressure. This appeared to be the only weak point the engine had, and it is one that can easily be remedied. The diagrams shown give a fair representation of the way the engine was worked in taking the train along Cards 3, 4 and 5 were taken in the notch where the most of the work was done. The steam follows the high-pressure piston about 65 per cent. of the stroke. In all the low-pressure diagrams there is a falling off in the steam line immediately after the beginning of the stroke until the period that high-pressure exhaust takes place, when the low-pressure steam line holds up and even inclines to rise. As the links are hooked up, the steam is admitted more evenly to the low-pressure cylinder. The best distribution of steam is shown on diagram 6, where the high-pressure valve is cutting off at about half-stroke. It will be noticed that a decided increase of lead would be likely to improve the low-pressure diagrams


The following are the leading particulars of the diagrams. The throttle-valve was full open when all the cards were taken.

| No of Card | Boiler Pressure | Revolutions Per Minute | Reverse Lever Notch |
|---|---|---|---|
| 1. | 164 | 80 | 1 |
| 2. | 160 | 120 | 3 |
| 3. | 162 | 156 | 4 |
| 4 | 166 | 108 | 4 |
| 5. | 156 | 128 | 4 |
| 6. | 161 | 140 | 5 |

The run of 140 miles was made at an average speed of 20½ miles an hour. The time lost at stations was 3 hours. In doing the work 15,005 pounds of coal was consumed and 98,100 pounds of water was used This was an evaporative duty of 8.6 pounds of water to the pound of coal

The total weight of the engine is 128,500 pounds, of which 97,000 pounds are on the drivers and 31,500 pounds on the truck.

Figures which I have received of other trips made by the engine show that in four trips the coal used per ton-mile was .094, .12, .09 and .07 pounds respectively. That is very low, even for trains of about one thousand tons weight.

IMPRESSIONS OF THE ERIE RAILROAD.

The whole of the front platform of the engine was surrounded by close panels about five feet high, which made an excellent protection for the men taking diagrams and gave convenient means of access from one side of the engine to the other. The place also afforded an excellent "coigne of vantage" from which to view the working of the railroad and the beautiful scenes we were passing through.

The writer sat in that box nearly ten hours, and the impression received, as a result of very close watching, was that the Erie was one of the best operated railroads he had ever seen. All the main line is double tracked and has block signals the entire length. The division we passed over has broken slag ballast and as fine a track to ride on as there is in America. Everywhere along the line there are evidences of the whole working staff performing their duties with vigilance and care.

It is well known that of late years this road has been remarkably free from accidents. The cause of this can readily be seen in the business manner in which the men responsible for the safety of the trains perform their duties.

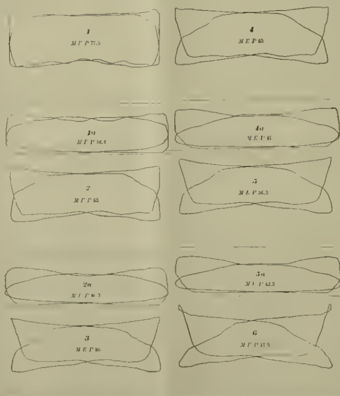
The block system is absolute for passenger trains and permissive for freight trains. That is, no passenger train is admitted into a block until the latter is perfectly clear and no other train is permitted to enter a block while a passenger train is in it. As the blocks are too long to move freight trains in this way without delaying the traffic, all other than passenger trains are worked by the permissive system. This permits two or more trains to be in a block at once under certain restrictions. If a freight train arrives at a block tower before the preceding train has got off the block, the signalman cannot lower his signal but he puts out a green signal which gives permission to the engineer to proceed with caution. When trains are stopped between stations the rules for protecting the rear are carried out as rigorously as if there were no stationary signals employed for the protection of the trains. In the course of the trip we saw repeatedly examples of how strictly the trainmen obeyed the rules respecting flagging. There were other evidences of the zeal of the men in striving to prevent accidents even in cases where rules were not the origin of their actions. When we entered a block where there was another train in front and met a train coming from the other direction the enginemen invariably gave signals that caution was necessary.

The officers in charge evidently do their best to keep alive that every-day vigilance so necessary to prevent accidents and so difficult to maintain in constant vigor. But their efforts are made comparatively easy by having an excellent class of trainmen. There were in all directions evidences that the *esprit de corps* of high and low is exceedingly good. It is a remarkably healthy sign when all classes of men, from the brakemen upward, are heard boasting about their road.

The country traversed is well worth writing about. I have traveled over all the leading railroads in America. There is no attractive route in the British Isles that I have not examined, and I have done considerable traveling on the continent of Europe. After seeing all the beautiful and attractive scenes that this experience yields, I am firmly convinced that the Erie Railroad, in its route from Jersey City to Buffalo, traverses the greatest variety of beautiful scenery to be witnessed on any single railroad. And yet the traveling public hears little about the scenic attractions of this magnificent route.

From Hornellsville to Susquehanna the line traverses a series of valleys with wood-covered hills on each side, that are always pretty and at times rise into impressive grandeur. All that make scenery attractive to the eye are present in their most alluring forms. Mountain, stream and lake, smiling fields round prosperous farms, shady woods and beetling rocky crags, all combine to form pictures of beauty and sublimity. Only one thing is wanting to make some of the regions traversed as attractive as the Trossachs—the romance of human association and the bard to people the scenes with life and reminiscences.

Between Waverly and Elmira, in a spot where the railroad follows the banks of that noble river, the Susquehanna, there is a scene greatly resembling one of historic interest. To the north of Perth, in Scotland, where the River Tay is seen sweeping round a beautiful valley with wooded heights beyond, the view is so impressive that beholders seldom forget it. Historians say that when the Roman army, on the first invasion of Scotland, reached the top of the hill from which this view was seen they stopped in admiring silence and then exclaimed "*Ecce Tiber!*" The scene on the Susquehanna is very much like the scene above Perth, with the exception that the Tay is a puny creek compared to the Susquehanna, and that the hills of Pennsylvania are much bolder than those that fringe the Tay at the spot spoken of.



DIAGRAMS FROM COOKE COMPOUND LOCOMOTIVE.

A correspondent of the *Railway Herald*, who has been investigating the performance of compound locomotives in France and England, makes a report to the effect that engineers are divided as to the value of the application of the compound principle to locomotives; this is not to be wondered at when we consider the great number of designs which are being tried or even introduced by the various companies who, during the past ten years, have been experimenting on this subject in order to find the best system, namely that which combines together economy and simplicity.

## Steel and Iron Tubes.

During the discussion at the Master Mechanics' Convention on tests of steel and iron, Mr William Forsyth said:

"I have a word to say in regard to steel tubes which may be of some value. I agree with the conclusions of the committee in the fact that steel tubes do not seem to be as durable as iron tubes, and that has been our experience with steel tubes. The fact of the matter is that steel blooms can be made a great deal cheaper now than iron blooms and the tendency of the manufacturer is to supply steel tubes at the same price as the iron tubes and thus force them into the market. A steel tube at the same price as an iron tube, I do not believe is as good. There may be steel tubes, solid drawn and seamless which are as good as iron, but they cost a great deal more. In addition to the trouble from corrosion with the steel tube, we have found the trouble with the weld. It is very difficult to weld a steel tube and make it stand in locomotive service. So I will caution our members to look out for this matter when manufacturers try to give them steel tubes of ordinary quality at the same price as iron tubes."

## Criticism of the Link Motion.

A young machinist, writing to us about valve motion, mentions that he was under obligations to Mr P. Leeds, of the Louisville and Nashville, for explaining to him very clearly why the link-pin is put back from the central radius link. He also says that he heard Mr Leeds make the statement that a good long motion would develop more power at half-stroke than any other valve gear. Our correspondent then proceeds:

"I claim that this is a great mistake on his part, as there never was a slide valve worked by link motion at half-stroke that did not wire-draw the steam, because the link motion closes the ports so slowly. I never saw a card taken from a locomotive that the steam line did not fall off considerably before the cut-off took place. Such is not the case with a Corliss engine, as the steam line is nearly parallel to the atmospheric line until the cut-off occurs. It is safe to say that a Corliss engine will give as large a mean effective pressure at one-third stroke as the average locomotive at half-stroke—I mean where the cylinders are the same size and the piston speed and boiler pressure are the same. If you are calculating the horse power, it is an indisputable fact that a Corliss or a Wright engine will have a much greater mean effective pressure, cutting off at half-stroke, than a locomotive cutting off at the same point. When you take a card from a locomotive, cut back in the first, second or third notch, you can see where compression commences, reducing the area of the diagram and consequently giving a smaller mean effective pressure. The Louisville and Nashville has freight engines that actually have $\frac{3}{8}$ of an inch lead when they are working in the first notch. Now, compression would commence very early in such a case like that, and the lead opening is all the opening an engine gets with link motion working in the first notch."

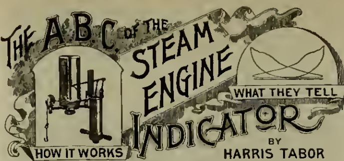
[Our correspondent evidently has not studied the subject on hand very thoroughly, or his experience with indicating locomotives is probably too limited to make him a reliable judge. With a well-designed link motion at slow speed, a diagram will be taken at half-stroke that is as good as one taken from a Corliss engine. We have repeatedly seen diagrams taken from locomotives at half-stroke that could not be improved. The objections raised to the increase of lead when the engine is hooked-up, are founded on imperfect knowledge. The compression complained of is a necessity for the conditions under which locomotives are run when the reverse lever is drawn close toward the center.—EDS.]

Rather a striking statement in relation to the labor cost of making open-hearth steel was made by the strikers in the Homestead mills trouble. It says: There are 112 tonnage men affected by the proposed reduction. They produce on a daily average of twenty-four hours 336 tons of steel ingots. In Schoenberger's open-hearth department, at the same number of furnaces as in No. 2, 168 tonnage men are required to produce 192 tons of steel ingots. At one particular place in the two mills the Homestead man would receive $14.15 per ton; in Schoenberger's he would receive $18. In Homestead if any accident occurs to the heat of the steel the men get no pay for it, while in Schoenberger's they would be paid by the day, be the steel good or bad.

In order to relieve "the difficulty of finding one's railway carriage after leaving it to enter the station," we are told that one of the great French lines has had the inspiration of putting conspicuously on every door "a natural history plate, presenting the figure of some bird, beast, reptile or insect." Perhaps stupid people may find help in trying to remember that their car is the frog car, or the rattlesnake car, or the hog car, or whatever the "natural history plate" may indicate, but it would seem that for travelers of ordinary intelligence the simple expedient of having the cars numbered would answer; or at any rate that the plan of naming the vehicles, which is in use on a thousand or more sleeping cars in this country, would meet the requirement.

During a little dispute about the handling of our mails last month, the fact was brought out that if the edition of LOCOMOTIVE ENGINEERING for June were piled up flat, it would make a monument 130 feet high, and if laid end to end they would stretch out a little over five miles. Twenty-one thousand two hundred and eighty copies were sent out.

Several have asked us the weight of the engine and train that made 91.7 miles per hour recently on the Central of New Jersey. The run was made Feb. 26th with a four-car train; the engine and tender, ready for the road, weighed 208,700 pounds, and the train weighed 230,000 pounds.




The ideal indicator card from a steam engine cylinder is one that gives the largest mean effective pressure with the lowest terminal pressure. The reason is plain. The mean effective pressure represents the amount of work done, and the terminal the cost, in steam. Hence it is that an indicator card with a large area and expansion line running down near the atmosphere always commands admiration. If the particular card in question does not show the best duty, its lines are such that we know the elements of economy are in the cylinder from which the card was taken. There are certain conditions in the construction of steam engine cylinders, independent of the valve gear, which govern the degree of economy. For instance we know that if an engine have an abnormally large clearance (waste room between the piston when at the end of its stroke and the valve face) no amount of argument on the part of its builder can make it economical. The waste room at the ends of the cylinder must be filled with steam, at the boiler's expense, before the piston has any movement. If the clearance be small, say 3 per cent., the loss on this account will be trifling; but if the clearance amount to 10 or 12 per cent., which is quite common practice, the loss will be considerable. The steam used to fill the clearance gives no return in the way of power, up to the point of cut off, beyond this point, however, the increased volume, due to clearance, raises the expansion line somewhat and reduces slightly the loss in the early part of the stroke. Condensation is another serious loss that comes from large clearance. The temperature of the cylinder follows closely the temperature of the steam within it. During exhaust the walls of the cylinder and ports are cooled by the low temperature of the steam after it has expanded, doing work; its flow to the atmosphere through the ports continues this cooling process until live steam from the boiler is ready to enter, and again go through the same reduction in temperature due to expansion. Large clearance necessarily increases the wall surfaces of the ports and adds to the cooling influence of the cylinder.

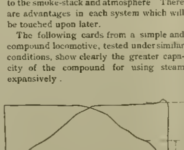
Independent of clearance, the expansion of steam in a cylinder, if carried too far, is a source of loss. It is doubtful if steam at 150 lbs. can be expanded more than four times in a single cylinder on a locomotive without loss. An indicator card would show gain with six expansions, but there would be losses due to condensation which the indicator does not make clear. In stationary engines of the "Corliss" and "Buckeye" type, with clearance as low as 2 per cent., expansion is carried much farther with excellent results.

When it is desirable to expand steam beyond economy in one cylinder it is the practice to put several cylinders, each succeeding one larger, in one train and expand the steam successively through them. By this means the range of temperature in each cylinder is kept down, and condensation is prevented. It is true that the multi-cylinder plan exposes more metal to the action of the steam, but the absorption of heat from the steam is less on account of the lesser range of temperature that is encountered in each cylinder. When two cylinders are used in a train the engine is commonly called compound, three cylinders are termed triple expansion and four quadruple. Thus far four cylinders is the limit in a practical way. In locomotive practice multi-cylinders have not been carried beyond the compound type in this country. In England and on the Continent several locomotives have been built with triple expansion. It is yet doubtful if any benefit can come from expanding through more than two cylinders for railroad work.

We have, in this country, what may be classed as two distinct types of compound locomotives, viz. the "Vauclain," built by The Baldwin Locomotive Works, which has four cylinders, one high-pressure and one low-pressure on each side—in other words two compound engines. On each side one cylinder is above its mate and the pair are connected to a crosshead midway between. Both compounds exhaust in one stack, as in the ordinary locomotive. A common steam-pipe with a branch leading to each engine supplies the steam. One valve distributes the steam in each pair of cylinders.

The other type is what may be classed as the two-cylinder compound, with the high-pressure cylinder on one side and the low-pressure cylinder on the other. The arrangement of cylinders in this case is the same as in the common locomotive. Steam is first taken in the high-pressure cylinder and then passed to the low-pressure, thence to the smoke-stack and atmosphere. There are advantages in each system which will be touched upon later.

The following cards from a simple and compound locomotive, tested under similar conditions, show clearly the greater capacity of the compound for using steam expansively.



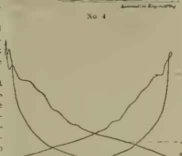
No. 1.

No. 2

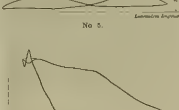
No. 3.

No. 1 was taken from a simple engine, cutting off steam at about ⅝ths of the stroke. The steam was expanded from a pressure of 156 lbs. to a terminal of 101 lbs. and at that pressure exhausted to the atmosphere. No. 2 was taken from a com-

No. 4



No. 5.



No. 6.

pound, carrying steam full stroke, expanding steam from a pressure of 165 lbs. to 34 lbs. No. 3 is also a card from simple engine cutting off at about ⅓d stroke and expanding steam from 154 lbs. to 61 lbs. No. 4 is from compound with an initial pressure of 147 lbs. which was expanded down to 16 lbs. The diagrams tell the whole story. In one case the steam was thrown away with only one-half its useful work applied, and in the other expansion was carried so far that but little loss occurred. Nos. 5 and 6 are cards from the same engines at a higher speed. In No. 5 we find expansion carried to the extreme in a simple engine, with a terminal pressure of 36 lbs.

Indicator spring .... 80
Simple cylinders .... 18 x 24 inches
Compound cylinders .... 11½ x 19 x 24 inches
Diameter of driving wheels .... 56 inches
Engines identical in all respects, except cylinders and valves.
Single nozzle .4⅛ inches diameter on compound
Single nozzle . 4⅜ inches diameter on simple engine

## Steel Cars for Mines.

A pressed steel coal car has been made by the Leeds Forge Company, Limited, Leeds, England, under the Fox patents, for use in underground workings. These cars are designed more particularly for carrying coal and are adapted to be used either in the pits or for taking coal from the pit mouth to boats or cars for shipment. The under frame is made of pressed steel parts ¼ inch thick, and is not unlike the Fox freight car truck used in this country, except that the framing has end sills. The truck is 7 feet long and 4 feet wide. The sides of the body are $\frac{3}{16}$ inch thick and are corrugated to give rigidity and obviate the need of stays or stakes. The total weight, including wheels, axles and springs, ready for use, is 720 pounds. These cars have proved very satisfactory in English colliery work on account of their light weight and small cost for repairs.

## Electricity Considered as the Future Motive Power for Railroads.

By J. E. Phelan.

It is conceded by all that electricity may sometime be the motive power for railroads. It is urged by many that such conditions are now at hand and possible.

Yet in railroad circles—among the hands and those contributing to the mental food of the railroad army—there is an unknowable essence about the subject more charming than satisfactory.

Railroad men to-day want information regarding electric railroads in simple terms and comprehensive phrases, getting posted in electric terms to many seems like a forced study of French in order to take a visit to Paris.

As Sinclair has recently simplified the problem of train resistance so that it can be presented in an understandable way, somebody should now "rise up" and present the problem of electrical railroading understandingly to the railroad army.

Air-line railroads building regardless of commercial conditions and natural obstacles, bearing trains shooting through space like the flashing of meteors, may be possible, but seem to a practical mind rather improbable—at least for some time to come.

Half a century since, the application of steam power to highways of commerce presented conditions inferior in point of development to the conditions governing electrical motive power as applied to railroads to-day.

This anxious expectancy of some combination saying "Let it be done," and immediately having the conditions of steam railroads revolutionized by the introduction of electrical appliances displacing steam power seems altogether improbable, yet such phenomenal change has revolutionized horse-car lines in street railway service.

To one familiar with all the details of a modern standard gauge road, the problem of similar change viewed in a probable light is a formidable one.

Taking the *Electric Review* as authority, the first commercial electric railroad in the United States was in service about six years ago.

To-day, within the United States, we have two thousand miles, or more, of track utilized by electric railroads.

The average cost per car-mile of horse railroads is about 5.7 cents, of cable, 2.5 cents, of electric, 2.2 cents, and of steam, as applied to street railroads, 5 cents.

The rapid application of electricity to street railroads for new lines, and substituting in many places established horse-car and steam lines, coupled with the comparative statement per car-mile, is self-evident that, at the same rates for transportation, profits are in favor of electric lines.

If similar conditions of comparative cost of operation of standard railroads by electricity, as compared with steam power, can be demonstrated, all reasonable minds can confidently anticipate revolution in motive-power appliances.

Granted that electric railroads are operated at less than one-half the cost of horse car lines and others (this statement includes relative proportion of fixed charges, labor for operating, cost of maintenance and all incidental expenses—everything being comparatively new), there may be an element of expense not appearing at the present time that may appear later as the expense for repairs of equipment increases and increasing cost of maintenance from year to year as renewals become necessary. Notwithstanding such prospects, a wide margin exists in favor of electrical roads with equal rates of transportation.

Further, has not the capital for recently constructed lines been obtained at a lower rate of interest than capital invested in lines showing a higher cost per car mile?

However, it will take only a short time to demonstrate such conditions for or against electric appliances.

The interesting question that needs to be answered understandingly now relates to the possible conditions permitting the favorable use of electric appliances on standard railroads as substitute for steam power.

We have account of the storage battery system having been put to practical test several years before the overhead system of trolley wires came into general use, yet the latter has taken the lead in practical application and popular methods.

It is announced in current publications that one prominent railroad in the United States has just contracted for three eighty-ton electric locomotives to be used in pushing trains through the belt line tunnel in a prominent city. These locomotives are expected to have a capacity to propel a passenger train of five hundred tons, at a speed of thirty miles an hour. This sounds well until a writer later on states that this power is to be delivered early next year, thus making prospects doubtful.

While it is announced that electric motors have been suggested as a more economical means for switching cars at terminals on Prussian state railways, we are left in the dark regarding details.

With electric locomotives yet in the uncertain stage, with the storage battery system antedating methods now in general practice, it seems most probable that the means of applying electricity to standard railroads would follow out the direction of development indicated in successful practice on street railways and inter-urban lines.

A most eminent authority has announced two different systems with both overhead and surface conductors as practically ready for trial in demonstrating the possible application of electricity to standard railroads.

The practicability of overhead conductors has been proven in street railway lines, while the possibilities of surface conductors remains for demonstration.

While all such promises are interesting, so far we have failed to find what we are seeking, viz.: a reasonable idea of how and by what practicable means electric appliances can be used for motive power on standard railroads in substituting steam.

We find able men quoted as pronouncing such prospects visionary.

We know it requires energy to produce motion. As railroads are conducted to-day, thousands of locomotives are distributed along the various lines representing so much stored energy for the propulsion of traffic. Each locomotive is given a train represented in tonnage according to the locomotive's capacity to pull such given tonnage over maximum grades.

All who are familiar with locomotive service know that the maximum power of a locomotive is taxed only for a fraction of the mileage run on ordinary standard railroads; hence we know that an enormous possibility in the way of motive power in the aggregate returns but a fraction in the line of results in execution, when compared with what such power might accomplish if kept in line of exertion to full capacity constantly.

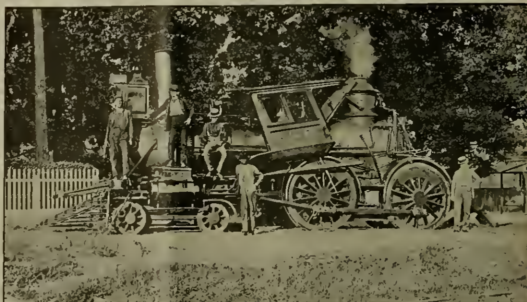
With electricity applied to the operation of standard railroads, as I understand, it would be a matter of concentrating at a given point a plant for the production of electrical energy sufficient to accommodate the full demand of traffic.

This centralized electric plant "corresponding to an aggregate of all the steam locomotives" for a given district would furnish constant power for all demands coming from its prescribed district.

Why is it not as reasonable to figure on an electric plant supplying the electrical energy necessary to supply the demands of given districts as readily as a water-works plant supplying the demands of consumers along various and numerous lines of consumption? The practical side of this principle is illustrated in the successful operation of the two thousand miles or more of electric line in various stages of development to-day.

Yet, while utilizing the steam locomotives to full capacity for only a fraction of time used or mileage run, we have authority for the statement that the total electric energy produced at a central station suffers a loss of forty per cent between the point of production and the point of utility in line of results in propulsion of traffic.

Let the management of a standard rail-



Hard on the Enginemen.

road abandon the maintenance in operation of all the locomotives required for a given district, thus cutting off the expense of water supply, fuel, shop expenses, wages of all employés necessary for maintenance and operation of locomotives, and in place of such appliances substitute an electric plant of sufficient capacity to supply energy sufficient for all demands of traffic, the expenses would be interest on

A Tender that Jumped.

the capital necessary to establish such a plant, interest on the capital invested in the abandoned machinery and appliances necessary in operation with steam, plus cost of operation and maintenance of the newly acquired appliances.

If the standard railroad involved happens to be located along the courses of rivers of good current and volume, ample for the production of power necessary for the production of electrical energy required in operation, the great item of economy under such conditions is readily recognized where applicable for all seasons of the year. Otherwise, the problem merges into the comparative consumption of fuel in producing electrical energy as compared with the amount consumed in the operation of a given number of locomotives.

It does not seem possible to realize economical results from establishing such centralized power plants for the operation of electric locomotives, working under conditions similar to steam locomotives in all respects, excepting the kind of power used.

But in light of success accomplished in electric railroads to date, it does seem possible to revolutionize the manner of moving traffic on standard railroads by the introduction of electric appliances and the establishing of centralized power stations in place of numerous locomotives.

I understand a problem is met with in the direction of conducting the electric current for long distances, continuously involving increased conductivity and amount of conducting material, involving a serious question of cost.

The idea of operating a standard railroad, with individual cars—passenger and freight—each carrying its own motor and starting whenever loaded and continuing without delay to destination, is a novel one, but in line with the progress of a busy world.

With power furnished by overhead or surface conductors from a central power station, and such power equal to the fluctuating demands of traffic, while produced with the least expenditure of necessary energy—to say the least such a possibility is not visionary but simply practicable and depending on cost of operation in comparison with other methods.

Such conditions would seem to involve a double-track railroad to accommodate perennial train service.

If capital is bold enough to make this experiment and returns are made in a convincing and profitable manner, we may look for revolution in the motive power of standard railroads.

Otherwise, the development of electric railroads must follow along the extensions of electric lines now existing where the natural field for development will be created and the cost of experimenting merged into the cost of construction and operation.

With standard railroads, operated for half a century or more with steam power, and remarkable development still continuing, it seems very reasonable to look for the development of electric railroads along the line of evolution until merging into the broad field of operation on standard railroads.

## Mormon Joe—Robber.

By John Alexander.

I'm on intimate terms with one of the biggest robbers in this country. He's an expert at the business, but has now retired from active work. The fact 'o the matter is Joe didn't know he was robbin' at the time he did it, but he got there, just the same, and come mighty nigh doing time in the Penitentiary for it, too.

Maybe I'd better commence at the begining and tell you that I first knew Joe Hogg in '79, out at the front, on the Santa Fé. Joe hailed from Salt Lake City and had run on the Utah Central, which gave him the nickname of "Mormon Joe," a name he never resented being called, and to which he always answered. I never did really know whether he was a Mormon or not, and never cared; he was a good engineer, that's about all I cared for. Joe took good care of his engine, wore a clean shirt and behaved himself—which was doing more than the average engineer at the front did.

I remember one night Jack McCabe—"Whisky Jack," we used to call him—made some mean remark about the Mormons in general and Joe in particular, and Joe replied: "I don't propose to defend the Mormon faith; it's as good as any, to my mind. I don't propose to judge or misjudge any man by his belief or absence of belief. All that I have got to say is, that the Mormon religion is a *practical* religion. They don't give starving women a tract or tramps jobs on the stone pile. The women gets *bread* and the tramps work for *pay*. Their faith is based on the Christian Bible, with a book added—guess they have as big a right to add or take away as some of the old kings had—so bigamy is upheld by the Bible, but has been dead in Utah for some years. It can't live, for the young people are against it. In Utah the woman have all the right a man has, votes, and is a *person*. (Since cut out of proposed constitution.) Before the Gentiles came to Salt Lake the Mormons had but *one* policeman, no jail, fifty saloons, no houses of prostitution—now the Gentile Christian has sway and the town is full of them. I guess you could argue on the quality and quantity of rot-gut whisky a good engineer ought to drink better than on theology, anyhow."

I never heard any of the gang twit Joe about the Mormons again.

I didn't take an awful sight of notice about Joe until I came in one night and the boys told me that Joe was arrested as an accomplice in the robbery of the Black Prince Mine in Constitution Gulch.

This Black Prince was a gold placer owned by two middle-aged Englishmen. They had a small stamp mill run by mule power, and a large number of sluice-boxes. They always worked alone and said they were *developing* the mine. No one had any idea they were taking out much *dust*, until the mill and sluice-boxes were burned one night and the story came out that they had been robbed of more than thirty thousand dollars.

Each partner accused the other of the theft. Both were arrested and detectives commenced to follow every clew.

Joe's arrest fell like a thunder-clap among us. The Brotherhood men took it up right away and I went to see Joe that very night. It was said that Joe had visited the Black Prince the day before, and had been seen carrying away a large package the night before the robbery.

Joe absolutely refused to say a word for or against himself.

"The detectives got this scheme up and know what they are doing," said he, "I don't. When they get all through you'll know how it'll come out."

To all questions as to his guilt or innocence, to every query about the crime or his arrest, he replied alike to friend and foe:

"Ask the sheriff; he's doing this."

He was in jail a long time, but nothing was proven against him, and he was finally released.

Neither of the Englishmen could fasten the crime on his partner, and they sold out and drifted away, one going back to England and the other to Mexico.

Joe ran awhile on the road and then took a job as chief engineer of a large stamp mill in Arizona, and going there he was lost to myself and the men on the road, and finally the Black Prince robbery passed into history, and nothing remained but the tradition, a sort of a myth of the mountains, like Capt. Kidd's treasures, the amount only being increased by time. I believe that the last time I heard the story it was calmly stated that thirty million dollars was taken.

When I was out West last time I got off the train at Sante Fé, and when gunning through the baggage for my *kiester* I saw a trunk bearing on its end this legend: "Mrs. Jos. Hogg."

While I was "gapping" at it, as they say down East, a very nice looking lady came in, leading a little girl, glanced along the lines of trunks, put her hand on the one I was looking at and said:

"That's the one, yes, the little one. I want it checked to New York."

Just then a fellow with whiskers on his chin and a twinkle in his eye came in and took charge of the trunk, the woman and the child, and with the little one's arms around his neck, bid them good-by and got them into their seats in the sleeper.

I watched this individual with a great deal of interest, he looked like my old friend "Mormon Joe," only for the whiskers and the stockman clothes.

Finally he jumped off the moving train, waived his hand and stood watching it out of sight, to catch the last glimpse of the (to him) precious burden bearer, he raised his hand to shade his eyes, and as he did so I saw that it was minus one thumb, and I remembered that "Mormon Joe" left one of his under an engine up in Colorado—I was sure of him.

There was a tear in his eye as he turned to go away, so I stepped up to him and asked:

"Any new wives wanted down your way, Elder?"

He glanced up, half angry, looked me straight in the eye and a smile started at the southeast corner of his phiz and ran around to his port ear.

"Well, John, old man, I don't mind being *sealed* to one about your size, right now. I've just sent away the best one in the wide world. Old man, you're looking plump; by the Holy Joe Smith, a sight of you is good for sore eyes!"

Well, we storted, and—but there ain't no use in me telling you all about it—I went home with Joe, went up a creek with a jaw-breaking Spanish name for miles to a very good cattle ranch, that was the property of "Mormon Joe."

Joe only quit running some three or four years ago, and the ranch and its neat little home represented the savings of Joe Hogg's life.

His wife and only child had just started for a visit to England, where she was born.

The next day we rode the range to see Joe's cattle, and the next we started out for a little hunt. It was sitting by a jolly camp fire back in the hills of New Mexico that "Mormon Joe" told me the true story of the robbery of the Black Prince mine and the romance of his life.

Filling his cob pipe with cut-plug, Joe sat looking away over space toward our hobbled horses and then said:

"Old man, I reckon you remember all about the Black Prince robbery. I don't forget that you were the first man that came to the cooler to see me while I was doing time as a *suspect*. Well, coming right down to the point, *I had the dust all the time!* and the working out of the mystery would be rather interesting reading if it was written out, and as you are such an accomplished liar, I wouldn't be surprised if you made it the base line of one of them yarns of yourn—only mind you don't go too far with it, for it's as curious as a lie itself. I would not try to improve on it if I was you.

"About four days before the robbery I was introduced to Rachel Rokesby, daughter of one of the partners in the Black Prince. I met her in what seemed to be a casual way at Mother Cameron's hash foundry, but I found out, a long time afterward, that she had worked for two weeks to bring about the introduction.

"I don't know as you remember seeing her, but she was a quiet, retiring, well educated, rosy-cheeked English girl—impressed you right away as being the pure, unrefined article, about twenty-two karat. She chinned me about an hour that evening, and just cut a cameo of her pretty face right on my old heart.

"Well, course I saw her home that evening and tried my best to be interesting, but if a fellow ever in his natural life becomes a double-barreled jackass its just immediately after he falls in love. Why he ain't as interesting as the unlettered side of an ore sack.

"But we got on amazing well; the girl did most of the talking and along toward the last, mentioned that she was in great trouble—of course I wa'nt interested in that at all. I liked to have broke my neck getting her to tell me at once if I couldn't do something to help her, say for instance, move Raton mountain up agin Pike's Peak.

"I went home that night promising to call on her the next trip, not to let any one know I was coming, not to tell anybody I had been there, not for *worlds* to repeat or intimate what she told me, and she would tell me her trouble from start to finish, and then I could help her if I wanted to. Well, I wanted to, *bad*.

"I went up to the Rokesby's cabin next trip in; it was dark, and as I went up the front walk, I heard the old gentleman going out the back, bound for the village 'diggins.' I had it all to myself—the secret I mean.

"When I went in I got about a forty-second squeeze of a neat little hand, and things did look so nice and clean and homelike that I had it on the end of my tongue to ask right then to camp in the place.

"After a few commonplaces she turned around and asked me if I still wanted to help her and would keep the secret if I concluded in the end to keep out of her troubles. You bet your life, old man, she didn't have long to wait for assurance—why I wouldn't a-waited a minute to have contracted to turn the Mississippi into the Mammoth Cave, if she had asked it.

"'Well,' says she, finally, 'it is not generally known, in fact, isn't known at all, that the Black Prince is a paying placer, and that papa and Mr. Sanson have been taking out lots of gold for some time, *they have over fifty pounds of gold dust and nuggets hidden under the floor of the old mill!*'

"'Well,' says I, 'that hadn't ought to worry you so.'

"'But that isn't all the story,' she continued; 'we have discovered a plot on the part of Mr. Sanson to rob papa of the gold and burn the mill and sluice boxes to hide the crime. You will find that every tough in town is his friend, because he buys whisky for them, and they all dislike papa, if he carried out his plan we would have no redress whatever. All the justices in town can be bribed. The plan is to take the gold, burn the mill, and then accuse papa of the crime. Now, can't you help *me* to fool that old villain of a Sanson and put *papa's half* of the money in a safe place?'

"I thought quite a while before I answered, it seemed strange to me that the case should be as she stated and I half feared I might be made a cat's-paw and get into trouble, but the girl looked at me so trustingly with her blue eyes and added:

"'I am afraid I am the cause of all the trouble, too. Papa and Sanson got along well until I refused to marry him, after that the row began—I hate him. He said I would *have* to marry him before he was done with me—but I *won't!*'

"'You bet you won't, darling,' says I, before I thought. 'Pardon me, Miss Rokesby, but if there is any marrying done around here, I want a hand in the game myself.'

"She blushed deeply, looked at the toe of her shoe a minute, and said:

"'I'm only eighteen, and am too young to think of marrying. Suppose we don't talk of that until we get out of the present difficulties.'

"'Sensible idea,' says I. 'But when we are out, suppose you and I have a talk on that subject.'

"She looked at the toe of her shoe for a minute, again turned red and white around the gills, looked up at me, shyly at first, then fully and fairly, stretched out her hand and said:

"'Yes, if you care to.'

"Course, I didn't *care*, or nothing—no more than a man cares for his head.

"I guess that was about a half engagement, anyhow, it's the only one we ever had. She said it would be ruinous to our plans if I was seen with her then or afterward, and agreed to leave a note at the house for me by next trip, telling me her plan—which she should talk over with her father.

"A couple of days later I got in from a round trip and made a dive for the boarding house.

"'Any mail for me, mother?' I asked old Mrs. Cameron.

"'No, young man, I'm sorry to say there ain't.'

"'I was anxious to hear from home.'

"'Too bad, but maybe it'll come to-morrow.'

"I was up to fever heat, but could do nothing but wait. I went to bed late, and raising up my pillow to put my watch under it, I found a note, it read:

"'Midnight, July 17.

"'Dear Joe:

"'Just thought of that rule for changing counter-balance you wanted. There has always been a miscalculation about the weight of counter-balance; they are universally *too heavy*. The weights are in pieces; take out *two* pieces, this treatment would even improve a mule sweep. When once out, pieces should be changed or placed where careless or malicious persons cannot get hold of them and replace them. All is well; hope you are the same; will see you sometime soon.

"'Jack.'

"Here was apparently a fool letter from one young railroader to another, but I knew well enough that it was from Rachel and meant something.

"I noticed that it was dated the *next night*; then I commenced to see, and in a few minutes my instructions were plain. The old five-stamp mill was driven by a mule, who wandered aimlessly around a never-ending circle at the end of a long, wooden sweep, this pole extended past the post of the mill a few feet, and had on the short end a box of stones as a counter-weight. I would find two packages of gold there at midnight of July 17.

"I was running one of those old Pittsburghs then, and she had to have her throttle ground the next day, but it was more than likely that she would be ready to go out at 8.30 on her turn; but I arranged to have it happen that the stand-pipe yoke should be broken in putting it up, so that another engine would have to be fired up, and I would lay in.

"I told stories in the roundhouse until nearly 10 o'clock that fateful night, and then started for the hash foundry, dodged into a lumber yard, got onto the rough ground back of town and made a wide detour toward Constitution Gulch, the Black Prince and the mule sweep. I crept up to the washed ground through some brush and laid down in a path to wait for midnight. I felt a full-fledged sneak-thief, but I thought of Rachel and didn't care if I was one or not, so long as she was satisfied.

"I looked often at my watch in the moonlight ... lock everything was as still as death. I could hear my own heart beat against my ribs as I sneaked up to that counter-balanced sweep. I got there without accident or incident, found two packages done up in canvas with tarred string handles, they were heavy but small, and in ten minutes I had them alone with me among the stumps and stones on the little mesa back of town.

"I'll never forget how I felt there in the dark with all that money that wasn't mine, and if some one had have said 'boo' from behind a stump I should have probably dropped the boodle and taken to the bush.

"As I approached the town I realized that I never could get through it to the boarding-house or the roundhouse with those two ... that looked like country sausages ... awhile on it and finally put them ... an old scraper beside the road, and ... without them to the shops. I got ... my seat-box a clean pair of overalls ... jacket and came back without being ...

"I wrapped one of the packages up in ... and boldly stepped out into the glare of the electric lights. I remember I thought ... too darned enterprising.

"One of the first men I met was the night ... hal, Jack Kelly. He was reported to be a Pinkerton man and was mistrusted by most of the men, but tried to be friendly and 'stand in' with all of us. He slapped me on the back and nearly scared the wits out of me. He insisted on treating me, and I went into a saloon and 'took something' with him, in fear and trembling. The package was heavy but I must carry it lightly under my arm, as if it were only overclothes.

"I treated in return and had it charged, because I dare not attempt to get my right hand into my pocket. Jack was disposed to talk, and I feared he was just playing with me like a cat does with a mouse, but I finally got off and deposited my precious burden in my seat-box under lock and key—then I sneaked back for the second haul. I met Jack and a policeman on my next trip, and he exclaimed:

"'Why, ain't you gone out yet?' and started off, telling the roundsman to keep his bunkos off me up to the shop. I thought then I was caught, but I was not, and the bluecoat bid me a pleasant good night at the shop yard.

"When I got near my engine I was surprised to see Barney Murry, the night machinist, with his torch up on the cab—he was putting in the newly-ground throttle.

"Just before I had decided to emerge from the shadow of the next engine Barney commenced to yell for his helper, Dick, to come and help him on with the dome cover.

"Dick came with a sandwich in one hand and a can of coffee in the other. This reminded Barney of his lunch, and, setting his torch down on the top of the cab, he scrambled down on the other side and hurried off to the sand dryer, where the gang used to eat their dyspepsia insurance and swap lies.

"After listening a moment to be sure I was alone, I stepped lightly to the cab and in a minute the two heavy and dangerous packages were side and side again.

"But just here an inspiration struck me. I opened the front door of the cab, stepped out on the running board and a second later was holding Barney's smoking torch down in the dome.

"The throttle occupied most of the space, but there was considerable room each side of it and a good two feet between the top of the boiler shell and the top row of flues. I took one of the bags of gold, held it down at arms length, swung it back and forward a time or two and let go so as to drop it well ahead on the flues; the second bag followed at once, and again I held down the light to see if the bags were out of sight, satisfied on this point, I got down, took my clothes under my arm and jumped off the engine into the arms of the night foreman.

"'What did you call me for? That engine is not ready to go out on the extra,' I demanded, off hand.

"'I ain't called you—you're dreaming.'

"'Maybe I am,' said I, 'but I would 'a swore some one came and called under my window that I got out at 2 to on a stock train, extra.'

"Just then Barney and Dick came back and I soon had the satisfaction of seeing the cover screwed down on my secret and a fire built under it—then I went home and slept.

"I guess it was four round trips that I made with the old pelter, before Kelly put this and that together, and decided to put me where the dogs wouldn't bite me.

"I appeared as calm as I could, and set the example since followed by politicians, that of 'dignified silence.' Kelly tried to work one of the 'fellow convict' rackets on me, but I made no confessions. I soon became a martyr in the eyes of the women of the town. You boys got to talking of backing up a suit for false imprisonment; election was coming on and the sheriff and county judge were getting uneasy, and the district attorney was awful unhappy, so they let me out.

"Nixon, the sheriff, pumped me slyly to see what effect my imprisonment would have on future operations, and I told him that I didn't propose to lose any time over it, and agreed to drop the matter for a little nest-egg equal to the highest pay received by any engineer on the road. Pat Dailey was the worst hog for overtime, and I selected his pay as the standard and took big money. I wasn't afraid of re-arrest, I had 'em for bribery.

"Whilst I was in hock I had cold chills everytime I heard the 313's whistle for fear they would wash her out and find the dust, but she gave up nothing.

"When I reported for work the old mill was out on construction, and they were disposed to put me on a mill pulling varnished cars, but I told the old man I was under the weather and 'crummy,' and that put him in a good humor, and I was sent out to a desolate siding, and once again took charge of the 'fence,' for the robber of the Black Prince mine.

"On Sunday, by a little maneuvering, I managed to get the crew to go off on a trout-fishing expedition, and, under pretext of grinding in her chronically leaky throttle, I took off her dome cover and looked in; there was nothing in sight.

"I was afraid that its cooking of two months or more had destroyed the strength of the canvas bags; then again the heavy deposit of scale might have cemented the bags to the flues. In either case, rough handling would send the gold to the bottom of the boiler, making it difficult if not impossible to recover, and worse yet, manifest itself sometime and give me dead away.

"I concluded to go at the matter right, and after two hours of hard work managed to get the upright throttle-pipe out of the dome. I drew her water down below the flue line, and, though it was tolerably warm, I got in.

"Both of my surmises were partially correct; the canvas was rotted, in a measure, and the bags were fastened to the flues. The dust had been put up in buckskin bags first, and these had been put into shot-sacks; the buckskin was shrunken but intact. I took a good look around before I dared take the treasure into the sunlight; but the coast was clear, and inside of an hour they were locked in my clothes-box, and the cover was on the kettle again and I was pumping her up by hand.

"I was afraid something would happen to me or the engine, so I buried the packages in a bunch of willows near the track.

"It must have been two weeks after this that a moon's wagon stopped near the creek within half a mile of the track, and hobbled horses soon began to hunt grass, and the smoke of a camp-fire haunted the clouds.

"We saw this sort of thing often, and I didn't any more than glance at it, but after supper I sauntered down by the engine, smoking and thinking of Rachel Rokesby, when I noticed a woman walking towards me pail in hand.

"She had on a sunbonnet that hid her face and she got within ten feet of me before she spoke—she asked for a pail of drinking water from the tank—the creek was muddy from a recent rain.

"Just as soon as she spoke I knew it was Rachel, but I controlled myself for others were within hearing. I walked with her to the engine and got the water. I purposely drew the pail-full, which she promptly spilled, and I offered to carry it for her.

"The crew watched us walk away and I heard some of 'em mention 'mash,' but I didn't care, I wanted a word with my girl.

"When we were out of earshot she asked without looking up:

"'Well, old coolness, are you all right?'

"'You bet, darling.'

"'Papa has sold out his half and we are going away for good. I think if we get rid of the dust without trouble we may go to England. Just as soon as all is safe you shall hear from me; can't you trust me, Joe?'

"'Yes, Rachel, darling, now and forever.'

"'Where's the gold?'

"'Within 100 feet of you, in those willows; when it is dark I will go and get it and put it on that stump by the big tree, go then and get it. But where will you put it?'

"'I am going to pack it at the bottom of a jar of butter.'

"'Good idea, little girl, I think you'd make a good pawnbroker. How's my friend, Sanson?'

"'He's gone to Mexico; says yet that papa robbed him, but he knows as well as you or I that all his bluster was because he only found *half* that he expected. I pride myself on getting ahead of a wicked man once, thanks to our hero, by the name of Hogg.'

"It was getting dusk and we were out of sight, so I set down the pail and asked:

"'Do I get a kiss this evening?'

"'If you want one.'

"'There's only one thing I want worse.'

"'What is that, Joe?'

"My arm was around her waist now, and the sun bonnet was shoved back from the face. I took a couple of cream puffs there, where they were ripe, and answered:

"'That message to come and have that talk about matrimony.'

"Here a man's voice was heard calling 'Rachel,' 'Rachel,' and, throwing her arms around my neck, she gave me one more kiss, snatched up her pail and answered:

"'Yes, I'm coming.'

"Then to me, hurriedly:

"'Good-by, dear, wait patiently, you shall hear from me.'

"I went back and put the dangerous dust on the stump and returned to the bunk car. The next morning when I turned out the outlines of the wagon were dimly discernible away on a hill in the road; it had been gone an hour.

"I walked down past my stump—the gold was gone.

"Well, John, I settled down to work and wait for that precious letter that would summon me to the side of Rachel Rokesby, wherever she was, but it never came. I have never got a line from her from that day to this."

Joe kicked the burning sticks in our fire closer together, lit his pipe and then proceeded:

"I was hopeful for a month or two; then got impatient, and finally got angry, but it ended in despair. A year passed away before I commenced to *hunt* instead of waiting to be hunted, but after another year I gave it up and came to the belief that Rachel was dead or married to another. But the very minute such a treasonable thought flashed through my mind my heart held up the image of her pure face and rebuked me.

"I was discharged finally for forgetting orders—I was thinking of something else—then I commenced to pull myself together and determined to control myself. I held the job in Arizona almost a year, but the mill company busted; then I drifted down on to the Mexican National, when it was building, and got a job. A few months later it came to my ears that one of the engineers, Billy Gardiner, was in one of their damnable prisons for running over a Greaser, and I organized a relief expedition. I called on Gardiner, and talked over his trouble fully.

"He was in a loathsome hole of a 'dobie, full of vermin, and dark. As I sat talking to him I noticed an old man chained to the wall in a little entry on the other side of the room. His beard was grizzly white, long and tangled. He was hollow cheeked and wild eyed, and looked at me in a strange, fascinated way.

"'What's he in for?' I whispered to Gardiner.

"'Murdered his partner in a mining camp. Got caught in the act. He don't know it yet, but he's condemned to be shot next Friday—to-morrow. Poor devil, he's half crazy, anyhow.'

"As I got up to go the old man made a sharp hiss, and as I turned to look at him, he beckoned with his finger. I took a step or two nearer, and he asked in an audible whisper:

"'Mr Hogg, don't you know me?'

"I looked at him long and critically, and then said:

"'No. I never saw you before.'

"'Yes, that's so,' said he, 'but I have seen you many times. You remember the Black Prince robbery?'

"'Yes, indeed; then you are Sanson?'

"'No, Rokesby.'

"'Rokesby! My God, man, where's Rachel?'

"'I thought so,' he muttered. 'Well, she's in England, but I'm here.'

"'What part of England?'

"'Sit down on that box, Mr. Hogg, and I will tell you something.'

"'Is she married?' I asked eagerly.

"'No, lad, she ain't, and what's more she won't be till she marries you, so be easy there.'

"Just here a pompous Mexican official strided in, stepped up in front of the old man and read something in Spanish.

"'What'en hell did he say?' asked the prisoner of Gardiner.

"'Something about sentence, partner.'

"'Well, it's time they was doing something; did he say when it was?'

"'To-morrow.'

"'Goodnough, I'm dead sick o' this.'

"'Can't I do anything for you, Mr. Rokesby—for Rachel's sake?'

"'No—yes, you can, too, young man; you can grant me a pardon for a worse crime nor murder if you will—for—for Rachel's sake.'

"'It's granted, then.'

"'Good, that gives me heart. Now, Mr. Hogg, it was me that robbed the Black Prince mine. I took every last cent there was, and I used you and Rachel to do the work for me and take the blame if caught. Sanson was honest enough, I fired the mill myself.

"'It was me that sent Rachel to you; I admired your face as you rode by the claim every day on your engine. I knew you had nerve. If you and Rachel hadn't fallen in love with one another I'd a lost though; but I won.

"'Well, I took the money I got for the claim and sent Rachel back to her mother's sister in England. You may not know, but she is not my daughter; she thinks she is, though. Her parents died when she was small, and I provided for her. I'm her half uncle. I got avaricious in my old age and went into a number of questionable schemes.

"'After leaving New Mexico I worked the dust off a little at a time and wasted the money—but never mind that.

"'It was just before she got aboard the ship that Rachel sent me a letter containing another to you to be sent when all was right—I've carried it ever since—somehow or other I was afraid it would drop a clew to send it at first, and after it got a year old I didn't think of it much.'

"He fumbled around inside of his dirty flannel shirt for a minute and soon fished up a letter almost as black as the shirt, and, holding it up, said

"'That's it.'

"I had the envelope off in a second, and read:

"'DEAR JOSEPH:

"'I am going to my aunt, Mrs. Julia Bradshaw, 15 Harrow Lane, Leicester, England. If you do not change your mind I will be happy to talk over our affairs whenever you are ready. I shall be waiting. "'RACHEL.'

"I turned and bolted toward a door when Gardiner yelled:

"'Where are you going?'

"'To England,' said I.

"'This door, then, sir,' said a Mexican.

"I came back to the old man.

"'Rokesby,' said I, 'you have cut ten years off my life, but I forgive you; good-by.'

"'One thing more, Mr Hogg; don't tell em at home how I went—nothing about this last deal.'

"'Well, all right; but I'll tell Rachel if we marry and come to America.'

"'I've got lots of honest relations, and my old mother still lives in her eighties.'

"'Well, not till after she goes, unless to save Rachel in some way.'

"'Good-by, Mr. Hogg, God bless you—and—and, little Rachel.'

"'Good-by, Mr. Rokesby.'

"The next day I left Mexico for God's country, and inside of ten days was on a Cunarder eastward bound. I reached England in proper time; I found the proper pen in the proper train and was deposited in the proper town, directed to the proper road, and house, and street, and number, and had pulled out about four yards of wire attached to the proper bell.

"A kindly faced old lady looked at me over her spectacles, and I asked

"'Does Mrs. Julia Bradshaw live here?'

"'Yes, sir; that's me.'

"'Have you a young lady here named Rachel R——?'

"The old lady didn't wait for me to finish the name, she just turned her head fifteen degrees, put her open hand up beside her mouth, and shouted up the stairs.

"'Rachel! Rachel! come down here, quick.'

"A door opened upstairs and I caught a twinkle of No. 2 slippers on the upper stairs, when the old lady continued:

"'Here's your young man from America.'

"Another aged woman opened a side door and looked for a minute, while Rachel and I were so close together that you couldn't tell which of us wore the bustle, and I heard her say:

"'He's been long enough coming—I never did see such faith, though. Lord, I *do* hope he's half as good as she thinks he is.'"

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The Brooks Locomotive Works are working on engines for the Great Northern, the Cincinnati, Hamilton & Dayton and the Big Fours. They are quite busy.

## The Pennsylvania Railroad Locomotive Building Shops.

At Juniata, two miles from Altoona, the Pennsylvania Railroad Company have shops devoted to the construction of new locomotives. The shops were designed and equipped regardless of expense, the one aim concerning them being to provide every facility of the most approved kind for doing work accurately, expeditiously and cheaply. The men in charge having the courage of their convictions that a perfect although expensive plant was an investment certain to produce fertile returns, the company are reaping the benefit in getting locomotives built at a cost not approached in any other railroad shop.

The shops are built on a level plot of ground, a short distance from the main line, that gives plenty of room and is convenient to the yards. The machine shops are built parallel with a small opening between them. At the end of these is a transfer table pit, and beyond this the boiler and blacksmith shop set side by side like the others, the whole four principal buildings forming a parallelogram. The offices and minor buildings are located at the most convenient points outside of the main group.

The shops are turning out three heavy locomotives per week, which represents a great deal of work. As the writer walked observingly through the various shops he was struck with the small number of men employed to turn out so many engines. A closer study of the operations made the matter plain. Nothing is done by men that can be conveniently performed by tools and power methods of handling material. There are about 880 men in the shops, so that one locomotive represents about 1,760 days of labor.

Entering the grounds—after a brief call at the office, which is opposite the entrance—the first place examined is the power boiler shop, which is separate from the other buildings, and so located that the steam distribution can be accomplished with the least amount of piping. This is a neat, clean building, with good boilers, fired with mechanical stokers. The coal is supplied by traveling buckets, and the ashes removed by similar means. There are no coal piles around and no ash heaps to disfigure the place.

Next we go to the machine shop, which is a two-story building, the light work being done above and the heavy work below. This place convinces me that a two-story machine shop is an excellent arrangement for concentrating work compactly, although I used to be prejudiced against the plan. The good methods now in use for elevating and lowering material and work overcome the old objections to this form of building.

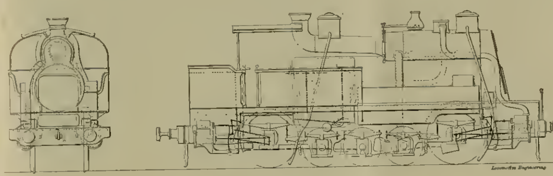
Standing on the ground floor of the machine shop we see a line of shafting on each side, each driven by a Westinghouse engine. The heavy tools are set toward the middle of the shop, but a clear space is left in the middle for the passage of material. An overhead traveling crane moves all material and puts the work on the heavy tools and takes it off. The shafting arrangement enables the heavy tools to be operated by the shortest belts. It also provides for the grouping of tools to best suit the movement of the work to them and from them. The lighter tools are set nearest the windows, where they have the advantage of the best light. Care has been taken to place the tools so that the work will always be advancing, and also that the movements from tool to tool will be as short as possible before the article is finished. For instance, the movements that a cylinder makes lead it but a short way into the shop before it is passed into the other building. It comes in at the east end of the shop and is immediately placed on the boring machine. From there it goes to a planer at hand, and another small step takes it to the drill press, where it gets the finishing touches, and is then sent out by the side door to the erecting shop opposite. A similar system is adopted with all other work not only here but in all the other shops.

The wheel, tire and axle work is done in the erecting shop, and the best of tools are employed. The rough material enters at one end and goes through the successive operations in regular order.

To me the most interesting part of the establishment was the boiler shop. So far as my experience has gone it is the best equipped boiler shop in this country or anywhere else. Hydraulic power is employed for all purposes, riveting, flanging, forming, punching, shearing, and for handling material. On entering the shop one is naturally struck with the great amount of work on the floor and the few men engaged upon it. Remaining in the shop a few minutes watching the tools soon makes the matter plain. There is no time lost in tedious handling of the heavy weights that boilermakers have to deal with, and the various operations were performed so quickly that a few men perform a large amount of work without much exertion. The tools here are also admirably placed to keep the various operations in close order. For instance, the sheets for a shell on entering the shop are laid out, and any required cutting or punching is done at the next step. Another movement takes the material to the rolls, from whence it is but a few steps to the hydraulic riveter. Then by a succession of easy movements it goes to the points where the dome, firebox and minor attachments are put on, every operation being facilitated by the most approved tools. Besides the overhead cranes that handle a great part of the loads to be carried from place to place there are numerous lifts and small cranes that serve the principal tools in all the shops. Good tools are a very great aid to the production of work, but the best of tools avail little without the proper organization that regulates the movements and keeps everything going like clockwork. The organization in these shops is conspicuously good and reflects very great credit on Mr. H. D. Gordon, the superintendent in charge, and the able foremen that are assisting him.

The blacksmith shop is well worthy of attention. Like the others, it is very well supplied with every kind of tool that can save labor and increase production. It is a clean, well-lighted shop, remarkable free from gas, good exhausting apparatus being employed to keep the atmosphere fresh. The furnaces in the shop are heated by gas generated in another building, in which the converters have the coal fed by means of mechanical stokers. The gas for forging may not produce a better job than coal, but there is certainly economy in the labor saved, and in the prevention of waste of coal. The gas is also a great promoter of cleanliness and order in the forging shops.

There are numerous minor points well worthy of notice. The shops are well lighted by electricity and heated by the Sturtevant system. A good many machine tools that cannot be conveniently reached by belts are driven by electric motors and this means of transmitting power is highly spoken of. There are many special tools, many of them very ingenious and not found elsewhere. We know of no place where a railroad mechanic could spend a day to better advantage than in the Juniata shops. A. S.



A CURIOUS OLD FRENCH LOCOMOTIVE.

## An Old French Double-end Locomotive.

American travelers in France seldom fail to be struck with the great variety of forms of locomotives to be seen. Some of the designing engineers appear to have exerted their ingenuity to produce odd shapes and peculiar arrangement of the mechanism. The engine shown in our engraving is one of the most striking of certain curious engines that came in fashion for a short time about thirty years ago. It is a double-ender in the fullest sense of the word, having sets of cylinders and driving wheels at each end. This form of engine has been taken as the pattern for certain forms of compound locomotives that are now to be found on several French lines.

The boiler is of peculiar form, having a large steam drum on top through which the gases from the smoke-box pass and escape by a stack set at the back end. Several modifications of this design have been tried in America, but they have not proved a success. The boiler has lately been tried again in England, which gives the old machine new interest.

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We have in a former issue mentioned a partly railroad partly East Indian story by Rudyard Kipling and the late Wolcott Balestier, that has been running through the *Century Magazine*. The story is now finished and we are afraid it has done nothing to redeem railroad life as a field of romance. To be sure the railroad part was a very small caudle appendage that came first, but the situations were tame and unnatural, the species of story that educated railroad men or especially women, do not indulge in was made to pass as raciness. The denouement of the story was simply ridiculous. Mr. Kipling is more at home portraying the wayward life of fast "unnative" residents of India, or in recording the habits and aspirations of beer-guzzling soldiers than he is in delineating the sentiments and actions of American railroad people.

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During a recent trip over the Michigan Central we found that numerous improvements had been effected during the year. The company are evidently preparing to be ready to handle the heavy Fair business next year. Considerable increase in double tracking has been made, and they are interlocking all switches as fast as possible. The intention is to put down track tanks this summer to permit of long runs being made without stoppage. A number of very handsome station buildings have been erected, that at Niles, Mich., being one of the handsomest road-side stations in the country. At this place they have hot houses for raising flowers and a bouquet is given to every lady in each train.

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## Settling the Size of an Inch.

We are constantly hearing of agitations being carried on to change our standards of measurement, and many people unreflectingly conclude that it would be a fine thing to introduce the French system of measurement with the meter, which is 39.3704 inches in length, as a basis. Those people seldom have learned anything about the difficulties there were encountered in establishing an exact inch as the basis of our measurements. Every boy who carries a well made steel scale now has in his pocket an inch that is the same length as the inch measured by instruments made specially to secure accuracy. The inch of every well regulated shop is of precisely the same length as the inch of any other shop of similar character. It is within the memory of men still young when a very different condition of affairs existed. The inch marked on the rules of different makers was seldom approximately the same, and the best of measuring scales rarely made the inch the same length and 1-32 inch difference on the foot was not considered out of the way. In fact there was no accurate unit of measurement on this continent till very lately.

Railroad engineering men are entitled to some share of the credit due for reforming the prevailing confusion in measurements. A committee of the Franklin Institute of Philadelphia made the first important move toward getting a standard system of screw threads introduced, and it was in connection with this that the need for an accurate inch came to be recognized. When the famous engineer, O. B. Chanute, was in charge of the mechanical department of the Erie in the early '70's he decided to have interchangeable screw threads used in a large number of cars to be ordered. When he entered into details the first difficulty encountered was finding the correct length of an inch. He applied to the various Government arsenals and shipbuilding yards and obtained scales giving the standard inch they were working to. On a comparison being made it was discovered that none of the reputed accurate inches were exactly the same length. Mr. Chanute was a highly influential railroad officer and a leading member of the principal engineering society of the day, and he had good opportunities for making the anomalous condition of American measurements well known to the engineering world. He hied hither and thither seeking for a true inch like the ancient philosopher searching for an honest man, and his quest was equally fruitless.

The agitation, however, brought about the necessary reform. The question was taken up by the Master Car Builders' Association, and a committee was appointed to select a firm to make gauges for standard screw threads. The choice fell upon the Pratt & Whitney Co., Hartford, Conn., and that company displayed wonderful enterprise in providing the country with a correct standard unit of measurement.

The labor performed was enormous, and the expense incurred was not less than $25,000. The first thing to be done was to ascertain the length of the standard British yard, which was the original gauge of our measuring rules. This yard was made with great care, in 1760, and was deposited for safe keeping in a strong room in the Houses of Parliament in London. Its length was based on a natural unit made by the vibration of a pendulum beating seconds at the level of the sea, in the latitude of London. It was supposed that this would provide the means of restoring the exact yard should the standard bar be lost or destroyed. The Houses of Parliament were burned in 1834, and the standard yard destroyed. When scientists undertook to restore the standard yard from the natural unit, they found that the vibrations of the pendulum were susceptible to influences that induced errors. After a most laborious and painstaking investigation, it was determined to restore the standard yard by measurements taken from various yards that had been made with great care, and compared with the standard yard of 1760. This yard, then constructed, is known as Bronze No. 1, and is the British national standard yard. It is kept in the strong room off the Old Palace Yard, Westminster, London.

To obtain an accurate transfer of this yard was the first work undertaken by the Pratt & Whitney Co. They engaged the services of Professor Rogers, of Harvard College Observatory, Cambridge, Mass., who is probably the first authority in the world on measurments and measuring instruments. The work was successfully performed, and very few connected with the vast interests that are enjoying the benefit of the accurate system of measurements established realize the great importance of the work that was accomplished.

The details of designing gauges and measuring appliances to introduce the accuracy of science into shop practice were carried out to a great extent by Mr. George M. Bond, of the Pratt & Whitney Co. This was done in such a practical manner that, within a few months after the standard measurement was established in this country, numerous shops were working to gauges that gave absolutely correct divisions of the yard. Although the yard is the standard of reference, the inch is the real standard of the machine shop. Among others who did valuable work in promoting the reform in our standards of measurement, were Mr. M. N. Forney, of the *Engineering and Railroad Journal*, and Professor Denton, of the Stevens Institute of Technology.

## Inventors Who Do Not Read Papers.

Considering the unparalleled channels now constantly engaged spreading mechanical information to every part of the earth, it is surprising how many people who ought to be informed are ignorant of things they are directly interested in knowing. The agitation stirring some Western cities for some months in regard to the prevention of smoke has started a movement in the direction of inventing smoke-preventing devices for locomotives. This line of invention has been quarried into as deeply as the line of inventing car couplers, yet many overgrown children with inventive tendencies are working on problems for the prevention of smoke without inquiring what has been done in this line before. Their labors are almost certain to end in disappointment. They invent things that were patented before they were born, and only learn the facts after paying a patent attorney to make application for a patent.

We were stimulated into reproaching inventors for not inquiring into what had been done in any appliance they incline to invent by a visit yesterday from a man with an arrangement for burning petroleum oil in fire-boxes or furnaces. It was a very crude affair, but the amazing thing about it was that the inventor expected to secure a foundation patent, for he had never heard of petroleum being successfully used in the generation of steam.

The men who are not aware that the problem of using petroleum as fuel in locomotives was solved years ago are profoundly ignorant of what is going on in the locomotive engineering world. The use of petroleum compounds for locomotive fuel is as common in Russia as the use of anthracite coal is for the same purpose in this country. A few locomotives in this country employed on special service are burning petroleum, and all the engines in the country would probably be using it if it were not that liquid fuel is more expensive than coal.

## A Remedy for Bad Feed Water.

The Chicago, Milwaukee & St. Paul Railroad people say that the boiler purge they are using for neutralizing the destructive effects of lime and magnesia in the feed water is a thorough success. A new engine was supplied with the water purifier regularly from the time she first left the shop. She has now run nearly 300,000 miles and has not cost a dollar for boiler work. This is phenomenal for locomotives running out of Milwaukee. The ordinary experience has been for engines to require the tubes to be taken out and cleaned every 50,000 miles run. After a locomotive has done the work represented by that mileage, the firebox begins to show leaky seams and stay bolts. Calking begins and is called for with increased frequency till new side sheets must be put in. If an engine runs 200,000 miles without getting new side sheets she is making an unusually good record.

Few master mechanics have any confidence in the doctoring of feed water, and in all directions we hear that chemicals for this purpose are a delusion and a snare that lead railroad companies to spend money that is worse than wasted. Now, how is it that the Milwaukee people have made a success of this while others have generally made ridiculous failures? We will venture an answer. The others never gave remedies for bad feed water a fair chance.

The experience of the C., M. & St. Paul people is rather edifying. When the purge was found satisfactory for one engine, it was supplied to all those running out of Milwaukee. A certain quantity was put on each tender at the beginning of the run, and the enginemen were instructed to put into the tank a measured supply every time water was taken. The thing went on smoothly. It was some one's business to examine the purge cans every time an engine came in, and they were found regularly to be empty. Results were expected soon, and the master mechanic kept watching the engines as they were washed out, expecting to see the old scale coming out in loads, but it did not come out. Months passed, and the boiler work kept up about the same, but the purge cans continued to come in empty. The master mechanic began to suspect that there was a colored person in the wood pile and he called in the enginemen and questioned them about how the purge was used. They all declared with the utmost unanimity that the purge was put regularly in the tenders.

A week or two passed and the boilers showed no symptoms of improvement. The master mechanic then took all the purge cans off the engines and employed a man to put half the quantity the engines had been using into the tenders before the engines left the roundhouse. Two or three days afterward a deputation of engineers waited on the master mechanic and represented that they could not run the engines with the quantity of purge they were receiving. He expressed the opinion that it was strange that they could not now get along with half the quantity that they were using when they applied it themselves and they were compelled to admit that they had been regularly throwing the purge away. They were informed that they must try to get along with the new order of things. The engines gave trouble with foaming at first and needed more than usual care in running, but this difficulty greatly diminished after the compound had been in use for a few weeks.

When the purge was systematically put in, the boilers soon began to show an improvement, and after the practice had been inaugurated six months, a very great improvement was perceptible. The shops do not now have to devote half the attention to boiler work that was regularly called for before the feed-water remedy was applied. Boiler repairs were what called the majority of engines into the shop formerly, but now it is rare that an engine has to be taken in till repairs of the machinery are necessary. The boiler purge has effected a revolution in the work. Why cannot other roads tortured with bad water apply this remedy?

## Attempts to Discredit Block Signals.

During the month we have heard considerable talk of a detestable character among railroad men about the accident that happened on the Pennsylvania Railroad, at Harrisburg, Pa., toward the end of June. A heavy passenger train was running in two sections. The first section was stopped outside the station at Harrisburg, but within a block protected by signals. The signal operator, by mistake, permitted the second section to pass into the block, and it crashed into the hind end of the first section, killing twelve persons and injuring about twenty others. Rear-end collisions of a fatal character are, unfortunately, extremely common on this continent, and this one would not call for comment from us were it not for the lamentable tone many railroad officers have indulged in concerning it. The Pennsylvania Railroad, undoubtedly the best managed railroad in the country, has the trains operated under a block signal system, and this is the object of attack and disparagement by some of the men responsible for inferior roads having no mechanical provisions for promoting the safety of trains. The kind of talk indulged in is: "There now, that is the result of your high-toned signal system. Signals and all the complexity and expense attending them are nothing more or less than a tempting of Providence. As a means of running trains safely give me well-trained crews that depend upon themselves alone."

This is the species of sneering opposition that has been offered to every improvement introduced into railroad operating. If the sentiments of the kind of men who still oppose a signal system had been followed railroads would still be using strap rails and operated with locomotives without cabs.

The Harrisburg accident was a very sad one, but the most striking thing about it was the reminder that the human element can never be eliminated from railroad operating, and it is human to err. When a railroad company has provided all the most approved appliances for securing safety, the officers are not to blame if a link in the human chain that does the operating should suddenly fail. There is a signal system now in use, so thoroughly perfected, that the signalman in a tower cannot lower his signal until the man in the tower ahead releases the actuating lever, which he does when a train passes out of the block. If the Pennsylvania Railroad had had this system in use the accident might have been averted, but the company is not greatly to blame for not having the very latest inventions in use. The management have displayed an enterprising willingness to provide the best appliances, and that is all that can reasonably be expected of any railroad company. We have heard opinions expressed that the Harrisburg accident has given a serious blow to the public confidence in signals. If it has, the blow has struck people whose judgment is worthless. It is just as well to say that railroad companies ought to go back to hand-brakes, because the automatic air-brake has sometimes failed to prevent collisions. Those who take the unction to their souls that the Harrisburg accident will screen them from blame for having no signal system, should a serious accident happen, will find themselves rudely awakened to the consciousness that the demand for a good signal system is still marching on. This is a movement like that in favor of power-brakes and safety couplers. Failures with the apparatus in use may temporarily check the public demand for improvements, but the sensible sentiment in favor of the best mechanical aids being provided to help the human worker will prevail in the long run.

## Making Safety Appliances Compulsory.

A bill has passed the House of Representatives making provision for the compulsory use by railroad companies of safety appliances, and it is said to have been reported on favorably by the Senate Committee. There is every likelihood that it will pass the Senate, and in that event it will become a law, for the President is known to be very favorable to the measure

The law, of course, only applies to cars and locomotives engaged on interstate business. It requires that after July 1, 1893, all new locomotives shall be equipped with power driving-wheel brakes, and that after July 1, 1895, all locomotives must have these brakes. After July 1, 1895, it requires that all new cars and all cars that go into the shops for general repairs be equipped with automatic couplers, and that after 1898 all cars must be provided with automatic couplers. It requires that after July 1, 1895, all new cars and those that undergo general repairs must be equipped with power brakes on every wheel, the same to be operated from the locomotives. Three years later all cars will be required to fulfill the above conditions respecting brakes.

On or before July 1, 1893, all railroad companies are required to give particulars relating to the height, form, size and mechanism of freight-car couplers deemed essential to secure uniformity. They are also required to certify to the number of cars they have engaged in interstate business. If companies owning 75 per cent. of such cars agree upon the details of a coupler requisite to secure uniformity, automatic action and safety in service, such coupler will be declared standard for use in interstate service. If the railroad companies shall fail to establish a standard, then the Interstate Commerce Commissioners are empowered to select a standard. After July 1, 1898, railroad companies will be at liberty to refuse any car not provided with the appliances required by this act. Railroad companies are made responsible for accidents caused by rolling stock not provided with the safety appliances mentioned; and employés and others injured by rolling stock not equipped with safety couplers and brakes shall not be deemed guilty of contributory negligence.

The American Railway Association is required to designate the standard height for draw-bars, and if it fails to do so the Interstate Commerce Commission is authorized to find out and establish a standard height. After July 1, 1893, cars must not be used in interstate traffic if they fail to comply with the requirements of this standard.

We have no fault to find with this law, and the railroad companies that have been struggling to prevent its enactment deserve no sympathy. The more enterprising railroad companies in the country are voluntarily equipping their cars with safety appliances at a rate which will not leave much extra effort to be made when the law becomes operative. It is high time that the companies which systematically hold back and do nothing should have the spur of compulsion applied to accelerate their action. These are the people who have made compulsory laws necessary, and it is only fair that they should suffer most.

The apathy of many roads to do anything to promote safety in car handling has been well illustrated in the case of the height of drawbars. There has been a standard height since 1872, but a great many companies have paid no attention whatever to it, although diverse heights of draw-bars has been a fruitful cause of accidents in car coupling. It is a very wise action to put a compulsory end to this inexcusable condition of affairs.

## Gland Metallic Packing.

The superintendent of motive power of one of our leading railroads, which has adopted the use of metallic gland packing for all the locomotives, on being asked lately how he was pleased with the change, replied that it was the most satisfactory improvement that had been put upon the locomotive since the injector was introduced. In the first place, he said, the packing is much cheaper than any of the fibrous varieties, but its leading merit is that it takes away a common cause for the failure of locomotives on the road. When glands are packed with hemp it frequently gives out before a heavily loaded engine can get over a division. This causes troublesome delay if the train has to be held till the packing is done. More than one accident has happened through trains being delayed unexpectedly while the engineer was packing a gland. Very few accidents will cause more expense than would be incurred in putting metallic packing upon all the engines. Delaying this improvement is one of the short-sighted policies common with those who do not understand their own best interests.

Another objection to the fibrous packing is, that when the contents of a stuffing-box suddenly blows out there is frequently no time to pack it, and the gland moves to and fro with the piston-rod and gets broken. This makes a failure of the engine reported against the mechanical department. In other cases when an engineer has to pack a gland on the road he gets nervous and hurried, and in screwing up the gland breaks a stud Result, another failure of engine. The metallic packing obviates all this trouble It makes a mechanical job and provides for the work of renewal being done by men who know how heavy a twist a stud is likely to stand. The fibrous packing for the rod is in line with fibrous packing for the piston-head, which was abandoned so long ago that few engineers are now aware that the piston-head was ever made steam-tight by the use of a hemp ring.

## Too Great Fertility of Rules.

In these days, when railroad officers of the martinet type are attempting to lay down hard and fast rules for every action of train men, a paragraph from a letter written by our correspondent, Paul Synnestvedt, is worthy of earnest consideration. He says, "There is no question but that some men are recklessly free with their use of the emergency action of the valve, and all reasonable measures should be taken to remedy this evil; but I cannot help saying, in behalf of those whose lives and limbs may be in danger, that considering the fast time made by the trains of the present day, the large number of trains run on the same track, many of them only a few minutes apart, and in general the many dangers that threaten the passenger as well as the railway employé, it is best that too many restrictions should not be put on the actions of our locomotive engineers, else they may hesitate in case of doubt; and it is assuredly true that when running at a speed of 60 miles an hour 'he who hesitates is lost.'"

American railroad men have been famous for the ability displayed to overcome difficulties as they arise, and for meeting unexpected emergencies with success. The qualities that have proved so valuable in this way have been developed through the men being permitted to use their own judgment. Railroad operating is now exceedingly complex, and more formulated rules are necessary than formerly, but care should be taken that rules are not made so numerous that an impression is given that the judgment of the man is no longer considered of value. We recently called upon a railroad manager who was wrestling with the formation of a book of rules for train men, and he had got material more voluminous than the Old Testament, and yet he was seeking more suggestions. His aim was to cover every event that could possibly happen and lay down directions about what was to be done. This sort of paternal management is not likely to produce good results. It is impossible for men to commit to memory voluminous rules, so the effect of issuing a code of this kind is the taking away personal responsibility without supplying a practical substitute. It is much safer to depend upon a man who will act promptly on his own judgment when an emergency arises than on one who tries to remember what rule is laid down to apply to the case.

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There are some statements made in C. B. Conger's letter on "Brakes," in another part of this paper, that ought to receive the earnest attention of men in charge of railroad rolling stock. Mr. Conger says "In the list of questions and answers on the automatic air-brake, the order is given that on freight cars the engineer may set the air-brake when the brakemen are setting the same brakes by hand, but on passenger coaches never. The Pennsylvania Company run a line of freight cars equipped with air-brakes which can be set by hand from either end of the car. One end has the brake worked from the end of car for tunnel use, the other is operated from the roof of car. When the brake is being set from the top of car by hand, and air is applied, it will set the brake against the brakeman same as a coach. There is another feature about this arrangement; if the slack is taken up some on brake chain at that end it changes the leverage on that truck by moving the fulcrum 7¼ inches further away from the power, so the braking strain is increased from 8,500 pounds to 14,000 pounds, in round numbers. There is a fulcrum pin working in a slot in a bracket between the power and coupling to hand brake; as long as this pin rests at the end of the slot the braking strain is the same on each truck; take up the slack with the hand brake, it is changed. Why is this?"

On another page will be found an article on Electricity Considered as the Motive Power for Railroads, by Mr. J. E. Phelan, superintendent of the Northern Pacific Railroad, which is well worthy of careful perusal. Railroad men familiar with existing motive power are very reluctant to admit the possibility of steam locomotives being displaced by motors operated by electricity. In their opposition to change they generally act like the ostrich, which pushes its head into a sand bank to hide the approach of danger. Making believe that electric motors cannot succeed in moving heavy fast trains will not do anything to avert the change. If development of electric machinery shall ever lead to a point where electricity will be cheaper than steam locomotives the change will soon be made. It then behooves progressive railroad men to look the question fairly in the face, and be prepared with the necessary knowledge to fall easily in line should electric motors take the place of steam locomotives.

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A correspondent wishes to know why it is that master mechanics and other railroad officers will not hire men for firemen who are over twenty-five years of age. We believe that young men are preferred for this business because they are likely to learn the part requiring skill more readily than older men. The arguments in favor of hiring young men as firemen are the same as those in favor of the novices for any business. Certainly the railroad companies have the right to establish a rule regarding the age at which men will be admitted to any kind of employment. From the experience we have had with men who succeeded in being started as firemen after they were thirty years of age and upward, we think it is wise for the railroad companies to keep the age below twenty-five years.

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Our readers will be gratified on finding that Captain Anderson continues in this issue his highly interesting account of his experience "Train Running for the Confederacy." In one part of the narrative a most exciting incident is described, where an act of coolness and determination seemed many times put in imminent peril by the insane actions of one intoxicated engineer The story is told with dramatic effect that draws the readers into the scenes depicted. The articles will be continued in our next issue Captain Anderson, writes as if another letter would finish his interesting story, but we are in hopes that he may be prevailed upon to continue writing on the subject he is so familiar with. We find that the various articles on railroading in the South during the war time, are greatly valued by our readers.

Our readers appear to reverse the common order of things in the summer months Most journals find it almost impossible to get correspondents to write articles for them during the heat of summer, but we have received more letters last month than ever before. We have devoted more than usual space to the correspondence, and yet there are several good letters crowded out. While thanking our correspondents for their attention, we request the excuses of those whose letters do not appear.

A correspondent who is evidently inclined to be sarcastic wishes to know if the constitution and by-laws of the Brotherhood of Locomotive Firemen forbid the ringing of the engine bell at public crossings. He says that for the last five years he has noticed that the firemen always jump down and begin putting in fire every time the engineer whistles for a crossing. We fancy that a tendency of this kind can be best restrained by the individual engineer.

When the Master Car Builders' Association adopted the vertical plane or Janney type of car coupler as standard, there were many members of the Master Mechanics' Association who believed that a serious mistake had been made, and a committee was appointed to find out whether or not the vertical hook type of coupler could be recommended from a mechanical standpoint The committee dragged along for four or five years without doing or saying anything in particular. There was for a year or two an inclination to find fault with the M C. B. coupler, but no decided action was taken in that direction. At the last meeting it was strikingly shown how much progress had been made among master mechanics on the coupler question. The committee reported, indorsing the action of the Master Car Builders' Association in relation to car couplers, and the action was cordially supported by the convention. There was not a single voice raised in favor of keeping the subject open.

We understand that the smoke inspector of the City of Chicago has written a letter to President Miller of the Chicago, Milwaukee & St Paul Railroad, saying that the locomotives belonging to his road make less smoke than any engines operating within the city limits. President Miller has credited this gratifying stote of affairs to Mr. J. N. Barr, superintendent of machinery, and Mr. Barr, on the other hand, avers that all the credit is due to an intelligent road foreman of engines, who understands combustion, and gave the enginemen and firemen directions as to how smoke could be made a very small nuisance. Some of the roads running into Chicago are badly in need of road foremen of engines like the Milwaukee man.

## NEW BOOKS.

RAILWAY CAR CONSTRUCTION. A work describing in detail and illustrating with scale drawings the different varieties of American cars now built. By William Voss. Published by National Car and Locomotive Builder, New York.

This is a practical work, written by a master car builder, thoroughly familiar with every detail of car designing and construction, and having the language and expression necessary to tell what he knows. It is the only book we know about on car construction. It is likely to become a manual for those requiring information on the subject. Few manuals have been written that required so little correction or modification. Mr Voss takes up the construction of freight and passenger cars in detail and illustrates the work as it progresses by profuse use of drawings, every step being made clear. Among the leading subjects treated are freight car bodies, floors and framing, sheathing and roofs, freight car trucks; power-brakes; passenger cars, passenger car superstruction; passenger car trucks, etc. It is a book which every man interested in the construction or maintenance of cars ought to have convenient for reference.

## The Official Railway List.

We have been looking anxiously for the last few weeks for the 1892 edition of this useful book, and are now pleased to tell our readers that it has made its appearance. It has the old familiar look, only it has kept pace with the business manager and has become a little fatter than it was a year ago. The increase of volume means increase of useful information, and we are glad to put up with the augmented weight to our traveling bag, where this book goes regularly when we go out to see people and things of interest. We cannot imagine how people who have to refer to the names and addresses of railroad officials can get along without the Official List. It is sold for $2 by the publishers, Rookery, Chicago.

By arrangement with the Pennsylvania Railroad Company the Cooke compound locomotive pulled passenger trains all the way on its journey to Chicago. The engine is reported to have done excellent work throughout the entire journey. Those in charge thought of offering to run from Jersey City to Chicago on one continuous train, but after proper consideration the plan was abandoned, although they had confidence that the long run could have been made successfully.

The South Side Elevated Railroad people of Chicago are substituting the Jerome rod packing for the United States packing on several locomotives.

## PERSONALS.

Mr. A. T. Ellis has been appointed roundhouse foreman of the Union Pacific shops at La Grande, Oregon.

Mr. F. W. Deibert has been appointed master mechanic of the West Milwaukee shops of the Chicago, Milwaukee & St. Paul.

Mr. W. B. McPhail has been appointed master mechanic of the Ohio Southern Railroad, at Springfield, Ohio, vice A. E. Trempe, resigned.

Mr. H. A. Fritz, who has been a draughtsman in the office of the mechanical engineer of the Illinois Central, has been promoted to be chief draughtsman.

Mr. M N. Davis has been appointed foreman of the machinery and rolling stock department of the Denver & Rio Grande, with headquarters at Minturn, Colo.

Mr R. J. Turnbull has been appointed master mechanic of the Seattle & Montana Railway and of a number of proprietary lines. His headquarters is in Seattle.

Mr M K Barnum, a member of the Master Mechanics' Association, has lately been appointed foreman in charge of the North Platte Division of the Union Pacific system.

Mr. Henry Millholland, who has been connected with the mechanical department of the Pennsylvania railroad, has been appointed mechanical engineer of the Gould Coupler Company.

Mr. William Finley, who has been master mechanic of the Brooklyn & Brighton Beach for a number of years, has been appointed general superintendent of that road, with headquarters at Brooklyn, N Y.

Mr. Henry A. Barnes, who at one time was superintendent of motive power of the Wisconsin Central and left that road in 1887, has been appointed general foreman of the Illinois Central shops at Chicago.

We regret to learn that Mr. Robert Derby, who has been appointed master mechanic of the South Florida Railroad at Sanford, Fla., has been very sick for some time. We understand that he is now able to get around.

Mr. Richard English, who has been division master mechanic of the Atchison, Topeka & Santa Fé, at San Marcial, N. Mex., has been appointed general master mechanic of the Atlantic & Pacific with headquarters at Albuquerque, N. Mex.

Mr. F. A. Stinard, of Paterson, N J., and for some years master mechanic of the Greenwood Lake Railroad, has been appointed the agent for the Pennell Water Purifier. We bespeak for Mr. Stinard a kind reception from railroad men generally.

Mr. A. W. Gibbs, late superintendent of motive power and machinery of the Central of Georgia, has been appointed master mechanic of the Atlanta & Charlotte Air Line division of the Richmond & Danville, with headquarters at Atlanta, Ga.

Mr. D. J Durrell, mechanical engineer of the Illinois Central, has resigned that position to accept a similar one with the Illinois Steel Co. Mr. Durrell is succeeded on the Illinois Central by Mr. A Rosing, who for the past year has been with the Grant Locomotive Works at Chicago.

The announcement has been made by H. M. Flagler, president of the East Coast line, that Mr. W. L. Crawford has been appointed general superintendent. There has been a regular reorganization among the officers of this party which includes a great many small roads.

Mr. W. S. Cox has been appointed air-brake inspector and instructor of the Atlantic system of the Southern Pacific, with headquarters at Houston, Tex He will have charge of the inspection of air-brake equipment and instruction and examination of all employés whose duties require them to use the air-brakes

The large number of railroad supply friends of Mr. Joel H. Hills among our readers will be sorry to hear that he died suddenly last month. Mr Hills was agent for the Granular Metal Company, of Boston, and was one of the most esteemed members of the supply fraternity. His departure makes a blank that many will feel.

The announcement is made that the office of superintendent of motive power of the Richmond & Danville Railroad Company has been moved to Washington. This takes Capt. Wade back to that city. How this office was transferred from Atlanta is one of the mysteries of railroading that none but those making the order can understood.

Mr. E Hedley was appointed master mechanic of the Brooklyn Elevated Railroads last month. Mr. Hedley has been for several years general foreman of the Manhattan Elevated Railroad shops in New York City, and was known as a particularly able man in carrying on the elaborate system of repairs followed in the Manhattan shops.

We have letters from our partner, Mr John A. Hill, intimating that he is absorbing all there is to be seen and heard in Germany, but he had not found time to put any of his impressions on paper. Mr. Hill has been devoting a great deal of his time to visiting railroad shops in Germany and Holland, and is pleased with the kindness shown him at every place visited.

Mr Clarence H. Howard has been appointed Secretary of the Safety Car Heating and Lighting Co., with headquarters in New York. Mr. Howard has been for a year or two Superintendent of the St. Charles Car Works, and previous to that was a master mechanic. He is a particularly popular young man, and we anticipate will make a great success in his new position.

The absorption by the New York, New Haven & Hartford of the New York, Providence & Boston has led to the announcement that Mr L M. Butler has been appointed master mechanic of the Providence & Worcester Division. Mr. Butler is one of the ablest mechanics in New England, and has lately received several tempting offers to take him away from Providence.

During the Master Mechanics' and Master Car Builders' Convention, Mrs. George W. McGuire was active soliciting subscriptions for the Fresh-Air Fund for children at Cleveland. She met with very great success, as is testified by an item we lately find in a Cleveland paper, to the effect that the lady named handed in $60.50 to the *Leader* office as a contribution for this very benevolent purpose.

Mr. Robert B. Reading has been appointed general foreman of the New York Elevated Railroad shops at 145th street, New York. Mr. Reading is a technical school graduate who went into a shop and worked at the bench on leaving college. He fired for some time on the Erie, and has lately been assistant foreman of the Elevated shops at 98th street, and before that was in the drawing office.

Mr. J. J Ellis has been appointed general master mechanic of the Chicago, St. Paul, Minneapolis & Omaha, to succeed his brother, Mr. Matthew Ellis, resigned on account of ill health. Mr. Ellis has been acting master mechanic for about two years, the hope being entertained that Matthew would get better. The latter is reported to be suffering from brain trouble, from which he is not likely to recover sufficiently to resume work again.

John A Hall, of Chicago, editor of the *Switchmen's Journal*, was killed at the Relay depot, East St. Louis, in attempting to board an outgoing train of the Cairo Short Line The train was already in motion and Mr. Hall grabbed at the railing with one hand, but the momentum was too great, and he fell between the cars and was crushed to death. Mr. Hall exerted great influence among switchmen and it was always exercised wisely.

Mr. C. F. Ward, who has been at Costa Rica for about a year, has returned to the northwest as master mechanic of the Duluth & Winnepeg and Duluth, Messabi & Northern roads, with headquarters at Duluth, Minn. Mr. Ward left the St. Paul & Duluth to be superintendent of motive power of the Santa Fé and Gulf system at Galveston, which he left on account of his health not being good there. He is one of the ablest shop managers in the country.

Nearly every railroad mechanical convention brings some new man to the front. This year the new man brought into prominence at the Master Car Builders' Convention was Mr. J J. Hennessey, master car builder of the Chicago, Milwaukee & St. Paul. He was chairman of the Committee on Wheel Guarantee, on which he submitted a good report. On the floor he displayed great readiness in debate, with good ideas to back the position he took on the various subjects.

Mr. George A. Hancock has resigned as master mechanic of the Atlantic & Pacific to accept the position of superintendent of machinery of the San Antonio and Arkansas Pass, with headquarters at San Antonio, Tex. Mr Hancock will be missed at Albuquerque and other places on the Atlantic & Pacific, for he had labored zealously to promote the comfort and well being of the men under his charge. By his efforts libraries were lately established at three division points.

Mr. W. W. Thompson has been appointed supervisor of rolling stock of the Chicago South Side Elevated Railway, the position being that of master mechanic under the superintendent. Mr. Thompson was for about ten years on the elevated railroads of New York, the greater part of the time filling the position of road foreman of engines. He left there to be division master mechanic of the New York Central. Col. Hain, speaking of this appointment said. "Mr. Thompson was one of the very best executive officers I ever had."

The report has again reached us that Mr. Theo. N. Ely, general superintendent of motive power, of the Pennsylvania Railroad, has been elected a vice-president and that Mr F. D. Casanave, of the Fort Wayne district, has been appointed general superintendent of motive power Some time ago Mr Casanave received a highly tempting offer from the Philadelphia & Reading, and it has generally been understood that he was retained in the service of the Pennsylvania by a promise of something much better than he had at Port Wayne.

The Society of American Railway Superintendents is an organization that is in a highly prosperous condition. Delegates have been appointed by the Master Car Builders and Mechanics' Associations to attend the next convention of the Superintendents. This action and the sentiment that prompted the sending of the invitations are likely to draw the three associations concerned into closer intimacy. Much of the recent prosperity of the Society of Superintendents is due to the work done by the secretary, Mr. C. A Hammond He holds decided views about the good work that can be done by his society, and labors vigorously to have the work accomplished.

## A Wonder for the World's Fair.

There was one thing at the last Paris Exposition that seemed to overshadow everything else in the eyes of visitors—that was the Eiffel Tower. There were many things at that exposition of greater value from an engineering standpoint, yet the Eiffel Tower received more attention than all the other wonders combined of that great show.

When the Columbian Exposition at Chicago was first spoken of, there were numerous proposals made to build a tower which would eclipse in magnitude that of Paris; but imitation is not one of the views of this nation, and the idea did not receive support. We now learn that it has been decided to build an apparatus at the World's Fair which will be as conspicuous as the Eiffel Tower and a far more wonderful conception from an engineering standpoint. Money has been raised to build of steel a revolving wheel 240 feet in diameter, with a periphery 50 feet wide. This immense wheel will be set on an axle and revolved by two engines of 1000 horse-power each. On the periphery of the wheel will be hung a series of cars capable each of seating fifty persons. The cars will be hung on the same plan as the revolving curtains that are to be seen in store windows for showing small articles that always keep perpendicular as the screen moves round. Passengers will enter these cars at suitable landings and be lifted up into the air round the largest wheel in the world. From the top a view may be had equal to anything seen from the Eiffel Tower.

The whole of the plans of this wonderful conception have been worked out by an eminent engineer down to the minutest detail. The drawings are made, all the money has been raised to defray the entire expense, and the contract is about to be let to parties competent to perform the work of construction within the required time.

## Foreign Railroad Exhibits for the World's Fair.

Mr. Willard A. Smith, commissioner of the transportation department of the World's Fair, has returned from a trip to Europe highly encouraged and elated by the interest displayed in the exposition by railroad and government officials in Europe. The German government will send a large exhibit of locomotives and cars, most of the former being compounds. Several other continental countries will send interesting exhibits. Some of the leading British railway companies will send locomotives and cars, and Mr. Smith has secured the promise of several machines of great historic interest, among them Stephenson's "Locomotion," one of the first engines that was used on the Stockton and Darlington Railway and similar in construction to the "Stourbridge Lion," the first locomotive that turned a wheel on an American railroad.

Mr. F. W. Webb of the London & Northwestern, has promised to send one of his latest compounds.

Mr. Smith is striving to arrange for the making of tests between European and American locomotives during the exhibition. There are few things that could be done to excite greater interest. There are many obstacles in the way of making such tests, but we hope they may be satisfactorily overcome.

## A New High-speed Engine.

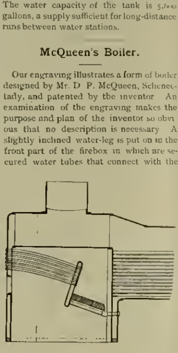
Scranton papers have contained lately some elaborate accounts of a high-speed locomotive built at the Kingston shops under the supervision of Master Mechanic Charles Graham, Jr. The engine has Wooten patent firebox and the intention is to burn anthracite coal.

The cylinders of No. 245 are 19 inches in diameter and 24 stroke, and the driving-wheels are 5 feet 8 inches in diameter. The firebox is 8 feet wide and 10 feet in length, and the cylinder part of the boiler is 54 inches in diameter at the smallest point and contain 220 tubes of 2 inches diameter.

In general beauty of design and mechanical construction it may be said that this engine excels in many points any of its predecessors. It has all the latest improvements, including air-brakes, air-whistle signal, air bell-ringing attachments, steam heat, sight-feed cylinder lubricators, and Leech's patent appliance for feeding sand on the rails by air pressure. It has also two No. 11 injectors, the largest made. The water capacity of the tank is 5,000 gallons, a supply sufficient for long-distance runs between water stations.

## McQueen's Boiler.

Our engraving illustrates a form of boiler designed by Mr. D. P. McQueen, Schenectady, and patented by the inventor. An examination of the engraving makes the purpose and plan of the inventor so obvious that no description is necessary. A slightly inclined water-leg is put on in the front part of the firebox in which are secured water tubes that connect with the



back water space of the firebox. A brick arch is built from the lower part of the water-leg to the front flue sheet. The purpose of the invention is to make a successful spark-arrester that will keep the sparks in the firebox, and also to increase the heating surface. No boiler of this design has yet been built but the inventor is in hopes that it will soon be given a practical trial.

## A Butting Match with Locomotives.

A press dispatch from South Bethlehem, Pa., says: Owing to a dispute as to who should use the switch first, the crews of two trains that met at the Third street crossing of the North Penn Railroad instituted a novel pushing match to-day, which may cost them their situations. Both engines were shifters and each had about a dozen cars attached. They met with a slight bump at the switch, and after an exchange of warm words each opened his throttle, intending to push the other back. Both the engines snorted and puffed, while sparks flew from their rapidly revolving wheels. For several minutes neither budged an inch. Finally the camel-back was forced to give way.

## Power Required to Move Reciprocating Parts.

Mr. Ben. Johnson, writing from Topeka, Kan., says:

"I wish to dissent from the conclusion of Mr. Frank Corbett, in your July number, that of the power developed in the cylinders of a locomotive running 60 miles per hour, 336 horse-power is consumed and lost in getting up the speed of crossheads and connections in the first half of each stroke.

"While it is true that the pistons start from a state of rest at the beginning of each stroke and attain a greater velocity at the middle, it is also true that from a great velocity at the middle of each stroke they come to a state of rest at the end of each stroke, and in so doing give out to be utilized in turning the wheels and moving the train all the enormous amount of power or energy absorbed in the first half of the stroke.

"The failure to recognize this fact is one of the principal reasons for the perennial crop of rotary engines that fill the Patent Office."

## Exporting American Railroad Track Spikes.

The proverbial "carrying of coals to Newcastle" has been again discredited by a transaction lately come to our knowledge.

The remarkable interest manifested in this country of the "Greer" Improved Railroad Track Spike has been met by the same feeling of interest in England and her colonies. A little while ago Morris Sellers & Co., of Chicago, received an order for several lots of "Greer" track spikes from the government of New Zealand for delivery at Auckland, Lyttelton and Dunnedin, New Zealand.

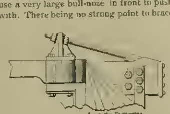
These were shipped via London, being then transhipped for the Pacific, and the remittances duly received in payment for same.

It makes considerable difference what kind of "coal" is sent to Newcastle.

The Greer spike is giving extraordinary results on numerous roads where it has been adopted. Its holding tenacity is nearly twice that of any other spike, and it does not split the tie but cuts its way in. Several roads are using the spike exclusively for curves and places difficult to keep in gauge.

## Drawhead Brace.

The annexed engraving shows a form of drawbar brace used for the front of pilots, by Mr. A. Dolbeer, of the Buffalo, Rochester and Pittsburgh. With the heavy coal traffic done on this road it is necessary to use a very large bull-noze in front to push with. There being no strong point to brace



from beneath, much trouble was experienced from breakage and from the bar dropping down. To give the required strength Mr. Dolbeer designed the brace shown, and it has proved a perfect remedy for the weak point. By its use the repairs to pilots and front drawbars have been greatly reduced.

## Lining Pistons.

In the July issue I see an article from Mr. Hugh R. Crawford in regard to lining by counter-bore of cylinder, in which he says: "To set a line in a cylinder worn the least possible measurement out of truth by the counter-bore is a delusion and a snare. One object in setting a line is to get the center of crosshead directly in line with center of cylinder, and if the crosshead guides are set with a line centered from counter-bore they will be found too high when piston-rod is keyed to crosshead." It seems to me that Mr. Crawford disregards altogether the back cylinder head in his idea of lining from worn part of cylinder. Suppose, for instance, a cylinder is worn an eighth of an inch out of true, and your gland fits both piston and stuffing-box neat, how would it be possible to connect piston to crosshead? A good way to bore a rod brass to fit a crank-pin to keep it from binding top and bottom, is to place a $\frac{1}{16}$-inch liner between each half of brass before boring, and to caliper pin with same thickness of liner allowed. You will find that it works admirably.

ERNEST MARTIN.

*Raleigh, N. C.*

We have received several notices lately that the Pennell Feed-Water Purifier is doing remarkably good service for railroads. M. M. Dunn, of the Idaho Division of the Union Pacific, where one of these purifiers is in use, writes: "You will remember that when you were out here last month I told you that the engines were leaking considerably, and that we were getting a great deal of scale out of the boilers. I think now that we have about all the scale out of the boilers of the two helping engines located there. They have been up to Montpelier to have the boilers washed, and necessary repairs done, twice in the last month, and each time they came in the flues were perfectly tight and we did not have to calk them. Another good indication is that whatever sediment we find in the boilers now is very soft and can be washed out readily. The only trouble we have is that they foam some. Have arranged to put pipes on the blow-off cocks, so that they can be blown off every day, or oftener if necessary, which I think will obviate the trouble of their foaming, and also keep the boilers clean, as it will blow off all the sediment as it collects in the shell of the boiler."

The Illinois Central Railroad officers have been investigating the propriety of ordering some compound locomotives. To help them to a decision they had some comparative tests made with a Baldwin compound and some of their ordinary engines. After weighing the question carefully, they have decided not to have compounded any of the engines they are about to order. The Cooke compound locomotive is built after the pattern of some ten-wheel engines the Illinois Central Railroad have in service, and this engine is now in Chicago to be subjected to tests alongside engines that are in all respects the same except in the cylinders. On the result of these tests will depend the future action of the Illinois Central regarding compounds. Several of the officers are very favorably inclined toward compound locomotives, but they intend to be certain that they are right before making a change.

The Ashton Valve Company of Boston have issued a circular announcing that they have bought the entire plant, material and business of the Boston Steam Gauge Company. They will manufacture all classes of steam pressure, vacuum and other gauges. Mr. H. L. Willard, formerly business manager of the Boston Steam Gauge Company, goes with the Ashton Valve Company.

Various improvements in car trucks have been patented by Arnold Miller, of Medford, Wis. They embrace changes on the diamond truck which put the springs over the axle-box and provide a strong frame for the pedestals, an improved journal bearing, and alterations on the passenger car truck intended to keep it from becoming distorted and to make it more durable.

The N. Y., O. & W. have increased their order for engines with the Dickson Mfg. Co. to ten instead of five, as originally let.

Lake Shore & Michigan Southern have just closed a contract with Brooks for twenty additional engines.

The Florida Central & Peninsula Railroad will contract for three hundred freight cars in the near future.

Specifications for one thousand freight cars for the Illinois Central road are in hands of bidders.

The Mahoning Valley will soon be in the market for three hundred more cars—hopper bottoms.

Baldwins have closed a contract with New York, Chicago & St. Louis for ten engines.

It is rumored that the B. & A. will contract for five hundred additional cars.

## Devotion to Railroad Duty.

By Sam Short

My sympathy and fraternal interest have been greatly moved of late for my old friend, Kurgess. He was the hero of my youth, in the days when hero-worship was one of my weaknesses. It is curious to notice the different kinds of objects that boys take for making heroes of. Boys of railroad proclivities generally fix on an engineer or conductor, or even an imaginative brakeman, as the object of adoration, but my hero was a wrinkle-faced, grease-apparelled machine-shop foreman.

When I was learning the machinist trade by doing chores in the two-stall mechanical headquarters of the Big Mountain Railroad of Illinois, Roger Kurgess was general foreman, and a better man to make things out of nothing there was not in the West, where original creative methods were greatly cultivated. Roger had peculiar views about some things, but a better mechanic never pushed a file. There was a tradition around that nothing had ever been done in the working of metals that Roger could not do better than any other man. He appeared to know more about boilers than any of the boiler makers, and when iron or steel worked badly under the blacksmith's hammer, Roger was the expert who investigated the cause of the metal's shortcomings, and always found them out.

These high accomplishments were in the line of Roger's ordinary duties. To see the ability and ingenuity of the man shine in full splendor, an engine had to come in with something broken that no other man ever thought of mending. To tell of the broken parts that Roger repaired with his own hands would be to enumerate all the parts about a locomotive. His pride and glory, however, was in repairing broken cylinders. The boys used to say that Roger was always uncommonly cheerful when he heard about a collision, and that his greatest pleasure was in seeing an engine come in with the cylinders badly stove up. This was probably a joke, but he took undoubted interest in repairing cylinders, and the harder the job the greater the personal care he bestowed upon it.

It was no wonder that a boy should become a blind admirer of a man so gifted.

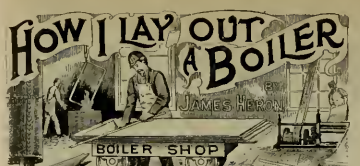
Roger was very careful about my training and took particular pains to see that I did not fall into idle habits for want of something to do. When I was not developing muscle twisting a tap or die lever, pulling at the lever of a screw-jack or operating a pinch bar, the foreman found work for me in packing boxes or cleaning up the place. This latter occupation was the resource when all others failed, and it was never properly begun.

Only one thing came between me and the sunshine of Roger's constant favor. I was fond of reading, and Roger had a particular antipathy to everything that was printed. On rare occasions I had concealed myself in tanks and fireboxes to finish some thrilling story by Mayne Reid or other favorite author. From bliss I would suddenly be dragged to humiliation by a hose stream directed by Roger. Then he would make me shovel out the ash-pit and keep me at roughest drudgery for a week.

About the time that I attained to the honor and dignity of facing valves, the Illinois Transcontinental fell in need of a master mechanic and Roger Kurgess was appointed to the place. At that time the road was small, having only about ten engines and 120 miles of track. But it was one of those ambitious Western railroads that started out with ten miles of scrap rails, an old locomotive, half a dozen second-hand cars and trans-oceanic aspirations. If it did not yet reach the aspirations of its promoters, it has not been for want of trying and boasting.

At the time Kurgess took hold as master

(Continued on page 293.)




### Taper Connection Sheet.

Fig. 10 shows front elevation of taper connection sheet, large and small ends. Radius of large end 2 feet 6¼ inches and 1 feet 2½ inches outside, and of small end 2 feet 4½ inches inside. Note that the large end is not a true circle. The radius for top of boiler is struck 6 inches from center of boiler and radius for side 3¼ inches above and 7¼ inches to one side of perpendicular center line. This is done to avoid having a flat place on side and to strengthen same by getting as near a circle as possible. I am aware that this is a hard problem for amateurs to work out, but if the boiler maker trying to work it out perseveres he will find it simple enough. It was my intention to give something easier for the first, but I have had several requests for the taper connection and I like to supply first what is most in demand.

Now, you must study Fig. 10 well before going to other figures. Fig. 10 shows edges of plate, back and front, after being bent to proper shape. I show but half view, as the other half would be the same. Now suppose you take and divide your small end into eight equal parts, by spacing off on edge of sheet, as at 1 to 0, then do the same with large end, as at *A* to 1. Then strike lines *A* to 1, *B* to 2 and so on; then your front elevation is complete.

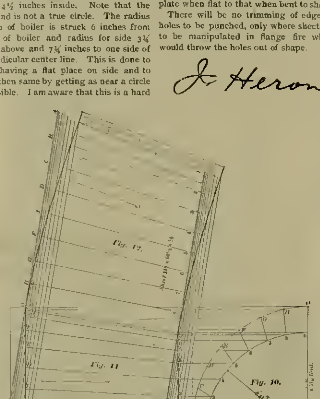
I speak of edges of plate in connection with this figure, to give an idea what these lines are for and why this elevation is required to be laid down in order to lay out flat plate.

Fig. 11 shows side elevation of taper connection. Note that Figs. 1, 2, 3 to 0 are parallel with Figs. 1, 2, 3 to 0, Fig. 10 or small end of taper sheet. The large end is the same, but I have not drawn all the parallel lines as it would not leave side view so clear.

Fig. 12 shows one-half of plate when flat, and taking 0, 0 as center, as shown. Were it of light material that could be bent by drawing same over Fig. 11, all lines and letters, figures and holes would meet the corresponding letters, figures and holes. In my next paper I will give a simpler method, and go into details of laying out plate when flat to that when bent to shape.

There will be no trimming of edges or holes to be punched, only where sheet has to be manipulated in flange fire which would throw the holes out of shape.

J. Heron




### A Separate Engine for Each Car.

A somewhat novel means of propelling railroad cars has been invented and patented by Mr. J. M. Keith, a member of the Railway Master Mechanics' Association, and now in the employ of the Baldwin Locomotive Works. Mr. Keith proposes to put a steam motor under each car and supply steam from a boiler carried in front. His object for this arrangement is stated to be that the full horse-power of the steam boiler may be applied in a manner enabling it to be utilized to the greatest possible advantage and to the utmost extent.

The cylinder to be used under each car transmits power to a gear wheel which engages with a gear wheel on one of the car axles. Means are provided for throwing out the gear connection when desired. Two lines of steam pipes are led through the train, one to supply steam, the other to return the exhaust steam to the smoke-stack of the boiler.

The claims for the invention are in a railway car the combination, with a wheel-axle, of a gear mounted loosely on axle, a clutch for making gear fast with the axle, a crank-shaft having a gear meshing with the axle-gear, a steam cylinder mounted on the car truck and having its piston and valves connected with said crank-shaft, separate live-steam and exhaust pipes connected, respectively, by flexible couplings to the live-steam and exhaust ports of the steam cylinder, said pipes having at their ends flexible couplings to corresponding pipes on the adjacent car or cars, and a common steam-supply to which one of said pipes is connected, substantially as described.

The combination, with a car-axle, of a steam cylinder mounted on the truck-frame, a crank-shaft connected to the piston and valves of said cylinder, a gear fixed to said crank-shaft, a gear loose on the car-axle and meshing with the crank-shaft gear, a clutch splined on the axle, a shipping lever for actuating said clutch, a live-steam pipe and an exhaust pipe carried by said car and connected to the steam cylinder, means for connecting said pipes to similar pipes upon an adjacent car or cars, and a steam-supply common to the steam-cylinders of several cars in a train.

### Master Mechanics' Association Scholarships.

The following circular has been issued by Secretary Sinclair of the American Railway Master Mechanics' Association.

"There will be one scholarship for the four years' course open for competition at the Stevens Institute of Technology next September. The requirements are that the applicants shall be sons of members of the American Railway Master Mechanics' Association in good standing, and they must have at least one year's experience in a machine shop.

"There will also be vacancies for scholars in the second and fourth year classes. Should no candidates pass for these, there will be two scholarships open in the Stevens Preparatory School for persons eligible for the Association scholarships in the Stevens Institute of Technology."

### Locomotives of the War Time.

Mr. Sam Manley, International & Great Northern Railroad, Palestine, Texas, writes us.

"I see in the June issue of your paper an article called 'A Completed History of the Rebel General,' taken up by Mr. W. A. Knight where Mr. W. H. Wesley left off. If you will give me space in your valuable paper, I shall tell what I know about this engine, and give some notes of my experience with locomotives in the South during war time. The hard-looking locomotive illustrated on page 211 of your June number was not called the Rebel General. The only engine named the Rebel General, that I ever heard of, was that belonging to the Western & Atlantic Railroad, captured by Captain Andrews and his company during the war and taken from her crew while they were eating breakfast at Big Shanty. The engine, as is well known, was recaptured by her crew after a very lively chase, and Captain Andrews and his crew were executed for the daring act of trying to run away with the engine.

"To go on with my story, Mr. Knight is entirely clear of his bearings, when he says that, when he took charge of the Tennessee Coal and Railroad Co., as superintendent of motive power, he found the Sewanee out back of the shop, where she had been furnishing steam to run the works. This is a mistake, as I was working for this company at the time as a machinist, and know all about it. My father, Joe Manley, was master mechanic at Tracy City, and I was working for him, and I had the honor, if any there be in it, of rebuilding the engine after her memorable trip down the mountain, though I believe she was brought to Nashville, Tenn., and rebuilt again by Mr. James Cullen, master mechanic of the Nashville & Chattanooga Railroad. When I went out to Tracy I found this engine in the shed, with a coat of white lead on her, where she had been put after being overhauled by my father, previous to his appointment of master mechanic of that road.

"I will always remember this engine coming out of this shed to go into service, as there is a very sad incident connected with the history of the first run. She was called the Colyer. The incident I intend to relate will show how some men have a presentment or forewarning of something going to happen, as I have noticed in different cases, especially among engineers.

"Engineer James Legg was called to go on his run at 5 A. M., with engine No. 3. While getting his engine ready, some staybolts gave out, which caused his engine to leak so badly that she had to be returned to the shop for repairs. It was then that the old Colyer was taken out to be put upon the road. Instead of the engine No. 3, my father had her fired up, and told Engineer Legg to go out on her until he could get the other engine repaired. During the time they were getting up steam on the Colyer, Engineer Legg said to my father, 'Uncle Joe, I do not want to go out on the Colyer. I feel that if I do something is going to happen to me.' My father told him he was foolish to think of such a thing. Engineer Legg then went home, and there is no doubt in my mind but he went there to take the last good-by of his wife and little ones. On his return to the engine he said again, 'I will go out, but I know something is going to happen.' Then my father said, 'If you feel that way do not go out,' and offered to make the trip in his stead, as there was no extra engineer at Tracy, but Engineer Legg replied, 'No, I will go out on it myself.' So out he went, and everything looked as if they would have a good trip and safe return to Tracy; but alas! such was not their good fortune. When they got to Corn Crib crossing, as it was called, the Colyer left the track and turned over on Engineer Legg, scalding him so badly that he died before morning.

"Another thing about this ill-fated engine, which hardly seems creditable, was that she once broke loose from her tender and went down the bank. The tender and eight car-loads of coal and caboose went down the mountain without her until stopped by a train crew. Comptroller Gaines was on the engine when she turned over; he was not hurt, but a worse scared man you never saw, and I guess he will always remember his ride on the old Colyer down the side of the mountain. She was afterward picked up and brought to Tracy. At that time I was overhauling engine No. 4, and our stationary boiler gave out. The Colyer was then made to furnish steam for the shops until the stationary boiler was repaired. After I was done overhauling No. 4, the Colyer was brought into the shop, and the engraving in the June issue of your paper shows how she looked. After I rebuilt her there were considerable changes made. She was an old Danforth & Cook, one of their first build when locomotives were in their infancy. She had no running boards on her until I put them on—nothing but a foot rail running from back end of engine to bumper on front end, made of 4-inch angle iron, and not a very safe thing for the engineer to go out on on a bad night when he imagined that something was going to be wrong. By a look at the engraving you will see I cut this rail off the back end of guide yoke and joined it to back end of cylinder for a brace for the yoke.

"I have started to give you my experience on this engine, and I will not stop until I tell you about her jacket. I did not know before I went to work at Tracy that a machinist had to be up to what the master mechanics now call a handy man. If I had known that before I would not now be writing my experience with the Colyer. When I got her ready to receive her jacket, I asked my father, who was going to put on her jacket? Imagine my surprise when he said, 'You are going to do it.' Well, I told him that if I had to put on that jacket to send off and get a good supply of Russia iron, as I did not want to be limited on material. Well, I got the jacket on, but not until I had lost

all my religion over the job. I never did ask my father how he liked the looks of the jacket, nor did I care to have him express his opinion. Suffice it to say, there was less Russia iron there when I got through than when I commenced.

"This is a true history of my experience with the Colyer, and not the 'Rebel General,' as Mr. Knight says. I know Mr. Knight well, as I worked for him. He relieved my father at Tracy, and not caring to be a handy man any longer, I quit."

## Rod Boring Machine.

Our illustration shows a new tool recently built by the Niles Tool Works, Hamilton, Ohio, for the Grant Locomotive Works at Chicago.

The machine was especially designed for rod work. It has great power and will bore both ends of the rod at the same time, thus allowing the work to be done in duplication with the greatest degree of uniformity.

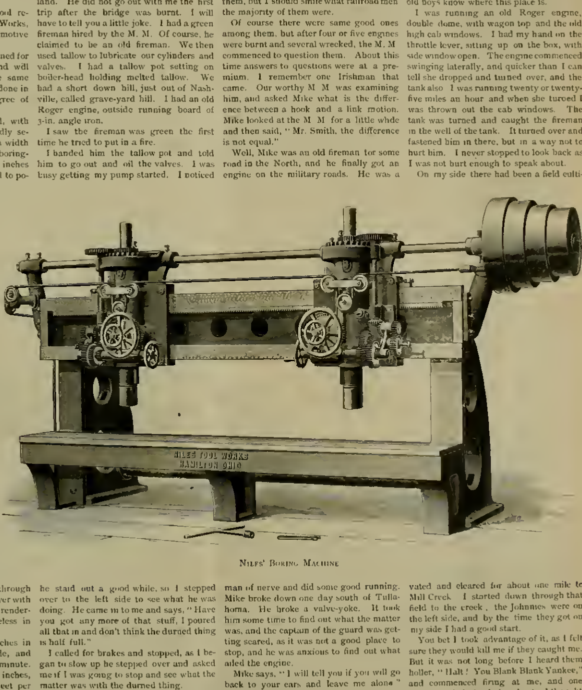
The housings are double-webbed, with the cross-rail and work-table rigidly secured to them. The cross-rail has a width on the face of 20 inches, and the boring-head saddles have bearings on it 26 inches long. Saddles are quickly adjusted to position on rail by means of rack and pinion, operated by a "T" wrench. Their relative positions once being determined for the work to be done, the saddles are firmly clamped in place.

Boring spindles are 3¾ inches in diameter, having a vertical traverse of 14 inches and a range between centers of from 3 feet to 10 feet. Both spindles are counterbalanced by a single weight, in same manner as the tool-bars on boring and turning mills. This device permits an adjustment of the saddles without moving the weight, and does not burden the saddle or rail with additional weight to secure the counterbalance, as must be the case with other methods.

Three changes of feed are available for each spindle without the change of gears, ranging from $\frac{1}{32}$-inch to $\frac{3}{16}$-inch per revolution of spindle. Spindles have rapid hand motion to facilitate setting, and are provided also with slow hand-feed. The spindles are always driven together, but the feed is independent for each.

The machine is designed for boring diameters ranging from 3 inches to 7 inches. Cone has four steps for 5-inch belt, and transmits motion to the spindles through tangent gearing, securing great power with extreme steadiness under cut and rendering the machine practically noiseless in action.

Countershaft pulleys are 23 inches in diameter, for belt, 5 inches wide, and should run 100 revolutions per minute. When operating on a diameter of 7 inches, this gives a cutting speed of 20 feet per minute.




NILES' BORING MACHINE

A smoke burner invented and patented by Theodore Lustig, Chicago, has a box set in the front of the grates with a perforated lid through which the air is admitted to the fire. Steam jets are employed to force a current of air into the box. Yarrow, in his first smoke-consuming firebox, used an arrangement similar to this without the jets and without the box. His was a perforated iron plate. It worked all right while the plate lasted, but it sometimes burned out in a single run.

A correspondent is solicitous that some one would write a good, plain article on laying out shoes and wedges as it is done in the best repair shops.

## Locomotive Running Among the Bushwackers.

By Old Soldier.

[Continued.]

After the bridge was burned and rebuilt we commenced running regular. The Johnnies did not hold the fort long, nor was there enough of them to hold it, so they were sadly disappointed.

Poor Pat, he told me he had enough of the military road, and that if he could raise the money he would go back to old Ireland. He did not go out with me the first trip after the bridge was burnt. I will have to tell you a little joke. I had a green fireman hired by the M. M. Of course, he claimed to be an old fireman. We then used tallow to lubricate our cylinders and valves. I had a tallow pot setting on boiler-head holding melted tallow. We had a short down hill, just out of Nashville, called grave-yard hill. I had an old Roger engine, outside running board of 3-in. angle iron.

I saw the fireman was green the first time he tried to put in a fire.

I handed him the tallow pot and told him to go out and oil the valves. I was busy getting my pump started. I noticed he staid out a good while, so I stepped over to the left side to see what he was doing. He came in to me and says, "Have you got any more of that stuff, I poured all that in and don't think the durned thing is half full."

I called for brakes and stopped, as I began to slow up he stepped over and asked me if I was going to stop and see what the matter was with the durned thing.

About that time I stopped and said to him "Now you get off this engine darned quick and walk back to Nashville." I called back to the captain of the guard and told him to send me over a "blue coat." Well, "blue coat" did pretty well for a greeny; but, oh Lord, how it makes me creep all over every time I think of him! He was covered with "graybacks." All the old soldiers will know what those are if you "tenderfeet" do not, or any old passenger conductor on military roads can tell.

Well, we went on to Winchester and returned without any serious mishap. The first fellow I met on my arrival was my fireman Pat. He could not raise money enough to go back to old Ireland, so he concluded to go back with me on the old six.

Going out we had a couple of cab windows shot out and several shots into the guard car and coaches, but returned to Nashville with the old six and our carcasses O. K.

About this time the soldier boys commenced to kick about pay, and the business commenced to pick up on the roads so fast that we had to get new engines and new men. We got some pretty hard old scraps, and the road that sold them got a good big price for them. The Government sent out men North to hire engineers and firemen and train hands. They got them, but I should smile what railroad men the majority of them were.

Of course there were same good ones among them, but after four or five engines were burnt and several wrecked, the M. M commenced to question them. About this time answers to questions were at a premium. I remember one Irishman that came. Our worthy M M was examining him, and asked Mike what is the difference between a hook and a link motion. Mike looked at the M M for a little while and then said, "Mr. Smith, the difference is not equal."

Well, Mike was an old fireman for some road in the North, and he finally got an engine on the military roads. He was a man of nerve and did some good running. Mike broke down one day south of Tullahoma. He broke a valve-yoke. It took him some time to find out what the matter was, and the captain of the guard was getting scared, as it was not a good place to stop, and he was anxious to find out what ailed the engine.

Mike says, "I will tell you if you will go back to your cars and leave me alone." As this was agreed to, Mike told them that the "doowaddle fell down on the dingus rigging and she came up on center and refused to qualify, but I'll have her ready on one side in about an hour." I think this gag got through the whole army of the Cumberland. The train then backed up to Tullahoma, and the conductor telegraphed back what the matter was, as this was a newfangled breakdown.

As I said before, the army wanted their pay. The road was being pushed on to the Tennessee River as fast as men could do it. I still retained my run. About twelve miles out of Nashville there was at that time a heavy cedar grove. It was to the left of the road after leaving Antioch, going south. Well, as I said in my last article, the Yanks liked revenge, so did the Johnnies, and Dick McCann got his.

He and General Forrest planned the capture of our paymaster. I was the lucky one pulling.

I think Dick and Forrest had 500 or 600 men. Dick was an old thoroughbred railroad man and he knew just how to capture a train. He spread the rail by pulling out the spikes until he got the tracks widened out to let the engine drop. I had just wood enough to build up first rack of wood in tank. The fireman had just about finished his pile when I struck this place. We had about three-fourths of a mile to run to old Mrs. Dows' wood pile. All the old boys know where this place is.

I was running an old Roger engine, double dome, with wagon top and the old high cab windows. I had my hand on the throttle lever, sitting up on the box, with side window open. The engine commenced swinging laterally, and quicker than I can tell she dropped and turned over, and the tank also. I was running twenty or twenty-five miles an hour and when she turned I was thrown out the cab windows. The tank was turned and caught the fireman in the well of the tank. It turned over and fastened him in there, but in a way not to hurt him. I never stopped to look back as I was not hurt enough to speak about.

On my side there had been a field cultivated and cleared for about one mile to Mill Creek. I started down through that field to the creek, the Johnnies were on the left side, and by the time they got on my side I had a good start.

You bet I took advantage of it, as I felt sure they would kill me if they caught me. But it was not long before I heard them holler, "Halt! You Blank Blank Yankee," and commenced firing at me, and one bullet struck the heel of my boot. I thought my ankle was broken but did not stop to investigate. The Johnnies had too much booty to follow me. I kept up running until I came to the creek. I jumped in and swam across. I had to swim the creek three times before I could reach Fort Nagle, but I made it and gave the alarm. Troops were immediately sent out, but too late to save anything. The whole crew and everything on that train were captured except myself.

[To be continued.]

The Fitchburg Railroad will begin work at once on twelve more coaches. Being so well pleased with the twelve just put in service, built by Superintendent Car Department J. W. Marden, they will be duplicated.


## Hold Better Sentiments.

*Editors:*

We see an article in your last issue with our names attached. Gentlemen, those names were signed by Mr. Goffney without our permission, for the letter he wrote in no way speaks our sentiments. To oblige us both will you please publish this in your next issue, to exonerate us from all the criticisms of a thinking public.

J. B. TUCKER,
WM. G. RAY.

*Water Valley, Miss.*

## This Paper is all Right.

*Editors:*

Messrs. J. R. Goffney, W. G. Ray, Jas. B. Tucker, you three old sports, what is the matter with you that this paper does not suit you? Tell me, and I will blow the Editors up.

Now come, boys, do not let your passion get the better of you, as you know this is just what we mechanical men want, and of course they cannot write to suit everybody. Now, just sit down and write the Editors something worth reading and I guarantee it will be published and you will feel better and subscribe for the paper another year, and the Editors will answer any question you may ask them about mechanical matters or on any railroad matters. Now come, boys, do not throw cold water on this paper, as its columns are open to all and it is a good channel of communication for all of us, from the M. M. down to the trackman. Now, Mr. Goffney, come out and retract your notion of this paper, not on account of the Editors, but on account of your fellow shop and roadmen, I for one; and I have been in the road and machinery departments of railroads for thirty-five years, and I find no paper printed so instructive to the engineer and mechanic. I never pick it up without learning something.

Do not imagine I am put up to writing this by the Editor, for he is in New York and I am in Texas, and I am what you might call an independent mechanic. Come, boys, no more of this, but pitch in and give us some new kinks.

E. A. CAMPBELL.

*Houston, Texas.*

[Our correspondent will see that Messrs Ray and Tucker are in line, as their letter in another column testifies. They deserve sympathy for being placed in a false position without their consent.—EDS.]

## "Lining by Counter-bore of Cylinders."

*Editors.*

In the July number of your valuable paper, Mr. Hugh R. Crawford says, in answer to engineers and young mechanics, that the method laid down by R. H. Zwicker for centering line by counter-bore when cylinders are worn is a "delusion and a snare." Now, if we follow out Mr. Crawford's advice, we will set line by the wearing surface of the cylinder, and if cylinder is worn below center $\frac{1}{16}$ inch, the center of crosshead will be just that amount below center of stuffing-box, and the consequence is that the gland will not enter stuffing-box but will bind on bottom. To do this job properly is to center line by front counter-bore and stuffing-box (first see that back cylinder-head is central with back counter-bore), set crosshead to line, put piston and packing in, and line piston up central with front counter-bore. The gland will then enter stuffing-box, the piston will travel central with counter-bore and stuffing-box, while the centers of packing rings are below counter-bore center $\frac{1}{16}$ inch.

JNO. R. GOULD.

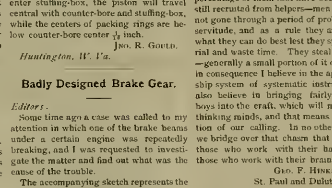
*Huntington, W. Va.*

## Badly Designed Brake Gear.

*Editors.*

Some time ago a case was called to my attention in which one of the brake beams under a certain engine was repeatedly breaking, and I was requested to investigate the matter and find out what was the cause of the trouble.

The accompanying sketch represents the lever arrangement as I found it, and as it




BADLY DESIGNED BRAKE GEAR.

is a regular curiosity in its way it may perhaps be of interest to some of the readers of LOCOMOTIVE ENGINEERING.

If any of them can figure the pressures on the different beams, let us hear from them in the next issue.

The fact that such a mechanical abortion was put on and sent out into service by one of our most prominent locomotive builders shows how badly some of the locomotive supply men are in need of a little instruction on the air-brake, for the road to which it was sent never sent them any such drawing, and if they had I doubt but it would have been good policy on the part of the makers to object.

PAUL SYNNESTVEDT.

*Chicago.*

## The Blacksmith Trade.

*Editors:*

I have read your valuable paper with great interest and benefit; have read therein articles from engineers, firemen, machinists and boilermakers, which have been interesting and instructive.

Now, I thought it would not be amiss to give blacksmiths some recognition. Blacksmithing is a calling, in my opinion, foremost among the mechanical arts, it is the groundwork, in fact, the root, from which the metal arts have sprung, and of all trades it is the most berated and abused. How often we hear the opprobrium, "A blacksmith's hair," deservedly applied in numerous instances. If blacksmiths in general would give that attention, exercise that regard which in the nature of their vocation is required of them, it would be only a question of time when they would occupy a position among the trades second to none.

Forging is to some extent lost sight of as not in keeping with other advances in the mechanical arts, something that is not comprised in the improvements and inventions. Yet there has by no means been a halt in the steady development of new features in this most useful and interesting branch of industry.

There are few branches of industry that present a greater variety in the choice of methods and wherein the judgment of the artisan is oftener called into requisition.

To learn to be a forger requires a considerable length of time, from four to five years being the customary time.

Now a few words relative to the skill and qualifications of blacksmiths (forgers would be a better term). There is quite a large percentage of them that have been and are still recruited from helpers—men that have not gone through a period of probationary servitude, and as a rule they are kept at what they can do best lest they spoil material and waste time. They steal the trade—generally a small portion of it only—and in consequence I believe in the apprenticeship system of systematic instruction. I also believe in bringing fairly-educated boys into the craft, which will mean to it thinking minds, and that means the elevation of our calling. In no other way can we bridge over that chasm that separates those who work with their hands from those who work with their brains.

GEO. F. HINKENS,
St. Paul and Duluth Shop.

*Gladstone, Minn.*

## Filed Preferred to Scraped Surfaces.

*Editors:*

While looking at the fancy scraped surface on machine tools, the thought suggested itself to the writer that this is one of the few places where a scraped surface is of any good, if at all. Of course the mottled surface can only be produced by a scraper and is all right for appearance sake, but in wearing surface the scraper might be used to advantage in removing tool marks on light bearing surfaces where there is very little friction, but when we get on locomotive repairs, such as rod brasses, shoes and wedges, valves and seats and journal filings, the file is the tool to use unless a driving journal or crank pin is full in the center. In such cases we must resort to the scraper, but where it is possible to use a file in the absence of a machined surface the file makes the best job and one that will give the best results. Scraped surfaces on valve-seats make the contact too severe at the start, as there is no room between the surfaces for oil, while the filed surface leaves a multitude of minute cells or cavities that will retain the lubricant and prevent cutting until the surface glazes over. A valve-seat well filed by a good mechanic seldom blows. How often we see valve-seats faced in the roundhouse where there is little time to resort to a scraper go out and give the very best results; and why is it that driving-boxes, rod brasses, shoes and wedges repaired in the roundhouse give so little trouble? It is for the simple reason that, in nine cases out of ten, they are filed surfaces, and often done at night, in a hurry, by the light of an old smoky torch, and everybody mad and disagreeable.

Now don't understand me as taking the ground that the roundhouse is the best place to have the work done; I am only quoting facts to illustrate my subject. The back shop is the place to rebuild an engine, but we are after the scraper fiends. Driving boxes, shoes and wedges can be planed to fit, and it is the worst kind of practice to scrape the surfaces. How much trouble there was with hot engine and tender-truck brasses when we used to scrape the brass down to a red-lead bearing, and how quick our trouble took wings when we filed the brass out too large for the bearing! My good brother, how often you have cooled off a hot box on the road and put in a brass that had not been fitted, and it would run all right. If you had not enough waste you would jam a lot of weeds or green grass into the oil box, and go on your way rejoicing.

There has been no time in the history of American railroads when our locomotives were doing better and harder work than at the present time, and at no time did they get less care than at the present, except in boiler work, and I say right here, boiler-shop work was never done better than at the present; as for the good or bad design of locomotive boilers, the boiler maker has nothing to do with it. The above remarks are not confined to any one locality, but from tramping up and down through the world, from west to east and from east to west. In these days of push and hurry and sharp competition, we must get rid of old ideas; out of old ruts, and deal with facts.

W. DE SANNO.

*Indianapolis, Ind.*

## A Roundhouse that is not Square.

*Editors:*

Will you please give me a chance in your columns to notice the communication of "Roundhouse" in your June issue. In the first place, I desire to say that I never entered the controversy in behalf of the "Over-worked wheel lathe." In taking that view of the case "Roundhouse" has shown himself to be as poor a critic as he makes me to be. In all probability my voice would never have been heard if it had not been that Mr Purves stated the conditions under which "two pairs of driving tires could be turned in one day and by a little extra crowding could get out three pairs if they were not extremely hard." I took this to mean that the man was the party to be crowded, not the lathe. Now, since "Roundhouse" has let his flood of light in on the subject I see my mistake, the man doesn't do any more work than he formerly did, it 's the machine that does it, the man simply watches "the wheels go round." This being the case, Mr. Purves made a serious mistake in increasing the man's pay.

Another point that induced me to take up arms in this unpleasantness was the needless insult Mr. Purves offered to every machinist in the United States (see his article "New and Old Tools" March number, L. E.), and which "Roundhouse" echoes when he says that "my interpretation of a machinist's duty is to do work good and in as long a time as possible." Now, I defy "Roundhouse" to prove this from my article. I stand pat on the proposition, that if you want a *good* job you must allow a *reasonable* time to perform the work in, and I'll venture this, that there are numbers of master mechanics who would not tolerate the kind of work that must result from the limit of time given by Mr. Purves and "Roundhouse Foreman" (for I guess he didn't sign his full name).

Then, again, there are M. M.'s who, on reading Mr. Purves' records, will insist on their men turning off a six-foot tire, worn down ⅜ inch, necessitating a reduction of diameter 1¼ inches, and extremely hard,

in the same time, overlooking the conditions prevailing in Mr. Purves' shop—viz., a 49¼-inch diameter reduced ¼ inch and probably "good tire steel," as "Roundhouse" says; and moreover, the above M. M.'s—most of them, I believe—would want the work as well done as if two days had been consumed in doing it, which is about the length of time it takes to do the kind and quantity of work described according to my observation and the appliances I have seen for doing it. And right here I want to say that I am not an expert at any branch of the business. I never ran a wheel lathe a single revolution in my whole experience, but still I take exceptions to the proposition laid down by "Roundhouse" that "To be a critic a person should be an expert in the work he criticises." "Roundhouse" is dead wrong here; take art matters for instance, the best critics cannot begin to do the work they pass their judgment on; it is so in music, painting, and the drama, it is so in mechanical matters; how often have we observed M. M.'s and foremen "jacking up," *i. e.*, criticising a workman whose performance they never equaled in their circumscribed existences, nor ever could, but they are the proper people, and what they say "goes."

"Roundhouse" indulges in a little flattery when he says (alluding to myself), "He would shine in another field," and is "just the kind of a man that railways are looking for to fill positions at the present time." On reflection I suspect that this is intended to be sarcastic also, but will only pause long enough to say that I *have* shone in the other field, and if considered of sufficient interest, will some day let your readers know to what extent I illumined the firmament made radiant by stars of such magnitude as Mr. Purves, Jr., and "Roundhouse," and the gentleman I described in my criticism, who undertook to show a machinist how to turn a crank-pin. As to his other bit of sarcasm, will say that railways don't have to spend much time in looking for men "to fill positions," the men are tumbling over one another in their mad endeavor to be the one that the lightning will strike next. I know I have not taken the popular and powerful side of this question, and have possibly made a serious error in exposing the cause of the maligned machinist, but I always sympathize with the under dog in a fight even if I own the top dog.

But this is a question of wide scope, and discussion could be prolonged indefinitely, so I will only notice two other suggestions that "Roundhouse" makes and they are both sarcastic to a degree. It seems "R" is nothing, if not ironical. He says, referring to the different methods Mr. Purves may employ in handling driving-wheels, "or by absorption in the body of a laborer," etc. Here is the meat of the nut, there is a class of people (and "Roundhouse" is only watching his chance to step over) who dread work to such an extent that they will resort to any form of oppression of their fellow-men to secure an easy position for themselves. They are only content when they are eating their bread in the sweat of the face of somebody else. These people never realize that they are no better than their less fortunate brothers till misfortune overtakes them, as it sometimes does, and they are rolled in the dust with the common herd. His other suggestion is in regard to "apprentices in his shop." "Roundhouse" certainly went out of his way to bring this matter in. So far as I recollect no whisper of the apprentice matter was broached by either Mr. Purves or myself, so it must have had its birth in the fecund brain of "Roundhouse" himself in one of his most satirical moods, with a deep and fell purpose behind it, which with my usual obtuseness, I fail to fathom. However, I will say that I have an opinion both on the apprentice and the expert, not forgetting that I was once an apprentice and may yet be an expert.

In conclusion it is admitted that "Roundhouse" has proved conclusively that a pair of driving-wheels can be turned off in three hours—on paper.

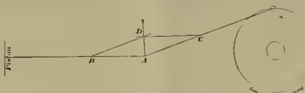
W. H. WESLEY.

*Nashville, Tenn.*

## Lining Guides.

*Editors:*

Under the heading of locomotive running and repairs, of the February paper, there appears an article on guides by L. C. Hitchcock. I consider this a very able article with a few exceptions, which I beg leave to state. The writer says. "That when the guides are level, straight and in line with the cylinder, to remove the line and place the crosshead on them," and then says "that the most particular part of the operation is then to take place in taking the rock out of the crosshead." He previously has stated just how to plane the crosshead perfectly true; so it is impossible for me to see just where that




TO FIND THE PRESSURE ON GUIDES.

rock comes in. I will say, after setting guides for fifteen years, that when my bottom guides and crosshead were as stated by the writer, I never once found that rock that he speaks of.

The writer further states that it is best to place a ⅛-inch liner between top guide and block, as the greatest wear is on the top guides of locomotives running ahead, thus permitting the ⅛-inch liner to be reduced to overcome wear, as the greatest pressure is on the top guides. The writer is correct in stating that the pressure is on the top guides when running ahead, but I say that the greatest wear is on the bottom guides, strange as this may seem to the readers of the article. Nevertheless, it is a fact, and only on examination of a number of crossheads, liners and guides you will agree with me in this statement. The reason for this, I will state, is caused by cinders, sand and dust being pounded in the crosshead at each end of stroke, when the crosshead drops, because the angularity of the main rod is not great enough to hold crosshead to top guides. You can well imagine the effect when the engineer shuts off the throttle coming into cities and running down hill.

I will give a rule to find the pressure on the top guides by the action of the angularity of the main rod. It will be necessary to refer to the cut, in which the engine is supposed to be running ahead. By the pressure on the piston and the angle of rod we obtain the pressure on the guides. For illustration, we will say there is 10 tons pressure on piston, and that each ton's pressure represents 1 inch on the piston line and crank line from the point $A$. Then 10 inches from the point $A$ on the piston line, we mark the point $B$ also on the crank-rod line; we mark the point $C$ 10 inches from $A$, and drawing a parallelogram to $A$, $B$, and $C$; we find the point $D$, and drawing a line from $A$ to $D$ gives the direction of the force, and the length of this line in inches gives the pressure on the guides, each inch representing 1-ton pressure.

C. F. WILLSON.

*St. Paul, Minn.*

## A Standard for Tests.

*Editors:*

There has been much time spent, and it appears that much more will be, in finding out how "*tests* should be conducted" with the locomotive, so that one may find out the merits, or demerits of the different types, kinds and breeds of said machines (and their name is legion). I have seen some very elaborate methods suggested which deserve much credit for their authors, but all such methods require an army of generals, lieutenants, and a few privates to conduct the test referred to in the manner prescribed; also needing a school of technology to explain reports to the ordinary mortal that he may have some understanding of them. It is quite possible that in making these tests as referred to, it gives employment to a certain class that are not of any value to the producing world, and that the time used by them is of little loss; but it should be remembered that *some* are required in the performance that could be useful in other vocotions. It appears to some that about all a test need show is *how much work can be done and what is the cost of doing it?*

To one not up in high science and the arts, it would seem to be only necessary to use a good dynamometer between tender and train, a record of speed, the work that was being done, and the amount of coal used.

Water-meters, pyrometers, calorimeters, indicators, vacuum gauges, etc., etc., are all tip-top things for a dress parade, but when you come right into actual service they are not worth a negative blessing, also the amount of ashes there is left is not a good thing for a railroad company to realize much dividend from.

Should any persons have doubt on this matter let them look over the reports made and published during the past two years on locomotives of different types, and then testify how much the writer is out of his head on this subject.

BILL PAVER.

*Buffalo, N. Y.*

## Single Wheels Slid Flat.

*Editors:*

In your July number I notice a communication in regard to flat wheels. In your case of one wheel being flat and the other wheel all right, I will answer the wheels were slid on a wet rail and the sand from the engine was running on one side; I know of cases of this kind. I saw an engine with four air-brake cars holding a train down a hill 5 miles long. When the brakes were released we found a pair of tank-wheels. One of them had a 3-in. flat spot, while the other one was not marked over ⅛-in. When we looked we found sand running from one sand-pipe. The wheel sliding on the wet rail (especially on an empty car) would not flatten very much. While the sand on the other rail would cut a very large flat spot either on a loaded or empty car. This is a very common occurrence, finding one wheel with a 3 or 4-in. spot and the other wheel only 1 or 2-in. Sliding an empty car on sand will cut flat spots in a very short time, while sliding an empty car on a wet rail will not have very much effect on the wheels; that is for a short distance. I think this will explain to your readers how this can be done.

FRED. F. HAYES.

*Ottumwa, Iowa.*

## Train Resistances.

*Editors:*

The June issue of your very interesting paper has just arrived here, and I have read the article, page 192, relating to train resistances.

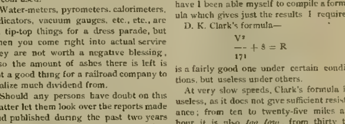
Compilers of text-books, and mathematicians, must have a formula for everything; they maintain that resistance *must* increase as the square of the speed. During the last twenty years the resistance of trains has received my constant attention, with the result that I have never found any formula in any text-book which gives results corresponding to actual practice, nor have I been able myself to compile a formula which gives just the results I require.

D. K. Clark's formula—

$$\frac{V^2}{171} + 8 = R$$

is a fairly good one under certain conditions, but useless under others.

At very slow speeds, Clark's formula is useless, as it does not give sufficient resistance; from ten to twenty-five miles an hour it is also *too low*, from thirty to forty-five miles an hour it is fairly correct; from forty-five to fifty-five miles an hour it is *too high*; from fifty-five or sixty miles an hour to seventy and seventy-five miles



WORK ON THE CYLINDER OF SCHENECTADY COMPOUND LOCOMOTIVE.

an hour it is useless, as it gives the resistance far *too high*.

I know of one special case in which an engine, according to Clark's formula, would just be able to run at sixty miles an hour with a certain train; in a few minutes I timed the speed at seventy-three miles an hour.

My opinion is, that no one formula can ever be made correct for all various speeds.

CLEMENT E. STRETTON, C. E.

*Saxe Coburg street,*
*Leicester, England.*

### Big Driving Wheels.

*Editors :*

For fast running, and economy both in fuel and repairs, there is in my opinion nothing equal to a single pair of 7 feet 6 inch drivers, cylinders 18½ x 26, and a steam pressure of 160 pounds per square inch.

Upon a heavy road where power is required, four coupled 7-foot drivers will give excellent results. Both the above classes are working in England, and giving the greatest satisfaction. I am not aware what is the result of working of "compound" express engines in America, but so far in England they are unsatisfactory. Three sets of motion cost more than two—cost more to maintain. The compounds burn more coal, use more oil, and the engineers have much more trouble than with the "simple" engines.

CLEMENT E. STRETTON,
Consulting Engineer.

*England, June 10.*

### Relyea's Brake Puzzle.

*Editors :*

In answer to W. F. Relyea's brake puzzle I would say the fault may have been in the governor.

I have seen governors that would stop the pump when maximum was reached, and not start it till the pressure had fallen five or ten pounds. With triple valves sensative to slight changes of pressure, and no leakage grooves in the brake cylinders, the brakes would be very apt to go on as he says.

W. E. WATTS.

*West Nanticoke, Pa.*

*Editors :*

In regard to air-brake puzzle on page 243, July number, "brakes settling on train when brake-valve was changed from running position to full release," I think there was a bad leak in main reservoir pipe or the drip-cock in main reservoir worked open. If the pump stopped, the pressure in main reservoir leaked down below train-pipe pressure. This it could do if valve was on running position, as excess pressure valve would stay on its seat, and train-pipe pressure will not raise rotary valve 13 off its seat till there is considerable difference in the pressures. The train pipe probably leaked a very little and set one or two of the brakes; the brake-valve was put on full release, thus letting air from train pipe to main reservoir, lowering the train-pipe pressure and setting all the brakes tight. The governor opened steam valve to pump as soon as pressure dropped in train pipe, and air enough was pumped up to release brake before train was stopped.

Try this experiment on a standing train. Shut off the pump when your train line pressure reaches 70 pounds, place the brake-valve on running position, open the drip-cock in main reservoir, see how many pounds reduction on red hand before black hand begins to drop back, and in how many seconds. When your tender brake begins to go on, turn the handle of brake-valve into full release and the results will surprise you in more ways than one.

Why is there no leakage groove in driver brake cylinders the same as for tender brakes? The same kind of triple valve is used for both brakes.

I notice in the list of questions and answers on the automatic brake, which has been under discussion by the railroad clubs and associations for months back, the statement that on freight cars the engineer may set the air-brake when the brakemen are setting the same brakes by hand, but on passenger coaches never. The Pennsylvania Company run a line of freight cars equipped with air brakes which can be set by hand from either end of the car. One end has the brake worked from the end of car for tunnel use, the other is operated from the roof of car. When the brake is being set from the top of car by hand, and air is applied, it will set the brake *against* the brakeman *same as a coach*. There is another feature about this arrangement; if the slack is taken up some on brake chain at that end it changes the leverage on that truck by moving the fulcrum 7¾ inches farther away from the power, so the braking strain is increased from 8,500 pounds to 14,000 pounds, in round numbers. There is a fulcrum pin working in a slot in a bracket between the power and coupling to hand brake; as long as this pin rests at the end of the slot the braking strain is the same on each truck, take up the slack with the hand brake, it is changed. Why is this? See P. R. R. car No. 75,942 or the Union Line cars.

On page 243 of the July issue there is a lubricator puzzle, also one in March issue—one not answered yet. Was the pipe which brings the condensed water down to bottom of oil tank of full length, and not loose or leaking at the top end? When this pipe breaks off the oil will go up into the condensation chamber or ball at the top of lubricator and from there through steam supply pipe into boiler. It will also do the same if this pipe does not come clear down to the bottom of oil tank. Of course this cannot take place if globe valve at bottom of condensation chamber is shut tight, but lots of them have got dirt on the seat and leak. In the small air-pump lubricators all this oil goes over into the air-pump, but it feeds out too fast when first started, or won't feed at all through the sight-feed sometimes, if this water-pipe does not come clear down to the bottom of the cup so the open end will be below the oil. Keep a good gasket in the joint at the bottom of sight-feed glass, and this glass as far down through the gasket as possible, that stops feeding when sight-feed valve is shut off.

C. B. CONGER.

### Relyea's Air-Brake Puzzles.

*Editors :*

In answering my last air-brake puzzle, will say that the pump governor caused the brake to set. The ⅜-inch copper pipe from governor is connected direct to train pipe. The air passed through ⅜-inch pipe to governor, thence past diaphragm-valve 17, thence past piston 5, and out at waste pipe connected at bottom of cylinder 3; this caused the brake to set when the handle of engineer's valve was in running notch or on lap.

See pump governor, plate D 9, of Reference Book of 1890.

I have one more puzzle, and will send a good 25 cent cigar to the man who guesses it.

An air-pump was reported to me as being worn out, so I had men called (it being midnight when the engine got into the house) to take it off and put on one that I had just overhauled but had not tested. When steam was turned on the pump would not work without the aid of a hammer; so they sent the caller after me. Well, when I got over to the engine-house and saw how the pump acted, I said to myself, it won't take long to fix that "thing." So I went at it, first like one of those fellows who thinks he knows it all, but don't. Well, it didn't take me long to find out that I was one of those fellows. Here is the way the pump acted: the piston would not move without tapping on the reversing cylinder cap, and then it would only go up and down once and stop. My first thought was that the reversing piston was too loose and would not press the main steam-valve down to open receiving ports in lower bush. I examined the reversing piston and it seemed to be all right, so did the reversing cylinder, but to satisfy myself I put in another reversing piston and plenty of valve-oil; but this did no good. Then I concluded that the main steam-valve was too tight, so I took off the head and found that the valve was as good and worked as free as I could make it. The supply port, leading from main-valve chamber up into the head and over to the reversing valve bush, was all clear. In fact, all steam ports were clear and the piston traveled its full stroke. But to make sure that the trouble was not in the top head, I put on a new one and gave her steam. The piston "went up and then went down again" and stopped as before. Not having examined the new head thoroughly, I thought, perhaps, in shifting, something might have got in some of the ports, especially the one mentioned above; so I took the head off again and found all ports open. My body had now attained a temperature of about 212 degrees and my mind was about ready to leave me, when I discovered the difficulty, and with a small hammer and chisel removed it, and the pump went to work all right. I omitted to say that there was a hole in the gasket to accommodate the port leading from main-valve chamber to reversing valve-bush.

In answer to Paul Synnestvedt, will say that if the engine was equipped like those on the N. Y. C. & H. R. R. R., the cause of brake-setting was this. There was a leakage that reduced the pressure in the main drum below that of train pipe, and in putting handle in release notch, the air went from train pipe back to drum. This reduction of pressure in train pipe allowed the governor to open and start the pump, and in a short time gaining pressure enough to release brakes.

I have another "nut" for next month, and it's no "chestnut," either, but something entirely new; look out for it.

W. F. RELYEA.

*Syracuse, N. Y.*

### Remedies for Air-Brake Troubles.

*Editors :*

Before attempting to solve some of the air-brake puzzles published in your July number, by stating how troubles resembling these have been remedied, I wish to echo the sentiments of Brother Wood in regard to correspondents making obscure statements of difficulties overcome by them. It is almost impossible to give a correct answer to a general description (although I believe the practice will ultimately be of great benefit to all who are interested in these matters), and as an illustration, will mention our friend from the Empire State whom we are all glad to hear from again. It will be remembered that last year he gave a case where the stop to main-valve was broken, but did not say that main piston was held against the upper head when steam was turned on and stayed there, if piston-rod packing was tight enough to hold it up when steam was shut off, which must have been the case. It is also my experience, that the investigator, to be successful, should usually, in person, examine the one who has met with the difficulty, as there is in such cases often a statement made in which everything is shown but the clew to the whole affair, this not being thought of sufficient importance to be mentioned.

As for brakes not going on, in Brother Wood's puzzle, on the front part of train, when it broke in two, there must have been some obstruction in train-pipe or hose on back part of last car on front section of train; perhaps sparks in coupling, lining of hose stripped down, or waste, scale or other matter sufficient to plug train pipe anywhere from strainer to rear end of last car.

If the train mentioned by friend Synnestvedt was all Westinghouse air, did not the engineer tell him that the brake-valve kept blowing from service exhaust longer than it ought when handle was put in release position, and in that case was not piston No. 17, plate D 8, or the port above it partially stuck or closed, giving way, finally, enough to let the piston seat itself?

Now for the tender brake, as this trouble has developed here. The first real tough case of tender brakes sticking on was not tough at all when located. It was caused by the tender brake beam-hangers bearing directly on wood, and being outside breaks, the rear hangers finally knocked holes in tender frame and brake-beam, and when the brakes were applied rear beam would carry up on wheels and top of lever would catch on a projection that was not in the way when brake was at its normal position. It would only release when engine was backed or dead rod disconnected, and as I had no chance to watch the engine while it was in motion, it ran two or three trips before the right remedy was given. Next brakes were found going on as described in paper, and a number of tests showed that the driver brakes, having 12 x 33-inch reservoirs and 12-inch brake-cylinders, had 50 lbs. in emergency stop, while tender brake with 12 x 33-inch reservoir and 8-inch brake-cylinder had 60 to 63 lbs. Of course when the brakes were applied there would be an emergency application on the tender brakes with only 7 lbs. reduction, and at 20 lbs. reduction the driver-brake reservoir would have 50 lbs. while the tender reservoir would contain 60 or more lbs., and would have a tendency to creep on again while the reservoirs were recharging or if pump governor was slow to act. We now let out tender-brake cylinder pistons in this condition as much as possible in order to expand the air more and make valve graduate better. We also found that working tallow in piston packing ring space was an improvement. The amendment to Schedule B[1], page 60, 1890, W. A. B. catalogue, will help explain. There is but or more cause easily detected, this is a lea above piston 17, plate D 8, or at the bo tom of piston; either will leak at servic exhaust and can be told by stopping th hole with the finger to see if pressure a cumulates.

GEORGE HOLMES.

*Roanoke, Va.*

### "Oil Can's" Break-Dowo.

I will try to explain the break-do puzzle which I gave in the July numl It was the go-ahead eccentric that bound, and what I did was this. I t down the strap on same and then pu it over on the shaft almost to the side, so as to get it out of my way, b careful to tighten it enough to prev turning around on the shaft. Then I took the back-up eccentric and slipped it enough to make it in a position to go ahead. I then knocked out the middle bolt or what was now the go-ahead, and took one of the long bolts that came out of the disabled strap and bolted both the rods securely together to the single eccentric, at the same time putting a piece of wood between both rods to prevent the link pins from rubbing. This done, I was ready to go on, and I can assure you it is better than to disconnect and take chances of stopping on center with no slack in a train, making it necessary to pinch the entire train back, one coach at a time, or cut off the engine. Those of us who have had a trial of this plan will resort to it rather than disconnect and run on one side.

OIL CAN.

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A quick acting triple valve for air-brakes has been patented by Jesse F. Carpenter, Washington. The inventor of this valve is the carpenter who had a combined air and electric brake at the famous Burlington tests.

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A station agent on a road in Kansas, tells a story of a German tramp who wanted to pay his fare for walking along the railroad track. That tramp ought to be found and exhibited at the World's Fair, as the greatest curiosity of the age, or the Ananias Club might invite the station master to enroll himself as an honorary life member.

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A Grand Trunk engine and the express and baggage cars took a fearful plunge of forty feet down a deep cut, when half way between Hilburst and Conticook, Canada, one day last month. The two cars were piled on top of the engine. When the frightened passengers left the train and went to the assistance of those who had been carried down with the engine and cars, they looked upon a scene of death. Every one of the men who took the plunge into the cut was killed.

## Train Running for the Confederacy.

By Carter S. Anderson.

Taking up the narrative of the part performed in the summer of 1862, by the Virginia Central, now Chesapeake and Ohio Railroad, in transferring General Jackson's army from the Valley of Virginia, and placing them in a position to attack General McClellan's rear, while the Johnson-Lee army attacked McClellan in front, I will now proceed. My last letter left us at Louisa C. H., Sunday night, with not even a rumor of any movement. It was so quiet and peaceful that we forgot it was the time of war. On Monday morning, though, the scene changed. If any of General Jackson's officers knew where the General was going, they were extremely true and prudent in keeping secret his plans. I have no idea of attempting war history, neither does General Jackson's character need anything from my humble pen; but I will make one remark which is as applicable to success in business as to success in war. General Jackson undoubtedly used the enemy's spies. He was glad for them to go and tell everything that he was doing, and then he always did the opposite to what most people would consider advisable and likely. This was certainly true of him in this movement, for on Monday morning he had everybody, citizens and all, figuring out the nearest and best roads to Washington. The railroad men felt confident that we would haul no more soldiers, soon. Before noon, however, the lumbering of heavy artillery could be heard along the country roads toward Richmond, and everything wore a serious and sober aspect. Pretty soon we were ordered to prepare immediately every train. "Load them to their fullest capacity and let each train give to the preceding train thirty minutes' time. Keep trains well in hand; sound no whistle; ring no bell. Brakemen, keep a sharp look-out for trains in front and rear. *Death* to the whole crew who cause a collision!" This was indeed what might be termed a limited time card.

Locomotives used by Chicago, Milwaukee & St. Paul in Making Tests of Simple and Compound Locomotives for Master Mechanics' Committee.

Our superintendent, acting under instructions from President Edmund Fontaine, who then resided at Richmond, would not assume the responsibility of running his trains any further into our unoccupied territory, but was perfectly willing to allow the Government to use the trains on its own responsibility. Since McClellan had removed the line of battle from Manassas to the Peninsula, beautiful Piedmont had been unoccupied by either army. Anywhere from the Potomac to the James, and east of the Blue Ridge to the vicinity of Richmond, the citizens would just as soon have expected a Southern army as a Northern one, and vice versa. The Southern as well as the Northern officers in approaching a farm house, would note that awful stillness around, and the apparent absence of every living being from this once nice and happy home. "Halloo" would sink so deep into the souls of the unprotected women and children, and cowardly men concealed within, that in many cases death resulted. For once the rich and poor met together, and sweet life, heretofore so unappreciated, was now all they asked for, and happy were they to retain "only that and nothing more."

No wonder then that our engineers hesitated to plunge their trains into such a country. The rain was pouring and it was nearly night. They did not fear for their own lives as much as for the responsibility of 2,000 soldiers, which was the average of each of the ten trains. The officers acted very nicely, and assured us that our cavalry had gone all through the country, as low as the South Anna river, and that there was not a Northern soldier west of Hanover C. H. Furthermore, they gave us two Confederate officers who rode on the pilot of the front engine.

Our ten trains of 18 to 20 cars per train, were soon placed for loading. I wish our passengers nowadays could have seen how quickly (about ten minutes) 1,500 to 2,000 men, with their heavy muskets, clumsy boots and haversacks, crawled into and on top of 20 box cars and work train flats. There is wisdom in letting every man taste a little of war, as the German Government does. It's the finest *peace tonic* I know that I ever used. You know how it is up there, but down here our old veterans are the best American citizens. They have seen a plenty.

Conductor John H. Richardson and Engineer Martin Alley took the lead of the ten trains in this momentous occasion, and two safer men never pulled a bell cord or stepped upon a footboard. Martin looked quite serene on the "Westward Ho!" engine, with a Confederate Brigadier on either wing of his pilot. It was a war picture indeed, and as he quietly and carefully pulled his engine pin and drew his train into the curve east of Louisa, there went up a yell which seemed to fill the whole air around us. Our train came next and the signal was given to my engineer, John Whalley, to pull down in place to load. To my horror, I then discovered that John was pretty drunk, and my fireman, John Wesley, dead drunk! We needed but little steam, however, as it was mostly down grade all the way.

I hope I may never again experience such feelings as I then had. I had on board 2,000 soldiers; a train just ahead, one just in rear, overloaded; pouring rain; nearly night, engineer very much in liquor, no fireman; not a whistle allowed to be sounded; not a bell allowed to be rung!

I at once, held an earnest conversation with Conductor Joshua Finks and Engineer Fendal Ragland, who were immediately behind us. No kinder-hearted man ever lived than Josh Finks. He was much older than I, and putting his arms around my trembling shoulders, said: "Carter, get on your engine and keep John from running into Richardson, and Ragland and I will keep from running into you." I gratefully acted as he suggested, and slipping upon the "Monroe" in front, tied a knot in his whistle cord. Cautioning my brakeman to keep a sharp look-out for my signals from my lamp on the engine and to use the brake on Whalley if he wanted to run too fast, I then informed Mr. Whalley that we were ready. He stepped upon the Monroe's footboard, and stooping a little to enter his cab, he tapped her open gently with his characteristic way.

I sat on the box opposite him and watched anxiously the curves as we rolled gently along toward Mineral City. Mr. Whalley told fireman John Wesley to fill her up, at the same time opening the firebox door with the toe of his boot. Wesley was so drunk that he thought the wood piled up in the tender was the firebox, and began cramming wood back and *firing the tender*. We were now approaching the 65-foot per mile down grade east of Mineral City, and as we had gotten into a pretty good swing on the level, I knew there was great danger, and asked Whalley to shut her off and get the train well in hand before he struck the grade. His eye flashed fire. He snatched the Monroe's throttle wide open and as she struck the down grade we dashed through "Rock Cut" at a desperate speed. Physically I was nothing to Whalley, but fear left my timid frame and left me strength instead. I felt I could do anything. I snatched the stick of wood out of Whalley's hand and told Mr. Whalley to shut her off. He saw that what I had made up my mind to do I would do, and reached immediately for the whistle cord, forgetting that it was *death* to pull it. The knot I had tied, however, saved his life. He at once drew her in back gear and as soon as he could possibly do so, nearly stopped the train. Looking ahead as we entered the reverse curve, I exclaimed, "Great God, Whalley, just look!" There, just ahead of us on the curve near Frederick's Hall, was what I had dreaded for the last few minutes—the *red lights on the rear of Richardson's train*, as he cautiously rolled down the grade!

Mr. Whalley realized now the situation, it sobered him. With tears rapidly rolling out of his great eyes he beckoned to me to come out to him, and drawing me close to his side, told me that when he shut off the Monroe and reversed her, it was with the full determination to throw me into the firebox, and the only thing

that stopped him was the ruby glare from the rear of Richardson's train

This very narrow escape from such an awful and wholesale massacre as would inevitably have soon followed had Whalley not shut off when he did, sobered him completely, and well it might. We crept along to Frederick's Hall, and putting a brakeman to firing, I assumed his place on top of rear car, and we reached the end of our trip in good order, though drenched with rain.

General Jackson did not take the train at all, but generally kept ahead of us. He stopped over night at Frederick's Hall, at the hospitable home of Mr. N. W. Harris. Mrs. Harris assigned him her best room, and the family retiring at the usual hour, General Jackson slipped out and rode to *Richmond*, about 45 miles, the nearest route; held a council of war with President Davis, General Lee and others, and returned to Mrs. Harris to breakfast. *Being a little late*, he apologized for it, remarking that he often took moderate horseback exercise before breakfast. Mrs Harris' housemaid was much bewildered to find that the bed had not been touched in the General's room, and ran down to tell Mrs. Harris that "De general either slep' on de flo' or made up de bed hisself." Mrs. Harris was curious to know how it so happened, but the silent old war-horse was gone.

I had intended concluding the narrative in this letter, but my superintendent, Mr. C. E. Doyle, must have my "record abstract" to-morrow. So I must try for a little corner in your next issue, and I will try to condense into it something to interest your readers

*Richmond, Va.*

## Reciprocating Parts of Locomotives.

A. Farmer, Youngstown, O., writes us

I have just finished reading my July copy of Locomotive Engineering, and while the subject is fresh in my memory I will beg the privilege of criticising the letter from Mr. Corbett appearing on page 241.

The importance that Mr. C. attributes to the weight of reciprocating parts of an engine will no doubt astonish engineers and locomotive builders, and on the other hand will be read with pleasure by those who favor electric motors for railroad locomotion, showing as it does at high speeds an unprecedented improvement of tractive efficiency. I am sure Mr. C. has made an error in his calculations, as well as in his philosophy, for theory ought not to be at variance with practice, and practice has proven many times over that Newton's third law of motion ("to every action there is always an equal and contrary reaction") is correct.

Some of our best builders of high-speed stationary engines make the crossheads very heavy in order to equalize the pressure on the crank-pin. These engines give excellent results in practice and will be sufficient evidence that Mr. C. is in error. It may not be amiss to add, however, that the force that brings the crosshead, etc., to a standstill at the end of the forward stroke, helps to pull the train along an equal amount, and that the force that stops the crosshead at the end of the backward stroke, retards the train an equal amount One balances the other, and no force is lost or gained thereby.

There is no part of a locomotive that may be studied with more interest than its reciprocating parts, and I hope Mr. Corbett will either conclusively prove the assertions he has made or else give us some that he can prove. This is written in a kindly spirit, and I trust it will be so received.

An improved form of car seat has been patented by Mr. Edward L. Bushnell, of Poughkeepsie, N. Y. The improvement consists of the mechanism for turning the back, and makes a combination that provides strength and simplicity that are likely to insure durability.

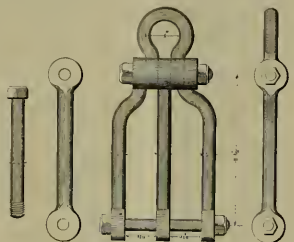
## A Big Steel Smoke-Stack.

One of the most notable achievements in the rapidly multiplying applications of steel to structural purposes is the new chimney of that material in Chicago, the dimensions as given being a height of 350 feet, with an outside diameter of 9 feet 5 inches, while the steel varies in thickness from $\frac{5}{32}$ at the top to $\frac{3}{8}$ of an inch at the bottom. The lower 75 feet of the chimney is lined with fire-brick 8 inches deep, formed to fit the shell compactly all around, and above this is lined with hollow tile. This lining is supported at intervals of 25 feet by an angle-iron riveted to the steel shell, that is, the chimney is lined in a manner similar to blast furnaces and foundry cupolas, no expansion by heat being able to lessen its strength, and the joints are all hot-riveted. The steel shell is carefully protected from corrosion and from any attacks by the weather, by painting inside and out. The weight of the chimney is spread to the foundations in the same manner or general way as that of the columns of the building, the base or foundation on which it rests being constructed similarly; the ground first is covered with a layer of cement, then two layers of steel rails in cement and one layer of I-beams, on which the cast-iron shoe, which takes the shell of the stack, rests. The capacity of the chimney is twelve 60-inch boilers, 20 feet in length. The outside diameter of this chimney is 9 feet 5 inches, while were it constructed of brick it would be 16 feet 6 inches.

You will never find a competent mechanic forcing a piece of work together with an idea that it may prove all right. The nicely adjusted bearings, fitted at all points with an idea of accommodating opposing parts, will go in direction of successful work, while all haphazard work will eventually return to condemn the loose methods of those responsible for them. In mechanic, or fireman, or engineer, the principle is the same. Honest methods insure honest work—honest effort gains its ultimate reward as surely as night follows day.

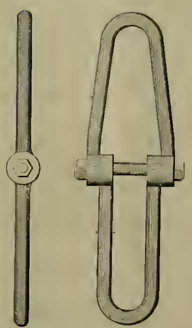
## Foster's Wrecking Pulleys.

The annexed engravings illustrate a form of single and double pulley blocks used by Mr. W. A. Foster, superintendent of motive power of the Fall Brook Railroad, for wrecking purposes. With this rig worked by a wire rope he can lift his heaviest locomotives. The device is so clearly shown in the cut that no description is necessary.



*Frame for Double Pulley*

*Pulley Wheel Sections*



*Frame for Single Pulley*

*Pulley Wheel*

Foster's Wrecking Pulleys.

The express messenger of a train on the Chicago, St. Paul, Minneapolis & Omaha road saved the money of his employers by a cool act in a recent interview with a train robber. The train was stopped by robbers in a lonely part of the road. While one man armed with shooting-irons looked after the welfare of the engineer and fireman, another thief went to the express car and interviewed the messenger. In answer to a knock, the messenger opened the door and found himself looking down the barrel of a rifle. He was ordered to open the safe and deeming it not safe to refuse he complied, but at the same time he whipped out the money package and slipped it out of sight. The train robber finding the safe empty departed in an angry mood without any booty. This was a very smart act on the part of the express messenger and he is receiving much praise for it, but we are inclined to ask why he was so ready opening the door of his car? The rules against this practice are pronounced enough. In the case of express messengers, it is a good plan to lock the door before the horse is stolen and keep it locked.

The car wheel loose upon the axle which is regularly pressed upon the attention of railroad men has again been patented, this time by Abner Johnston, of Jersey City The invention this time has a rather practical look about it. The wheel is held in place by two collars, and provisions are made to supply the wheel seat with lubricants.

The activity of train robbers is setting inventors at work to provide the means of frustrating the designs of thieves upon express cars Several patents have lately been granted on methods for protecting express cars, the most elaborate of them being the invention of John Beermaker, Wahoe, Neb. He proposes to make the inside of the car a bullet proof fort, with means for opening or closing the doors at the will of the man inside.

## Steel Plates, Old and New.

During the discussion at the Master Mechanics' Convention on tests of steel and iron, Mr. Lauder said:

"One statement made by Mr. Smith brings out a fact that we should all dwell upon, and that is that he has got, even with his extremely bad water, boilers that have given him from 400,000 to 600,000 miles service, covering a period of nearly twenty years. I think that it is a very remarkable fact that a firebox on the Chicago & Northwestern road, with their extremely bad water should give a service of twenty years, while he produces before us here samples taken from a furnace that has run less than one year and is absolutely worthless, being cracked from some cause or other. Now, to a layman like myself, it seems that if twenty years ago the manufacturers of steel in this country could make a plate that would give us twenty years' service, they ought to be doing the same thing to-day. (Applause.) In fact they ought to be giving us a better plate, because they ought to be progressing in their business, as we hope we are in ours, and to know more about the manufacture of steel to-day than they did twenty years ago. Possibly some of the fault lies with us. The average purchasing agent wants the steel that he can buy for the lowest price. Manufacturers well understand that, and if they cannot produce a steel to sell as cheap as the other man, on many roads they cannot sell any.

"Now, I do not suppose there is a railroad in this country on which the mechanical man would not consider the question of price of secondary importance and the question of quality of the first importance. But, unfortunately, on many of these roads the matter is not settled entirely by the mechanical man. It is settled by some one who wants to make a good showing in his particular department without regard to the machinery department, and if some fellow comes along with a glib story to tell and a lot of scientific tests formulated in a table and offers steel for a quarter of a cent a pound lower than some well-known manufacturer offers it, he gets the trade. What is the consequence of all this? It forces the man who has been making an honest article, and making it intelligently, to come down to the methods of those who sell the steel cheaper than it can be made. Now, I believe, that instead of the price of steel for fireboxes of locomotives dropping all the time, it would be largely for the interests of the railroads if it were increased, if the increase meant a better product.

"I think the facts produced here in this discussion should be scattered broadcast amongst the railroads of this country and amongst the general managers and the men who are responsible for the financial results of the operation of our railroads. Just think of it for a moment; a new boiler costing from $1,500 to $2,000 is put into service, and in ten months torn all to pieces at a cost, I don't know how much, because some one has chosen to put in plate that is improper, while the neighboring engine, doing precisely the same work, has caused no expense to the owners. I tell you these facts have a broad bearing on the future prosperity of our railroads, and in the West especially, where they are cursed with bad water. This question of firebox steel is one of the questions that is probably as serious a one as they have to contend with—by far the most serious, perhaps. In my country almost any of the steels sold would give us good results, because if we take out a furnace in less than twenty years we think there is something radically wrong. I speak warmly about this thing for my neighbors; I am not troubled myself, but I know the difficulty of operating boilers in the western country with this extremely bad water, and I tell you the steel manufacturers and the railroads in combination ought to do something to eliminate this terribly destructive effect that the bad water has on the firebox of the locomotive, if it can be done."

## The Oldest Steel Converter.

The vessel shown in the annexed engraving is of great historic interest to every one interested in the development of the manufacture of iron. This is a converter for making steel direct, by what is known as the Bessemer process, and the vessel shown was made and operated years before Henry Bessemer astonished the world with his great discovery. This Kelly converter, as it is called, is to be seen in the Cambria Works at Johnstown, Pa. It was made in 1853 under the direction of a metallurgist named Kelly, and he and friends experimented at great length to convert pig iron directly into steel. The theory of the process was that by blowing hot air through the molten metal in the converter, the excess of carbon and silicon could be burned out (oxidized), and that the blowing could be stopped at the point where the necessary amount of carbon was still left in the charge. The stopping at the right point was the great difficulty encountered by Kelly and his associates. If the blow was kept going a few seconds too long, or if it was stopped too soon the charge was worthless. Bessemer overcome the difficulty in 1856 by blowing out all the carbon and silicon and then recharging with spiegeleisen or ferro manganese metals that contain the required quantity of carbon. By this simple expedient Bessemer made himself the most famous metallurgical engineer in the world and accumulated a colossal fortune. Although Kelly did not achieve success he was working in the right direction, for his converter is essentially the same as that employed by Bessemer several years later. We know of few articles that are more worthy of a place in the Nation's Museum of Industrial Curiosities than the Kelly converter. It is going to be exhibited at the World's Fair.

KELLY'S CONVERTER.

## In the Grant Locomotive Works.

When a visitor goes through a great manufacturing establishment and sees all the machinery at rest, he must call upon his imagination to picture the possibilities of production within the power of these silent tools. Such an experience does not offer good matter for description, and it is not altogether inspiring, but it gives a mechanic a good opportunity to study the plan of operations. This idea struck me during a recent visit to the Grant Locomotive works of Chicago.

The shops have not been built on the plan of any other locomotive works, but it is evident that much thought has been devoted to making them models of convenience and perfect in arrangement. The designers of shops like these have an enviable problem to work out, compared to those who are left to struggle to enlarge an old establishment, and keep it in harmonious shape. They had an open prairie to plan on, and they have worked to the end of building shops where material can be converted into locomotives, with the lowest possible amount of handling and where the work shall be done on tools that are the best of their kind.

The main building, consisting of the machine shop and erecting shop is built in the ┘-form, the long leg being the machine shop, which is a fine lighted building, with galleries upstairs for light tools. The floor is traversed by a heavy traveling crane, which takes the work to and from the heavy tools that are purposely set so that they can be reached by the cranes. The wheel lathes and some of the heavier tools, are set in the erecting shop wing, the overhead crane that serves that part being used to handle the work for the wheel lathes. All the tools are set so that work will be finished with as little movement as possible, all the tools for the finishing of cylinders for instance, being grouped together, and the same with frames and other parts that require to be worked on by different machines.

The machine tools moved from the Grant Works at Paterson, appear to cut little figure in the new works, for all the most important machines are new. They have a good supply of tools for special operations, milling, and grinding evidently receiving prominent attention. A separate shop is provided for grinding tools and the intention is to have everything of the most approved kind therein. Portable appliances for drilling, tapping and such light work, where it is not convenient to reach a foundation tool, is quite a feature of these shops.

The separate-power plan has been adopted, independent engines being used to drive the principal lines of shafting and separate engines for the machinery in the various shops.

The erecting shop is arranged with pits set at right angles to the shop, a transfer table being employed to take the engines out. A careful study was made of the leading erecting shops in this country, both of builders and railroad establishments, and it was concluded that the stall plan was more convenient than the longitudinal floor plan, where engines must be lifted by a crane. The cranes in this erecting shop are powerful enough to lift an engine, but they will not be used much for that purpose. The machine shop and erecting shop are ready for business, but the other shops are scarcely in working order yet. The firm has already done some repairing and have engaged to do a great deal more. Those in charge think that the works can be conveniently organized and put gradually in operation while doing repair work. Mr. Edwin M. Herr, the very energetic superintendent of the works, is working things into shape very rapidly. He has an able lieutenant in Mr. P. Arnot, master mechanic of the shops, who was long superintendent of the Grant Works at Paterson. I missed seeing President Fenner during my visit to Chicago, but I understand that he has adopted the policy of having the best appliances possible to equip the shops.

The original purpose was to start the boiler shop with an ancient steam riveting plant, but Mr. Fenner has ordered an entire outfit of Wood's hydraulic machinery for this shop. When this plant is in, nearly all operations in the boiler shop will be performed by hydraulic worked tools.

The blacksmith shop has the most approved form of forges, with down draft leading to pipes under the floor, the gases being drawn in by an exhaust-fan. This shop is well provided with furnaces, hammers and all kinds of tools used to facilitate blacksmith's work.

The foundry appears to be particularly well designed and equipped. There are two Collau furnaces that are supplied with material by an elevated railroad outside. A traveling crane traverses the whole shop and handles everything for the cone ovens, besides the ordinary floor work. The only familiar thing we found absent here was the molding machine, which will no doubt get there in due time.

The management of these works are to be congratulated on the progress they are making to produce a model locomotive building plant.

A. S.

## South Harrisburg Accident.

A correspondent in Mount Savage, Md., writes us:

I wish to say something about the brakes on the second section of the train that caused the fatal accident at South Harrisburg on June 25th. Engineer Kelly says that he was running about thirty miles per hour when he saw red signals, and had about one hundred yards to stop in; that he whistled, reversed, and applied the air-brakes, but on account of the wet rails the brakes did little good. Now, out of seven cars, five were Pullmans; the other two were baggage cars. In traveling I find that a great many Pullman cars are not braked on the middle wheels of the six-wheel trucks, and the brake rigging for the other wheels is by no means perfect. With the great weight of the train and the small portion of it braked, it is no wonder that the engineer reported that applying brakes did little good. The miserable form of the cam arrangement for driver brakes is also very objectionable and reduces the chances still further for a quick stop in case of emergency. The whole of this brake question wants overhauling. It is not long since that a report was published to the effect that the Chicago limited, when suddenly flagged, running at a speed of fifty miles an hour, ran over two thousand feet before stopping. This state of affairs is an invitation to the killing of people in collisions. It appears to me to be the duty of railroad companies to see that all the cars on the train are properly braked, and while six-wheel trucks are running with two-thirds of the wheels braked, this duty cannot be said to be done.

(Continued from page 276.)

mechanic, Mr. Simeon Hailbreth was superintendent and representative of the principal bondholder, a New York financier. Mr. Hailbreth was a fortunate roadmaster who rose through a well earned reputation as a hustler. He was reported to be capable of putting more emphatic language into a common order than any man in Indiana, where the headquarters were located. His policy as a manager was very simple. Run the road with as little expense as possible and beat competitors out of all the business that can be taken from them.

When Kurgess took charge, a construction company was extending the road at the rate of a mile a day, which was kept up, with brief interruptions, for several years. During the construction period there was no difficulty in getting all the machinery and tools necessary for operating the road. First class locomotives and cars were purchased and shops were built calculated to take care of fifty engines and two thousand cars.

Before the gala days of illusory prosperity ended, the company owned nearly one hundred locomotives and five thousand cars, and the shops that were built to take care of half that volume of rolling stock were promised material additions in the way of buildings and tools. But a succession of adversity blizzards put their chilling influence upon the Illinois Transcontinental. In the first place the stock market was overtaken with an epidemic of skepticism concerning the value of securities founded on streaks of iron oxide starting from nowhere in particular and striving to reach a similar objective point. This suddenly put an end to the flow of joy that had for a few years streamed from the Construction Company, and the road was forced to fall back upon earnings to defray operating and other expenses. This was a new and bitter experience to the management, but there were still other griefs in store, for the management of a rival trunk line with many potential advantages in the form of size and connections was moved to enter into aggressive competition. There were numerous debts outstanding among the connections that believed in returning to the Transcontinental an equivalent for meanness rendered, and not a few of them were returned with interest when adversity dawned upon the road. Mr. Hailbreth was a very successful maker of enemies, and his ability in this direction helped the road to make rapid headway down the financial grade when once it was started in that direction. It is not surprising, then, that the road made startling progress from reputed prosperity into the hands of a receiver.

About the time this event happened things were looking remarkably blue for the property. Business seemed to have dropped out of sight. There were long stretches of the road that yielded neither passengers nor freight. It was for some time a serious question with the receiver how he could find money to pay operating expenses. Like many another man put in control of a business he did not understand, this receiver conceived that a change of operating officers was the first movement toward bringing back prosperity to the property, so he appointed a new general superintendent, and he, in turn, removed most of the other officers, including my friend Kurgess.

The men on top now fell into an error which has cost the owners of railroads untold sums of money. They encouraged a clean sweep of the employés high and low as far as the policy could be carried out. Good men who were familiar with the working of the road were turned off to make place for men whose only recommendation was that they had previously been acquainted with some of the new officials or with the friends of the officials. Officers who go to a railroad with a tail of followers behind them trail a powerful means for creating failure. Men acquainted with all the details of a railroad's operating appliances must be ridiculously inefficient if they cannot do the work more satisfactorily than strangers. The wise man who takes hold of a prominent position on a strange road makes the best of the material he finds there, and he soon has every man helping to contribute to his success; the man of the long-eared kind finding himself newly in power on a railroad proceeds to show his authority by making numerous changes. Every change brings him some enemies and rouses opposition to the new incumbents. Open hostility may not be practicable, but there is covert opposition in all directions and a prevailing tendency toward carelessness which soon brings woful fruits in railroading.

Mr. Winter, the new general superintendent, was a better railroad man in many respects than Mr. Hailbreth, but he began by demoralizing the army that was going to help him to business victory or defeat. There was no *esprit de corps* on the road. The energy that on a well-managed road is devoted to hearty performance of duty was spent in endless bickering among individuals and in the settling of personal animosities. By the time that the road had been in the hands of the receiver for nine months the property ran down so badly that a sale was forced and it was bought up for the bondholders.

This brought back Hailbreth as general manager, and he called Kurgess to his old position. The road and all its belongings were in a ruinous condition, and the problem to be worked out was the paying of fixed charges and operating expenses. A prolonged struggle was engaged in to put the track and the machinery in decent running order. Patch and scheme and mend were the watchwords of the mechanical department as they were of all others. Kurgess worked early and late. Wherever there was a difficulty encountered, he was there to help and encourage. When breakages of worn-out appliances took all the persistence and hopefulness out of others, Kurgess came to the front with directions and patient, stimulating aid that shamed failure out of the field. He appeared to have no thought but for the interests of the company. Self was entirely immolated in devotion to what were considered duties and which by degrees became sources of pleasure.

Good or bad habits are apt to grow upon us, and with Kurgess the habit of making his worn-out engines and antiquated cars last a few years longer became a passion. This taste was strongly encouraged by the general manager, who made it a leading article of his business faith to refuse renewals till the road began to suffer. So Kurgess became noted in the West as a wonderful patcher. Nothing pleased him better than to take his friends into the engine house and point out fearful patches to cylinders and other parts. It was frequently difficult to identify the original parts of engines and cars after they had gone through the shops under the supervision of Kurgess. The boys used to say that he would jack up a bell and build an engine under it for the sake of saving the bell. But the men did not forget that they still had an old engine made at an outlay which would have bought a new one.

Under the fostering penurious care it received on all sides, the road gradually emerged from its financial difficulties and of late years it has been considered in a prosperous condition. A few months ago the management appeared to become aware of the fact that the practices of the mechanical department were antiquated. The diamond stack and small familiar engines suddenly became an eye-sore to the man

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DESTRUCTION OF ILLINOIS CENTRAL BRIDGE, AT GALENA, ILL.

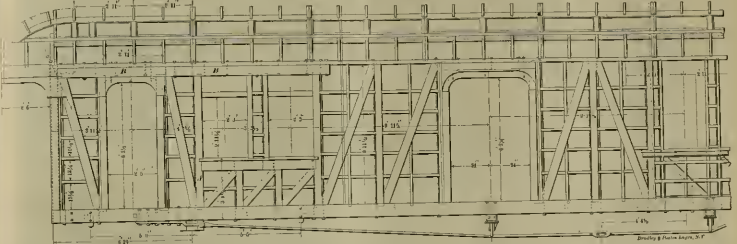

who had turned his face for years against any suggestion of change or improvement that involved the spending of a cent. The shops, the engines, the cars and everything under the master mechanic were declared to be out of line with modern ideas and the only remedy within sight was the relegating of Kurgess to the street. He was a back number, and back numbers were no longer in favor on the Transcontinental.

No hint that a change of policy was desirable was given. General fault-finding was indulged in for a few weeks and then the intimation was given that Mr. Kurgess' resignation would be acceptable.

Here is a man whose work was the object of devotion approaching adoration. His thoughts were even more bent in serving the company than in looking after his own interests. Sunday and week-day and holiday always found him attending to business. He never took a single holiday and never attended a meeting where railroad men assemble to talk on questions that interest the craft. Yet he was turned adrift on two weeks' warning. Verily there is a striking reward in store for men who devote heart and soul to the interests of some railroad companies.

## The Cantilever in Car Framing.

The framing of the combination baggage, passenger and express car, shown in the annexed engraving, embraces a novelty that probably never was before introduced in the construction of railroad cars. The car is one of the New York, Lake Erie & Western, and is throughout a good specimen of designing with the end of getting the greatest possible strength out of the least material. In putting in the side door toward the end of the car it was found that with ordinary methods of framing the vertical strength of the car would be very much reduced. To overcome this Mr. A. E. Mitchell, superintendent of motive power, resorted to the cantilever principle so well known in connection with bridge work, and applied the timber B B. The middle of the beam rests on a post which is immediately above the body bolster and transfers the load direct to that strong point. The strengthening timber thus becomes a cantilever with the body bolster for a support



FRAMING OF NEW YORK, LAKE ERIE & WESTERN COMPOSITE CAR.

## Make the M. C. B. Coupler Automatic.

An esteemed correspondent who has performed an important part in the improving of railroad rolling stock writes us as follows:

I notice the indorsement of the M. C. B. type of draw-bar is reported, which if correct, will confine that type in use, as I think. The point now should be to make it so far automatic as to be manipulated by switchmen and trainmen without the necessity of going between the cars. This point is what must be reached in the successful bar, as I understand the action of Congress may follow the action of the Master Mechanics' Association on this point, and in some direction ought it not to be so shaped as to bring out the point of necessity for automatic action in the bar? Is it not a fact that the interest of the men using the bar, as also of the roads, calls for this as the first consideration? The only objection to the type from the first has been on this point, and now that indorsement of the Master Mechanics' Association is had for it, why cannot the defect be emphasized so as to reach a correction of it? I think the interest of the men should be recognized and urged in all proper ways. The roads are able to, and doubtless will, as usual, take care of their side, but there is room for others to work on the other side.

A tragic incident happened lately on the New York, Ontario and Western. A helping engine was pushing a train and a signal was given to the engineer to slow down, but he did not respond and kept the engine working full steam. A brakeman climbed back from the train to see what was the matter and found the engineer dead, leaning with his head out of the cab window. He had been struck by some projection in a rock cutting. The fireman was attending to his duties in the hind cab unconscious of the accident. The engine was of the Wootten type which keeps engineer and fireman apart. The tragedy was sad enough but it carried the possibilities of one much greater. A dead engineer in the front cab and the fireman in another part of the engine with no means of finding out that anything was wrong make a startling situation. When these men are so widely separated it raises the necessity for another man being on the engine.

## Merits of Simple and Compound Locomotives.

Considering the large number of compound locomotives now in service all over the world, it appears strange that there still exists so much diversity of opinion concerning the merits of the compound as compared with the plain locomotive. The advocates of the compound locomotive have no patience with the conservative tendencies of those who cling to old forms, and simple-engine advocates consider the views of those who favor compounds as being nothing short of temporary lunacy. We think that considerable arguments have been adduced on both sides, although we think the weight of evidence appears to be in favor of compounds being so economical as to be worthy of introduction where coal is expensive. There is always a conflict of opinion when an important change is proposed in machinery matters, and the opposition to the compound locomotive is certainly not nearly so vindictive and aggressive as was the opposition to the compound marine engine in times within the memory of men who are not yet very old.

At the Master Mechanics' Convention, when there was talk going on about a committee to investigate compound locomotives, considerable amusement was excited by Mr. Forney when he suggested that a committee be appointed to investigate plain locomotives. The question when properly considered is not as funny as it seemed to be. We do not recall any question that might have offered better subject for investigation than, "how can the simple engine be made more economical?" The ordinary locomotive has been one of the worst neglected machines that we know of so far as its possibilities for securing improved economy are concerned. In connection with this subject we consider the remarks that Mr. Forney made at the Master Mechanics' Convention while the discussion on compound locomotives was going on as being worthy of the most careful consideration. He said:

"Supposing a railroad company wishes to have a certain number of locomotives, those locomotives to weigh, we will say, 100,000 pounds. Suppose under that condition of things that the general manager of the railroad should go to a builder of compound engines and say to him, 'We want you to build engines weighing 100,000 pounds for such and such traffic,' and suppose that same general manager should go to some other builder of engines and say 'We want you to build us some simple engines, weighing 100,000 pounds for such and such traffic,' and that he were to tell each builder that he would not be obliged to conform to any conditions except those he saw proper, what he had to do was to put 100,000 pounds of iron and steel into the form of a locomotive to give the best service; whatever advantage the simple system gave, the builder of simple engines could avail himself of. Under those conditions we have two locomotives in which we may imagine we have the highest degree of efficiency of the two systems.

"What do we find under these conditions? In the first place it is generally acknowledged that compounding increases the weight of the locomotive considerably. Now, to the extent to which we increase the weight of the engine it is a disadvantage. The simple engine man, under those circumstances, might take that extra weight and put it into the boiler and get a larger boiler on his simple engine so as to get greater efficiency from that larger boiler. A trial made with engines of that character would, I think, reveal what are the relative advantages of the two systems. If the system of simple engines has an advantage in weighing less, why surely you have a right to avail yourself of that. In the comparisons and tests and discussions that have been made, it seems to me that in nearly every instance the compound engines have asked for odds in their favor. They have asked to make the engines heavier.

"One of the most important things in locomotive engineering, or in building locomotives, is to get locomotives that will do the work. It is not a question of getting locomotives that will make a good indicator diagram. It is not a question of getting locomotives which will show good results from very careful tests when all these variables are brought into consideration. The business of a locomotive is not to burn variables; it is to burn coal. The important and overwhelming question, the one which your general manager, your directors, everybody, asks you, is, How long can you keep your engine in service? The most important question is the number of miles you can run in the course of a year and the number of cars you can haul. The question of hauling cars is of infinitely more importance than the saving of coal. Now, is it probable that we can get an amount of service out of the compound engine which is equal to that of the simple engine? If the compound engine is not able to give as many miles service in the course of a year as the simple engine, it will condemn the system.

"A good plan would be to appoint two committees on this subject, one consisting of the advocates of the compound system, to get up a compound engine of the very best character they can find, and the other consisting of gentlemen like Mr. Barr, who are agnostics on the subject, and let them get up the very best simple engine that can be found, and then have a competition of these two engines, and let the advocates of the two systems have charge of those tests. It is unfair to try a man for his life without giving him counsel. It is unfair to try the simple engine before the public without giving it counsel. Therefore I think there should be a committee to stand up for the simple engine. It may be that the simple engine can be improved still more than it is."

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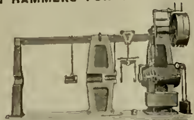

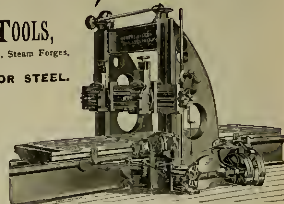

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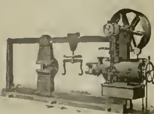

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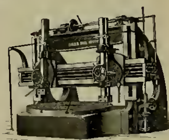

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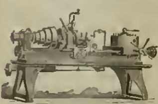

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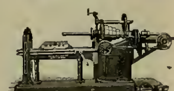

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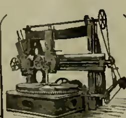

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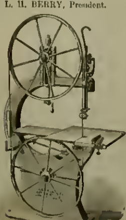

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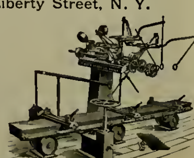

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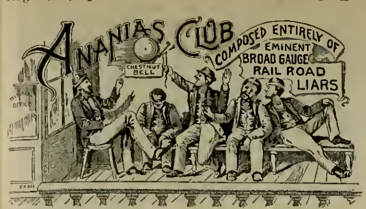



## Will be Wiser Next Time.

"The Master Mechanics' Convention was a great disappointment to me this year," remarked our funny editor, as he masticated the last piece of pie left at the lunch counter.

"What was the matter with the convention?" inquired Tom Purves. "I thought it was the best I had ever attended. I am sure the members attended to business closely enough."

"That's just the grievance," was the reply; "it was not business I wanted, it was stories. Why, I did not hear but one funny story at the convention. Why man, when they were sitting on the piazza in the evening, instead of telling funny stories as they used to do, they talked about compound locomotives. I got more sick of that word than I was of the compound of salts and cream of tartar that my mother used to dose me with when I was a boy."

"Was the solitary funny story you heard worth repeating?"

"It scarcely comes up to the mark of the Ananias Club. It was told by E. S. Marshall, who is now superintendent of the Madison Car Works. Mr. Marshall is a Southern man, having been superintendent of motive power of different Southern roads. The story as he told it went something like this

"Some of your Northern people used to come South in winter and many of them were always wanting to regenerate the natives down there. One of your effusive goody-goody preachers came to our place and he had a letter of introduction to me from a friend in Boston. I showed him all the courtesies I could, and on his expressing a wish to see the way prisoners were treated in the State Prison, I obtained a permit of admission and accompanied him through the place He would persist in talking to the prisoners and giving them what he called seasonable advice.

"There was a big nigger in one cell whom he seemed particularly anxious to convert. He entered into conversation with the convict, and spoke of the power of grace in sustaining a man in that unhappy position. Then he inquired.

"'For what crime were you convicted that led to your deplorable incarceration in this place?'

"'Fo' de stealin ob a hog, Sah.'

"'I am sure you will know better than steal again when you are released.'

"'Yes, Sah, I'll know better next time. Will neber steal nuffin again dat can squeal.'"

## A Misleading Change of a Word.

We owe our correspondent, Mr. W. F. Relyea, an abject apology. It is well known that Mr. Relyea is one of the steadiest and most respected citizens in Western New York. Those acquainted with him personally know that Mr. Relyea has always been a steady man, with no inclinations toward convivial habits, yet we have unconsciously implied that passing the ruby was once in his line In our last issue, while writing on a brake question, Mr. Relyea attempted to say that he had "resumed business at the old stand after a satisfactory trial of dispatching." Imagine our horror on finding after the paper was all mailed that the printer had perverted dispatching into "dissipating" We offer our regrets and sympathy.

The incident reminds us of an incident that happened in a rather pretentious literary society that the writer belonged to some years ago in a Western city They had a series of literary entertainments and among them an amateur theatrical performance. The intention was to send out circulars intimating that the most accomplished amateur actors in the city had been engaged as performers. The wicked printer got in his work, it was said with malice aforethought, and the circulars first sent out read "amateur asses."

The wicked printer does not have a complete monopoly of making mortifying blunders. The typewriter is now coming in for a share. A friend writing lately from Scotland mentions a curious blunder caused by a careless typewriter. A station master had been teasing the superintendent to give him a change to a more important station. The man was not entirely satisfactory and the applications generally called forth reproaches for shortcomings In one letter, after berating the applicant, the superintendent intimated that he had given orders for the man to be changed to Auchterarder. The typewriter missed the c in changed and the aspirant for a better position received notice to his amazement that orders had been given that he should be hanged to Auchterarder.

## Paid for Change of Opinion.

"Dutch Frank," who used to run old 161 on the Union Pacific in the sixties, had for a fireman a Milesian named Patsy Lahey. 'Twas during the French and Prussian war and Frank was eating lunch and talking war with Pat who had no lunch and would have to wait until they arrived at Sydney for his dinner. Frank remarked, "Patsy, vot do you tink, de Prussians git away mit de French, eh?" "Yes," said Pat, "I think so." "Here," said Frank, "took a nudder piece of pie, Pat" Pat ate the pie, and the conversation continued. Finally, Pat said, "Well now, Frank, come to think it all over those Frenchmen are pretty smart and may get away with the Dutch yet" "Ugh! Shuffel in some more coal," said Frank. "Da ol angine vorkin in de corner vill gif you some sings to do breddy soon."

## Another Railroad Man Who Tried Farming.

It is sad to reflect on the number of railroad men of saving habits who have accumulated enough to buy a farm and taken that way of spending their hard-earned money. Train men seem to be especially prone to hanker after the charms of rural retirement, and they are the last men in the world to be satisfied with the uneventful, dull existence that most farmers lead We can recall the names of scores of men who had good runs as engineers or conductors and left them to turn farmers. After a few tailsome years they would return to railroad life sadder and wiser men, ready to begin life again at the bottom.

The last dreadful example that we have to relate of this form of madness was gone through by one of the last men in our acquaintance whom we would have suspected of hankering after rustic simplicity

A year ago W. W. Thompson, who had long been road foreman of engines of the Manhattan Elevated Railroad of New York, accepted a position as division master mechanic of the New York Central at Mott Haven, New York. The new place did not suit him and he resigned, and intimated that he was going to California to turn farmer. A month ago Mr. Thompson went running an engine on the Elevated Railroad of Chicago.

We recently gleaned a few particulars about the experience of Mr Thompson as a farmer. Having friends on the Pacific Coast, William was persuaded to try his hand on a rented place before purchasing, which he fortunately consented to do. A good farm was selected and all appeared to go merry as a marriage bell when the looking round period was on. Then he got a few necessaries together and took possession of the house

"Now," he said to Mrs. Thompson, the morning after arrival at the place, "the first thing to do is to get a garden ready. I'll spade you up a fine plot and you can get all the seeds you want put in it right away."

"Had'nt you better wait till the plow comes and have the ground plowed," suggested Mrs. T

"Oh, no," said William, "I cannot wait for that. My motto is strike while the iron is hot"

He measured off about half an acre and proceeded to turn over the soil as if his life depended on the work being done in one day The hot sun poured down and the hot moist air rose from the baked ground, but William toiled at his determined task and finished it in good style Next day he was laid up with an attack of muscular rheumatism. Lying in bed in a solitary farm house is not an exhilarating experience to a man accustomed to the bustle and turmoil of cities, but the neighbors, who were not more than four or five miles away, would make visits of condolence every four or five days and do their best to cheer the sick man. Several of them were very careful to assure William that he had their regards and they would not fail to attend his funeral if he died.

He did not die, however, but after two or three weeks got round, painfully leaning on a cane. Mr. Thompson had an idea that he would pull California farming out of the rut of grain-raising that it had fallen into. The way to make money in farming, he told his neighbors, was by raising stock. To show the way, he began by buying a thoroughbred bull. The animal was delivered and was kept in the pasture, secured by a long rope and stake. William was proud of the bull, and during his convalescence spent considerable time visiting with the bull and admiring its various good points. One day he thought it would be a good plan to change the bull to another part of the farm, so he pulled the stake, and as he was still very lame, fastened the rope round his waist as an aid to locomotion. As he drove along something frightened the bull and he began to run William shouted and held back, but the more he shouted the faster the bull ran. He was like the innocent tender stuck to a runaway engine. He was anxious to let go but couldn't Failing to let go he tried to keep up, and soon was running with steps that took about three to the acre. He held bravely on through a thick piece of brush and a muddy creek, and was still right end up when the bull reached the barn.

Next day he could walk without a cane. The incident that brought about his sudden cure of lameness, however, broke his confidence in farming. As he was tearing along like a rocket, attached to the bull, he reflected about the mortifying end it would be to get killed in that tame way, after passing through all the perils of running locomotives in three continents. The thought was too much From that moment William turned his thoughts eastward, and a few months later found him speeding toward the restful haven of Chicago.

## Stack-base Damper.

The Rogers Locomotive Works have lately delivered to the New York & Northern Railroad a passenger engine, cylinders 18 x 24, 62-inch drivers and a double-ender rapid transit engine, cylinders 14 x 22, 54-inch drivers, fitted with the usual appliances of first-class engines, and with the Luttgens' stack-base damper, this being the third lot of engines furnished to this company so fitted.

Howe, Brown & Co., Limited, of Pittsburgh, have sent out a circular to railroad men, intimating that they are prepared to supply crucible steel cast-steel suitable for fireboxes. It is said that some fireboxes recently taken out of engines on the Chicago & Northwestern Railway, that made extraordinary mileage, were made of crucible steel, and this is evidently why the makers offer to resume the manufacture of this article.

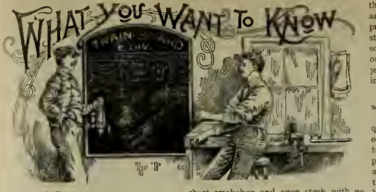
A very simple form of brake slack adjuster has been patented by George L. Harvey, Chicago. A ratchet is attached to the brake-rod which connects with a clutch by a sliding-rod. When the brake piston travels beyond the limit, the clutch moves a catch along the ratchet one notch, thereby taking up the slack. It is one of the simplest devices we have seen for the purpose

Messrs. Spon & Chamberlain, of Cortlandt street, New York City, have sent out a circular intimating that the Standard Electrical Dictionary, by Professor T. O'Conor Sloane, will soon be ready This book will be of great service to the many men who are trying to post themselves on electrical matters.

Jackson, Sharp & Co. have contract for thirteen coaches and two chair cars for Jacksonville, St. Augustine & Halifax River Railroad

## Burdette on the Drummer.

"He looks over my shoulder as I register after him, and hands me a card with a shout of recognition; he peeps over the register again, and watches the clerk assign me to ninety-three. 'Ninety nothing!' he shouts 'Who's in fifteen?' The clerk says he is saving fifteen for Judge Dryasdust. 'Well, he be blowed,' said my cheery friend. 'Give him the attic, and put this gentleman in fifteen.' And, if the clerk hesitates, he seizes the pen and gives me fifteen himself, and then he calls the porter and orders him to carry up my baggage and put a fire in fifteen, and in the same breath adds 'What time will you be down to supper, Mr Burdette?' And he waits for me, and seeing that I am a stranger in the town, he sees that I am cared for, that the waiters do not neglect me, he tells me about the town, the people and the business, he is breezy, sociable, full of good stories, always good-natured, he frisks with cigars, and overflows with 1000-mile tickets, he knows all the best rooms at the hotel, he always has a key for the car seats, and turns a seat for himself and friends without troubling the brakeman, but he will ride on the woodbox or stand outside to accommodate a lady, and he will give up his seat to an old man. I know him pretty well. For three years I have been traveling with him, and I have seen the worst, and I know the best far outweighs the worst. I could hardly get along without him. I am glad he is so numerous"




(73) H. T. F. says:

Why does not an injector, say the Monitor of '88, or Seller's of '87, waste water at overflow while working? *A.*—Because the injectors are so constructed that the stream of water is carried over without any escaping.

(74) C. W. W Stovall, N. C., says

The Westinghouse Instruction Book says the pressure on top and bottom of valve 17 is equalized. I think there is a greater pressure on the top on account of the valve stem on bottom of valve, which gives the top the greatest area, consequently the greatest pressure. Am I right? *A.*—Yes. The difference is very little, however.

(75) E. F. B., New Orleans, La., asks:

Why do locomotives have brass or copper throttle-stems while others have iron or steel? *A.*—Because copper or brass is not so liable to corrosion as iron. 2. I was on an engine that had her pop set to blow off at 132 pounds pressure. When pulling on a hill she did not pop when she had 145 pounds Please tell me the cause. *A.*—The safety-valve was badly adjusted, or was out of order.

(76) E P., Montreal, Que., writes:

We were talking about the crystallization of metal, and a man whose opinion is considered of value said that the talk of metal becoming crystallized by use is an old-fashioned fallacy. How is that? *A.*—The theory that metal becomes crystallized by vibration, shock or constant stress is no fallacy. In tests where metal is vibrated till it breaks, it is seen that a change to crystalline structure has taken place.

(77) C. H. K., Tucson, Ariz., writes:

What is the difference between a high-pressure and low-pressure engine? *A.*—The difference usually has been that a low-pressure engine exhausts its steam into a condenser. In early days engines of that type worked very low steam pressure. Condensing engines nowadays often use as high steam as engines that are called high-pressure engines. The original distinction between high-pressure and low-pressure engines was that one exhausted into atmosphere and the other into the condenser.

(78) Subscriber, Ennis, Tex., writes:

We have some ten-wheeled engines with eccentric blades about eight feet long. When you get one of them running about 30 or 35 miles an hour you cannot drop the reverse lever down. Some of them have caused a clean sweep of all the motion when the attempt was made to hook them up What is the matter? *A.*—The eccentric rods are too long and heavy. They get vibrating from the movement of the engine in a manner that puts the link beyond control. The trouble is a common one.

(79) P. W., Atlanta, Ga., asks:

What is understood by the expression, "An American engine," when applied to a locomotive? *A.*—An ordinary eight-wheel engine with a four-wheel truck. 2. What is the leading difference between an American engine and an English engine? *A.*—American engines have outside cylinders and bar frame with provisions for arresting sparks. English engines generally have inside cylinders and slab framing with short smokebox and open stack, with no provisions for spark-arresting. There are other minor differences

(80) S. P. R., Cincinnati, O., writes:

Why is it that they put thicker steel in the shell of a large boiler than in a small one? *A.*—Because there is greater surface to receive pressure, and greater strength is necessary to resist the tendency to burst open the boiler. This will be understood better by imagining you see a ring of the boiler one inch wide. If this ring is 66 inches diameter it will have a surface of 207 square inches. With 100 pounds of pressure to the square inch there will be 20,700 pounds pressure on this ring. If the ring is only 50 inches diameter, the square inches exposed to pressure will be 157, and with 100 pounds of steam the total pressure will be 15,700 pounds.

(81) J. M., Kansas City, Mo., writes

What is cylinder condensation and re-evaporation? I have several times seen the expressions together, but do not understand them. *A.*—When the steam enters the cylinder it generally goes into contact with metal colder than itself. As ordinary steam has only sufficient heat to keep it in the gaseous form, the least abstraction of heat causes some of the steam to turn into water. At the end of the stroke, when the pressure is released from the steam, the water that has been condensed at the beginning of the stroke is liable to turn back into steam. This practice of steam condensing at the beginning of the stroke and re-evaporating at the end inclines to make an engine wasteful of steam.

(82) Foreman, Omaha, Neb., writes;

In reading your paper I see that you say in speaking of the big wheeled locomotives on the New York Central that the increase of wheel has made the engines easier on fuel. I cannot see why it should. It is contrary to the law of mechanics, which says that increase of speed is obtained by decrease of power. The same horse power must be exerted to pull the trains, whether the wheel be large or small. *A.*—There is a certain piston speed that is the most economical in the use of steam. When an engine with a small wheel has to run very fast the piston speed is so great that the steam is not used to good advantage. The comparatively slow piston speed is what gives a big wheeled engine the advantage.

(83) D. A. G., Pittsburgh, writes.

In answering a question in the July number you say that compression is back-pressure. If I understand the thing properly you are away out. If compression is back-pressure, why make two names for one thing? *A.*—We suspect that you do not understand the action of steam in the cylinders very well. Compression is back-pressure in the piston, yet back-pressure is not necessarily compression. When a piston begins to move on its return stroke it is obstructed by steam generally of low-pressure, that has not had time to escape through the open valve. That is generally known as back-pressure. When the valve advances to the point where the valve closes, the steam left in the cylinder gets squeezed into smaller bulk, and the pressure rises sometimes so high that it raises the valve off the seat. That is called compression, because it represents the time that the steam is closed in the cylinder and compressed. Although being compressed it is still back-pressure, as it obstructs the movement of the piston. Persons interested in questions of this kind ought to study books bearing on the subject or the current articles by Harris Tabor in this paper.

(84) Chequamegon, Ashland, Wisconsin, writes:

Will you kindly answer the following question to settle a dispute With a train of thirty cars of air we turn up fifteen retaining-valves, make a reduction of fifteen pounds, recharge train and make a second application of ten pounds. Now, does this second application apply to the rear brakes only, or to all, and if so have the forward brakes with retaining-valves turned up twenty-five pounds pressure? Our retaining-valves are weighted to fifteen pounds. *A.*—When you first release brakes the forward cars will retain fifteen pounds, then when you reduce train-pipe pressure ten pounds there will about eighteen pounds flow into the cylinders instead of ten, after air has passed the triple and gone to the cylinder it has no influence on the movement of the valve; when the second reduction is made about eighteen pounds will flow into the rear cylinders and about the same into the forward ones; this is *added* to the fifteen already there, but probably loses a little from the resistance of the pressure already there. The Westinghouse people say the pressure on the brakes with retaining-valve will be practically about twenty-five pounds; the *exact* figures are hard to arrive at.

## Air-Brake Disorders.

By Paul Synnestvedt.

Permit me to hazard a few more guesses on some of your air-brake puzzles.

The flattening of one wheel without the other showing any damage is not an infrequent occurrence, and is probably due to the fact that when the pair slid one rail was slippery from moisture or oil, and the other dry or possibly sanded. Many air-brake men know that a wheel can slide quite a long distance on a wet or greasy rail without doing it any perceptible damage, for it does not begin to flatten until it is so heated that the chill is taken out, and then it wears away very rapidly. Of course heating takes place on a dry or sanded rail much more rapidly than on a wet slippery one. Another condition that may have entered into the case is that there is quite a difference in the chills of different wheels, especially in the depth of the chill, and the deeper one would take longer to heat up to the softening point.

Though the statement is made that the chill seemed to be all right, I think it would be found on very close examination that the metal was damaged immediately around the flat spot, for I have known many cases where, though examination revealed no defect in the metal and the wheel would run ordinarily till the spot was worn away, a very cold day would cause it to shell out so badly as to make the wheel dangerous to run.

Mr. Woods' puzzle looks to me very like the case that excited so much discussion a short time ago, in which the inside of one of the hose was damaged in such a manner as to prevent all the brakes from setting from one end, while they worked all right from the other end. From some defect in hose or piping on the box car the forcible separation of the coupling back of it closed the communication, preventing the escape of air from the forward section, but of course not interfering with the operation of the brakes from the head end. Possibly when stretched the internal lining of the hose gave way and rolled up in such a manner as to close the opening.

Mr. Relyea's brake-puzzle is one that is encountered in actual practice probably more than any other one in the whole list of air-brake difficulties. The engineer's constant complaint is "my tender-brake sticks," and he generally wants the triple-valve cleaned, quite naturally supposing that that is the seat of the difficulty.

I think that out of ten such cases there is seldom more than one in which any of the trouble is due to the triple-valve. Some times the cylinder needs oiling, or it is full of dirt, and the leakage groove is not performing its proper functions because it is stopped with gum. Generally, however, such trouble arises on the engine, which, when first equipped with the driver-brake, were supplied with an auxiliary reservoir under the tender of sufficient capacity to supply both the tender and driver-brake cylinders. Afterward a separate reservoir was provided for the driver brake, leaving the large reservoir under the tender with only one 8-in. cylinder to supply, and resulting, on an application of the brakes, in a much higher equalized pressure under the tender than in either the driver or the car-brake cylinders, and this necessarily causes the brakes to reset after a release when the pressure in the train-pipe becomes reduced by feeding into the reservoirs under the train in which the pressure is not so high. I know of many engines on which "tender-brake sticking" has been permanently cured by simply putting on a smaller auxiliary reservoir.

Although well satisfied with Mr. Holmes explanation of the reason why one engineer's valve can be handled successfully in the service-stop position with the little drum cut out, while another cannot, I am much surprised at his statement that it is possible to stop a train in a shorter distance in service application than in emergency. It seems to me it would be very poor policy to suggest to the men anything other than the instruction that they must never hesitate to use the full emergency in any case where there is a question of danger, for although I am well aware that with all the air exhausted out of the train-pipe there is considerable back leakage through the triple valves, and that a wheel loses braking power when it begins to slide, the back leakage can be prevented by putting the handle back on the lap after making the application, and there is little danger of much damage being done in the way of flat spots, provided the pressure carried be not excessive, as a wheel rarely or never slides at a high rate of speed.

There is no question but that some men are recklessly free with their use of the emergency action of the valve, and all reasonable measures should be taken to remedy this evil, but I cannot help saying in behalf of those whose lives and limbs may be in danger, that considering the fast time made by the trains of the present day, the large number of trains run on the same track, many of them only a few minutes apart, and in general the many dangers that threaten the passenger as well as the railway employé, it is best that too many restrictions should not be put on the actions of our locomotive engineers else they may hesitate in case of doubt, and it is assuredly true that when running at a speed of 60 miles an hour "he who hesitates is lost."

*Chicago, Ill.*

"Speaking of the inability of compound locomotives to burn the same coal as common locomotives," said M. N. Forney, "reminds me of a little story There was a young doctor who was called upon to attend a patient who was in the last stages of consumption and who desired very much to have some corned beef and cabbage. The doctor thought the patient would die very soon, and perhaps it would hasten his death, so he allowed him corned beef and cabbage. The patient began to improve, and finally got well. Soon afterward the doctor had another patient, of the German persuasion, who was suffering from stomach trouble, and who, in the absence of the doctor, ate corned beef and cabbage and died. Thereupon the doctor made this entry in his book 'Corned beef and cabbage cures consumptive shoemakers and kills dyspeptic Dutchmen.'"

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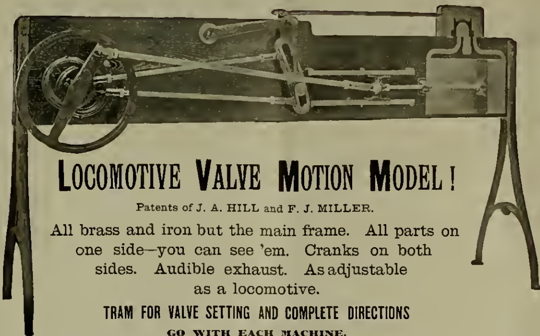

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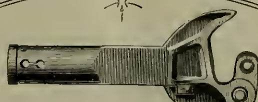

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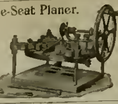
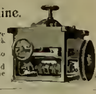


—DAVIS—

Valve Port Milling Machine.



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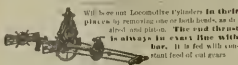

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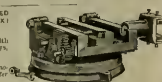

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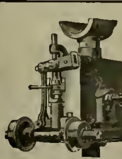

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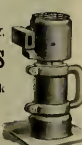

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# LOCOMOTIVE ENGINEERING.

A Practical Journal of Railway Motive Power and Rolling Stock.

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## A Tortuous Climb.

The engineering difficulties encountered by the Canadian Pacific Railway in crossing the Selkirk Mountains are strikingly illustrated in the annexed engraving. Four tracks are shown from the point where the photograph was taken, three of them being almost parallel, each working upward to attain the elevation necessary for climbing over the upper pass

The scene represents "The Loops in the Selkirk," situated immediately west of the summit of the Selkirk range of the Rocky Mountains and a short distance beyond the great glacier of the same range. By means of these loops, which show four portions of the main line, the road is brought down from a considerable elevation to a lower level and the apparent paradox of two trains rushing past one another on the same pair of rails not unfrequently occurs. The loops occur in the midst of some of the most magnificent scenery of the Rocky Mountain ranges and in the immediate vicinity of the peak known as Sir Donald, and the highest in that range on the line of the Canadian Pacific Railway. A few miles east of the loops is the Glacier House, one of the picturesque and luxuriant chalet hotels erected by the C P. R. Co., about a mile and a half from the great glacier at the foot of Sir Donald; a favorite stopping-place for tourists and hunters of the mountain sheep and mountain goat. The river in the valley fed by the glacier is the Illecillwaet.

This is one of a variety of most striking views which we have of this region. For those who are fond of mountain scenery or of examining difficult engineering works, we know of few places that would give greater satisfaction than a trip over the Selkirk Mountains, on the Canadian Pacific Railway.

The trip can be made from Montreal to Vancouver in about six days, and the splendid accommodation provided by the Canadian Pacific Railway makes the trip a luxury

CANADIAN PACIFIC CROSSING THE SELKIRK MOUNTAINS

## Notes on the German Railroads.

[EDITORIAL CORRESPONDENCE.]

It seemed to me as if I got into Germany on stepping on board the Norddeutscher Lloyd steamer *Ems* at Hoboken. She was manned from bridge to forecastle by Germans, many of them unable to speak a word of English, the signs and notices were printed in German and the cooking was German, while charges were all in marks instead of dollars.

Of course I went into the engine room and stoke hole—they couldn't have kept me out with a gun. The *Ems* is eight years old and is fitted with compound engines [illegible] high-pressure cylinder in the center and two low-pressure cylinders, one on [illegible] I did know the diameter of the [illegible] cylinders in meters, but cannot [illegible] I should say the high-press-

The pressure gauges were numbered 1, 2, 3, 4, 5, 6, 7, and pressure was at 6, which meant 90 pounds, the gauges being figured for atmospheres, 14.7 pounds, practically 15.

had covered about 390 miles a day—which in going eastward is less than twenty-four hours by some thirty-six minutes, as you go toward the sun.

I shall not attempt to describe the engine

The engineers do not get half as good pay as locomotive runners and the firemen get about half what men on locomotives in the United States do.

But, I started to tell you something

Railway Station, Frankfort-on-the-Main.

[illegible] about 40 inches in diameter and the [illegible] 60 and 70 respectively, all with [illegible] of 42 inches.

[illegible] were four boilers about 18 feet in diameter, but very short, with three furnaces in each end.

The engines were started at Hoboken on Saturday morning at 7.30 o'clock and were not slowed down or stopped until we reached Southampton, England, a week from the next Sunday. They had made over 700,000 revolutions and the *Ems*

room, it is simply a labyrinth of machinery for almost every conceivable service, water works, lights, fire, drainage, hoisting, cooling, etc. An ocean steamship can only be likened to a village afloat—a village of 1,500 inhabitants.

about the German roads. Well, there a[illegible] some things to admire and others tha[illegible] wouldn't suit the restless American pub[illegible] at all.

In the first place the most of them a[illegible] owned by the government and they a[illegible]

Railway Bridge at Cologne.

conducted in military style, every last man wears a uniform, even the section men, you won't find any enginemen there with overclothes on. There are about three times as many men around as you will find in America. There are no baggage checks and large numbers of "grip packers," as the Americans call them, are suits trimmed with red, with the brass insignia of railway service, two wings and a wheel, on the collar and cap.

The cars are compartment affairs with the doors on the sides. There are four classes, first for blooded people and tourists, 33⅓ per cent. higher than second class and little better. The best German distinguished from the crew by a red leather bag, with a shoulder strap of the same material.

You have bought your ticket, tipped your porter and got into a compartment marked "Nicht Rauche," which means no smoking. The gafter has punched your ticket and closed the door, all the others railroad. Every street and road-crossing, no matter how remote, has a gate and a guard in uniform, and as the train passes each man comes to a salute position with his flagstaff used as a gun.

The section buildings are very much superior to the best of ours. They are far longer and have facilities for getting from

Roman Gate, Cologne. Railway passes through

around to lug baggage, for which you are expected to *tip*, in fact tipping is the principal exercise foreigners are expected to indulge in.

The station-master wears a red cap and a blue suit with red trimmings, gorgeous shoulder straps, braid, etc.; the train crews, engineers and firemen as well, wear blue people ride second class—I went with the best. The third class is cheaper but has seats without cushions, while the fourth class cars have no seats, and fifteen to twenty persons are crowded into a section, yet they are always full.

The train crew—brakemen—collect the tickets before you start. The conductor is are closed, the trainmen salute the conductor, he salutes the station-master, a porter rings a bell on the platform, the station-master swells out his chest and whistles on a little dingus hanging to his uniform, the conductor whistles on a similar concern, the engine gives a sharp little screech and you are off—on a German [illegible] platform [illegible] without crossing any tracks.

The platforms are spacious, the waiting rooms large and all accommodations clean and good, the buildings are of stone or brick, handsomely ornamented and are built to stay, all the permanent way is the same, heavy and substantial.

Across the Rhine at Coblentz.

The photographic reproduction of the station at Frankfort-on-the-Main shows one of these buildings for a moderate sized city. There are three immense train sheds of iron and glass, with an elegant station in front of them. On all station platforms in Germany clocks are placed to face each way, and on many of them the difference between official, or railroad time, and local time is given. Thu at Bremen, where we landed, the station clocks were marked on the face + 24 m., which means that the railroad time is twenty-four minutes ahead of local time. The picture of the Frankfort station was taken before the carriage drive in front was finished.

The railroad bridge at Cologne is a sample of this permanent kind of work. The noted cathedral is shown in the background. This bridge crosses the Rhine. Another handsome piece of steel is the Rhine bridge at Coblenz, while the bridge at Mainz is fully as good.

Cologne was once a walled city, the original walls having been built by the Romans in the twelfth century. These walls have been taken down and parks made in their places, but the historic old gates have been left as monuments. Through one of these, the

"Hahnen Thor," a railroad enters the city. I couldn't get a picture with a locomotive in it, but here is the gate.

As I sat looking at it I dreamily imagined it peopled and guarded again by Cæsar's soldiers, with their zinc undershirts, wire socks, battle-axes and two-handed swords, and I wondered how many of 'em would shed their tin overclothes and try to climb those little trees if one of these modern Dutch locomotives made a dive for that gate with her pop up and whistle open.

It is seldom that passenger trains are late in Germany; they run only about twenty-five miles per hour, but they are very regular. On top and at the ends of the coaches there are little coops for the train crew, where they can see over the [illegible]. These little houses are found perched [illegible] ends of cars, even four-wheeled [illegible] cars having brakes [illegible] freight cars have brakes, [illegible] entirely unprotected in this [illegible] large cars you will find [illegible] employes in stopping [illegible] setting the club in front of [illegible]

[illegible] and six-wheeled, [illegible] American [illegible] wheeled [illegible] cars are being introduced [illegible] have [illegible] heavy iron trucks and [illegible] side beams.

All cars have an immense spring buffer at each corner and are coupled together by a couple of links on hooks. Between these links there is an inch and a-half square threaded bolt, one end right, the other left, and from the center of it projects a handle with a weight on it; the slack is taken up with this before starting.

About ten six-wheeled carriages seems to be an average passenger train. These cars seat thirty four passengers and weigh nearly 800 pounds per passenger.

The car wheels are always of wrought iron, 38 and 40 inches, and the pedestal jaws are long and light, the bearing on each side of the box being but 1 inch wide.

The Carpenter air-brake, which has been applied to upward of 2,500 engines and 10,000 cars, is now being taken off, and the Westinghouse applied. It is claimed that the Carpenter brake was not reliable and produced destructive shocks.

The engines are generally four coupled with a single pair of leading wheels. They are not large engines and seem to have rather an easy job of it—I did not see a thirty-car train of freight in Germany.

The cabs are short iron ones without side windows. The injectors are on the boiler-head and the door handle is on the hinge side of the door and is placed on an extension of the hinge-pin so that it is about twelve inches above the door and can be reached without stooping down.

Screw reverse is used, and the throttle is a grindstone crank that is opened by shoving it from you. This has one advantage over the American plug, and that is that it is handled easily and will stay where you put it without a latch.

There is no provision at all for the crew to sit down, but on one engine I was on the engineer had a little iron three-legged stool with a round seat of wood; he sat on this *in the tank gangway*.

The tenders have iron boxes in each head and the water space is *under* the coal pit, so that coal is shoveled from about knee high.

There are no bells used on German engines but they have two whistles.

Great care is taken of oil; the fireman does the oiling, and when a long stop or lay-over is reached he pulls the wool feeders out of all the truck and driving-wheel boxes and those on the tank; when they start he goes around and sticks them all in again. Truck and car boxes are small. The top of the box is but large enough to hold the brass and carry the spring above it. The cellar is the largest part of the box and can be taken off, exposing the lower half of the journal, without any trouble, generally by loosening one screw.

Every freight car is marked with its weight, length between end axles, load capacity in kilos, age, etc., and has in addition the number of horses and the number of men it can carry in case of war—usually six horses or forty men.

Perhaps two-thirds of the goods shipped are loaded in open cars with sides about three feet high. This car is piled full of some commodity and then a large tarpaulin is tied over it. This canvas is numbered the same as the car. This variation in load makes it impossible to get over a freight train and calls for a load gauge. These are frames built over the tracks at all important stations with iron pieces hanging down from the top and hinged from the sides. If a load touches one of these irons it is too big and can't go. The largest cars carry fifteen tons and from that down to six tons.

The engines carry the clumsiest looking jacks I ever saw, they have wooden sides and the bar has teeth instead of a screw; the head is lifted by a crank.

Copper fireboxes and brick arches are universally used, while open stacks, short fronts and high nozzles are the rule.

Machinists in the shops get about 4½ marks a day, a mark being equal to 24 cents of our money. Engineers get 1,800 marks the first year, which is increased to 2,100 the third; this is the highest pay, but the men make premium money on oil and fuel, which amounts to considerable—one engineer told me that he made 3,400 marks last year on a favorable run. They have free doctor, hospital service and a pension when disabled or old, the same as soldiers, and there is a permanence to their positions that is at least encouraging.

There are very many details of the engines and shops that I have gathered, with the camera and otherwise, which I shall give to the readers of LOCOMOTIVE ENGINEERING when I get back to the land of the stars and stripes. J. A. H.

AT MAINZ, GERMANY.

A letter from Geo L. Beckwith, of Pacific Junction, Ia., takes up the proposal made by a correspondent of running trains with the baggage car behind so that there would be lessened loss of life in case of a collision. Mr. Beckwith looks upon this as a barbarous proposal and holds that the life of a baggageman is of as much value as that of a passenger, and is deserving of as much protection.

## Master Mechanics' and Car Builders' Meeting at Galveston.

A Galveston, Texas, correspondent, who signs himself J. McD., sends us the following notes of the above meeting.

There was a meeting of Master Mechanics, Master Car Builders and Joint Inspectors held in this city on the 20th and 21st instant, with representatives from the following railways: G. C. & S. F., I. & G. N., S. A. & A. P., H. & T. C., So. P., T. & P., M. K. & T., Ft. W. & Rio Gr., A. T. & S. F., St. L. & S. W., 'Frisco, Mo. P., St. L., I. M. & S., H. E. & W. T.

Mr. F. Reardon, master mechanic of the Mo. P. Ry., was chosen chairman and Mr. Cain, of the A. T. & S. Fé, secretary; both were good selections. After complimenting the meeting for large attendance, the chair called on Mr. Douglas, master mechanic of the T. & P. Ry., to explain the purpose for which the meeting was called. Mr. Douglas, in a few well-chosen words, said the principal object of this convention was to see if some uniform understanding could not be agreed upon to get rid of the present annoying and unsatisfactory manner of carding cars. The friction caused by the too rigid inspection of cars at local and interstate points was so disagreeable that this meeting was called with a view of more friendly relations and uniformity of inspection and carding.

The matter was discussed in an intelligent and friendly manner, and it was decided to have a representative from each road present form a committee to draft resolutions, and submit them to the meeting later for adoption. The following gentlemen composed the committee:

John Player, A. T. & S. F.; Jos. Billingham, G. C. & S. F.; F. Reardon, St. L., I. M. & S.; W. P. Siddons, I. & G. N. Ry., Jas. McGee, H. & T. C., Jas. Doyle, M. K. & T., J. R. Cade, So. Pac., G. A. Hancock, S. A. & A. P.; J. R. Groves, 'Frisco, R. N. Galbraith, St. L. & So. W., F. McGee, Ft. W. & D.; C. H. Burke, Ft. W. & Rio G.; E. A. Campbell, H. E. & W. T.

The committee not being ready to report at 4 P. M., they accepted, through the courtesy of Mr. Farrell, of the Sante Fé, an excursion on the bay, that they might have a good view of the harbor improvements of the deep-water port of Texas. The sail was delightful, but on the return trip there was not enough wind to fill the ship's sails, and, as a sailing craft cannot "compound" in a calm, the party had to disembark and walk over the Jetty Railway. On arrival at the beach they disported in the surf until, wearied with the day's work and pleasure, they retired.

Promptly at 9 A. M., next morning, Chairman Reardon called the meeting to order and announced readiness for the report of the committee. Secretary Cain read the report, as follows:

"Your committee, appointed to devise a uniform system of inspection and carding of cars on the railroads of Texas and connecting lines, recommend that inspectors be instructed to receive all foreign cars having old defects which do not render them unsafe to run or unsafe for trainmen; that a record of the condition of such cars be kept, and that each company be responsible and card only for new defects of foreign cars that may be brought about while the cars are on its lines. Inspectors are requested to dispense with the use of indelible pencils, and use pen and ink when making out defect cards. A copy of these resolutions shall be furnished the representatives of Texas and connecting railways."

The report of the committee was unanimously adopted.

Mr. Adrien, of the Westinghouse Brake Company, being present, extended an invitation to all to go fishing, promising that he would furnish enough air to fill the ship's sails for the return trip. The invitation was accepted, and many availed themselves of the pleasure.

After adopting resolutions thanking the Galveston *News*, Houston *Post* and citizens of Galveston and managers of the Beach Hotel, also the Pullman Palace Car Company, for use of a special car, and Mr. Billingham and Mr. Farrel, for courtesies, the meeting adjourned.

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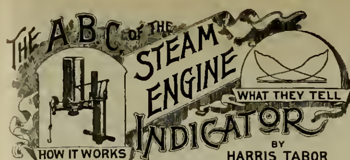
The New York Central Railway, in its exhibit at the World's Fair, will strikingly illustrate the wonderful improvements that have been made in railway transportation by showing a magnificent, complete vestibuled train and alongside of it a reproduction of the first train of cars used in this country, the cars of which resemble old-fashioned stage coaches.




Probably no recent change in the construction of locomotives has had so great an influence on the motive department as compounding is bound to exert; and as this influence will touch the traffic manager as well, in the way of cheaper haulage, it is only fair to assume that *all* railway executive officers must soon give this question serious thought. The gains from compounding involve so small a cost and risk, and so little change in existing plans, that we may expect to see this system tested very soon on all important roads. Where tests have been made, with rare exceptions, the results have been largely in favor of expanding steam in two cylinders. In many cases the gains reported have been so absurdly large that conservative railroad men have regarded them with skepticism. It is an argument with radical reformers that advocates of a cause can never hope for all they ask, and for this reason claims are made looking away beyond possible realization. It is possible the more enthusiastic advocates of the compound locomotive are influenced by the reformer's argument when they claim a gain of from 40 to 60 per cent. over a simple engine in ordinarily good condition. Such gains are simply impossible, and must be so considered in discussing the compound and simple engine.

It is a general belief that the source of gain from compounding lies in the fact that expansion of steam may be carried farther, with less condensation, in two or more cylinders than in one. If steam at an initial pressure of 100 pounds be expanded to the atmosphere, the range of temperature will be from 327.9 degrees at 100 pounds, to 212 degrees at atmosphere, or $14\frac{7}{10}$ pounds, a range of 115.9 degrees. To a certain extent the walls of the cylinder respond to this change in temperature. The low temperature of the exhaust steam cools the cylinder, which is again warmed by the incoming steam from the boiler; this transfer of heat from the steam to the cylinder causes initial condensation, which is a serious loss. When the temperature of the expanding steam in the cylinder falls below the temperature of the walls, a portion of the heat stored in the iron is returned, causing re-evaporation, unfortunately too late in the stroke to be of value. If steam at an initial pressure of 100 pounds be expanded through the same range in two cylinders, each cylinder will be subject to a smaller range of temperature, and less condensation will occur. Where high steam pressure is used the gain from condensation, as a result of compounding, is considerable. But this is not the only gain from compounding, nor is it the greatest gain. Clearance is always wasteful, and especially so when it equals one-eighth of the piston displacement, which is not unusual in many simple engines running in competition with compounds.

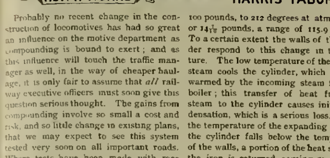
There are two ways in which clearance may be lessened: 1, by reducing the space between the valve face and piston, when it is at the end of the stroke, 2, by filling this space with steam of less weight. The best designers of compound locomotives have done both. It may be claimed with safety that the loss due to leakage is greatly reduced by compounding. In the simple engine the conditions (high-pressure on one side of piston and valve and low-pressure on opposite side) that indure leakage exist; in the compound the pressure is divided between two cylinders, and the extremes in opposite pressures are less. In the simple engine all steam that leaks past the piston goes to the atmosphere, and is wasted; any leak by the high-pressure in the compound engine must exert its expansive force on the low-pressure piston before it is released.

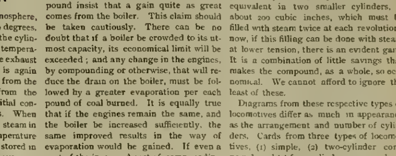
The sources of gain from compounding, thus far considered, are independent of the boiler. The advocates of the compound insist that a gain quite as great comes from the boiler. This claim should be taken cautiously. There can be no doubt that if a boiler be crowded to its utmost capacity, its economical limit will be exceeded; and any change in the engines, by compounding or otherwise, that will reduce the drain on the boiler, must be followed by a greater evaporation per each pound of coal burned. It is equally true that if the engines remain the same, and the boiler be increased sufficiently, the same improved results in the way of evaporation would be gained. If even a part of the increased cost of compounding a locomotive would be put in additional heating surface of the simple engine's boiler, it is probable that its evaporative qualities would be equal to the compound.

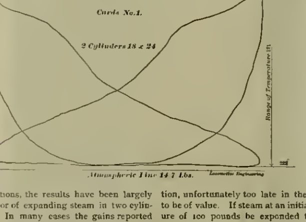
In the preceding paper attention was called to two distinct types of compound locomotives which have been thoroughly tested in this country, these have become standardized as commercial machines, under the names of two and four-cylinder compounds. These only will be considered comparatively. There is a greater difference in these types than the number and location of cylinders would indicate. They should be classed as receiver and non-receiver. Each has its advocates. The friends of the four-cylinder system make two strong claims, and with some show of reason. (1) A better steam distribution, because a full-sized pipe is used to supply cylinders containing only half the contents, (2) an equal distribution of power to the drivers, same as with a simple engine. The first claim is well supported by the cards recently published in LOCOMOTIVE ENGINEERING, from No. "385," at the wonderful speed of more than ninety-one miles per hour. The believers in the two-cylinder system also make strong claims, which are well grounded. Their principal gains, from their standpoint, are: (1) the use of the receiver which allows a cut-off in the low-pressure cylinder, which is adjustable by the link, (2) superheat by means of the hot gases in the smokebox, by which the receiver is surrounded. The amount of heat absorbed from the smokebox is probably small; but a small amount has its value because it checks condensation in the low-pressure cylinder. There are other gains from the use of the receiver which its friends have ignored, viz., a farther reduction in the range of temperatures, and a reduced clearance by means of filling this space with steam at a lower tension. The clearance space in a low-pressure cylinder 30 by 26 inches, or its equivalent in two smaller cylinders, is about 200 cubic inches, which must be filled with steam twice at each revolution, now, if this filling can be done with steam at lower tension, there is an evident gain. It is a combination of little savings that makes the compound, as a whole, so economical. We cannot afford to ignore the least of these.

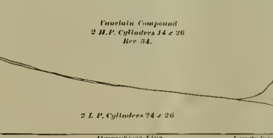
Diagrams from these respective types of locomotives differ as much in appearance as the arrangement and number of cylinders. Cards from three types of locomotives, (1) simple, (2) two-cylinder compound, and (3) four-cylinder compound are introduced for the purpose of illustrating the effect compounding has in reducing the range of cylinder temperatures and clearance. On each card is marked the highest and lowest temperature of the steam, and on each low-pressure card is marked the initial pressure which fills the clearance space.

The two-cylinder compound from which these cards were taken is the "Pitkin," built by the Schenectady Locomotive Works. Nos. 3 *A* and 3 *B* are from the "Vauclain," built by the Baldwin Locomotive Works. The Pitkin cards represent a full revolution for each cylinder, and the Vauclain a high-pressure card in one direction and a low-pressure in the opposite, the two making one revolution.




Card No. 1, from the simple engine, with much lower initial pressure, shows a decidedly greater range of temperature than either from the compounds. With 160 pounds initial pressure, this would be increased to 143 degrees. No 2 from Pitkin compound, with an initial pressure of 175 pounds, gives a range of temperature in the high-pressure cylinder of 79 degrees; and in the low-pressure cylinder a range of 78 degrees, a difference of only 1 degree. No. 3 *A*, from a Vauclain compound, with an initial pressure of 160 pounds, has a range of temperature in the high-pressure cylinder of 86 degrees, and in the low-pressure cylinder the extremes cover 118 degrees This is not a fair case, however, for an increase in speed to running conditions would raise the back-pressure line, and consequently the temperature, which would reduce the temperature range in proportion No 3*B*, from the same type of engine, represents more nearly the average running conditions Here we find a difference of only 3 degrees in the two cylinders But with the same initial pressure, as shown on the two-cylinder card, the range in the high-pressure cylinder would be increased 2 degrees, and with the same back-pressure in low-pressure cylinder, the range in that cylinder would be increased 14 degrees. If we consider these cards with a view to filling the clearance space, we find that in No 1 it takes steam at 125 pounds, in No 2 at 60 pounds, in No. 3*A* at 58 pounds and in No. 3*B* at 75 pounds

Harry Tobey

## A Practical View of Compound Locomotives.

Mr. F D. Casanave, superintendent of motive power of the Western lines of the Pennsylvania system, is recognized as being one of the ablest and most progressive railroad officers in the country. He has given careful study to the subject of compound locomotives, and his views on the question are well worthy of consideration. At the Master Mechanics' Convention he said

"We have had no experience with compound locomotives on our road so far, having had only four or five, which are scattered over a large territory, and we have very few figures to show the economy From somewhat imperfect trials which we have made of one compound of one type we have found an economy of about 5 per cent. in fuel. There is no doubt, from all the figures shown, that there is economy in compounding and that the economy will be greater where the price of coal is larger, but it seems to me that one of the essentials is to confine the compound locomotive to the simplest form That matter of repairs is one that must be looked to in order to ascertain whether any saving in fuel will not be absorbed by it. The compounding of locomotives is certainly in its infancy. If I were to take the money out of my pocket to equip a railroad I hardly think I would go very extensively into compounding I would wait for a year or two until it is clearly shown where the range of economy lies "

## Improvements on Fitchburg Railroad

On a recent trip East one of the many things we found to interest us, and which indicates progress of the most gratifying character, is the management of the operating department of the Fitchburg road In the adoption by this company—virtually the first New England road to do it—of the standard code, with some slight modifications where changes are made, the departures strongly indicate improvement The effort made to secure more rapid movement of freight, that is a fixed determination to deliver all freight received to destination, whether local or through, within 24 hours of its receipt, is most commendable. That the *shipshod* manner in which the average road handles its freight business is open to the harshest criticism, there is no doubt whatever in our minds, and this effort on the part of the Fitchburg road cannot help but meet with the most substantial encouragement on the part of shippers The senseless practice, so commonly in vogue all over the country, of hauling half-filled cars for hundreds of miles and returning them entirely empty, is receiving attention and great savings are effected. That other roads will sooner or later give this matter the attention it deserves there can be no question of doubt.

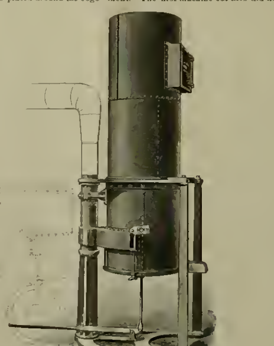
President Marcy is to be highly complimented for bringing about these numerous reformations. They reflect very creditably upon his management and his selection of men to bring them about.

## Long's Swinging Cupola.

The accompanying illustration represents a cupola furnace having a hinged movable section which moves both horizontally and vertically from under the upper or stationary portion of the furnace.

The advantage gained over the ordinary stationary furnace is the ease and convenience with which the necessary cleaning and lining process is performed. This improvement is not found in any other furnace manufactured.

The dotted lines represent the hinged section in position for picking and lining, which is performed by the operator from the outside with the same ease and convenience as an ordinary foundry ladle. The bottom of sand or clay can be placed more securely, and the kindling and bed of coke may be charged, after which a daubing of clay is placed around the edge



LONG'S SWINGING CUPOLA.

of the hinged section to insure a tight joint when closed.

In an open position, the hinged section is somewhat lower, to allow it to pass under the plate When in a closed position, as shown, a lifting jack is placed under the bottom, which elevates and holds the section in position and insures a tight joint as the process of melting is carried on, after which the jack is removed, allowing the section to drop to the collar, on the supporting column The clay joint is broken by the drop, the section opens out, and the bottom drops in the usual way.

Mr. A Beckert, master mechanic of the Louisville & Nashville Railroad, at Decatur, Ala , and several other experts examined the working of the cupola and testify very strongly about its convenience and efficiency. It is recommended as a good furnace for melting brass and other metals in crucibles instead of a regular brass furnace The furnace effects great saving of time and labor, and ought to be valuable in railroad shop foundries. It is made by Long & Jervis Co., Decatur, Ala

One cannot go about the shops of European roads without noting the absence of machinery and the presence of extra men to what we are accustomed to in America. Men are cheap there and machinery dear. In a large shop that we visited in Germany the machine shop proper occupied about one-fifth of the space it would in our country, and while there were pits for thirty-five engines in the shops they kept each one in for about six weeks and employed 900 hands, there being more than 150 vises in the erecting shop alone. The locksmith seems to be the ideal, and tools and devices are exhibited as good, because "made by hand."

## To Prevent a Rose-Reamer from Chattering.

"I wish that seating tool would cut smooth ; it chatters fearfully," was the tail-end of a remark overheard in a shop recently. The seating tool or rose-reamer was liberally supplied with soap and paper to fill the teeth and prevent chattering, but was not entirely satisfactory. The paper and soap will help, but the best help is in cutting the teeth correctly. By correctly I do not mean *evenly*, for that is probably the way they are cut at present, but space them as irregularly as convenient, and see if there is not an improvement. The first machine-cut files did not give satisfaction, from the fact that they chattered badly, due to the teeth being cut evenly, while the hand-cut files were spaced by the eye, and consequently not exactly even ; this is remedied now, so that a man can hardly pick out a hand-cut from a machine-cut file, and the trouble has disappeared also. Try cutting the teeth unevenly, and not having them too sharp, and see if it isn't an improvement —*F. H. Colvin, in Am. Machinist.*

One thing that the Germans excel us in is their method of lighting the locomotive. All the lamps on a passenger engine are lighted by Pintsch gas. They have no headlight, but their two forward signals are reflector lamps set on the forward buffer, and are 12-inch reflector lamps. Even the gauge lamps and tail lights have gas jets. The supply is carried in the regulation sized receiver placed at the rear of the tender. It is better, cleaner, safer and a better light than oil

Things seem to be coming to a pretty pass in some countries in Europe where steam boilers are used. There was a disastrous explosion on Lake Geneva some time ago through a worn-out boiler blowing up. Instead of censuring some petty official or arresting the engineer the Juge d'Instruction caused the arrest of the leading director of the company.

## Locomotive-Running Among the Bushwhackers.

By OLD SOLDIER.

(*Continued*)

I got to Nashville O. K. with my mind made up to get back North and join a regiment, as a common soldier had ten chances for his life that engineers and firemen had on the road, but after talking with some of my friends I concluded to try it again, so I reported for duty and got another good old Roger engine and pulled out again.

Obstructions were thicker on a military road than cattle are on Texas roads. That is, such as putting cross-ties and old rails across the tracks , they did not put any fish-plates on, for we did not have any on the Nashville and Chattanooga road. I have often thought if the road had been laid with fish-plates how handy it would have been for the Johnnies. We had the U rail. This rail was made in England and, by-the-by, you seldom see as good iron as it was. About this time the business was picking up fast on the Nashville & Chattanooga road, and the management was pushing the road to Stevenson, Alabama, and then seven or eight miles further to Bridgeport on the Tennessee River. Here at Bridgeport we had quite a siege.

The two armies lay here for about fifty or sixty days and at this time we had a large army of men, and so did the Johnnies The Johnnies laid on the south side of the river and the Yanks on the north side Now, dear reader, just imagine what a sight that must have been to an eye witness viewing the great hostile armies divided by the river, both sides throwing up breastworks and expecting every day and night to come together, neither one knowing the strength of the other, both armies being re-enforced every day Now, remember this was before any of the battles were fought at Chattanooga, but the Yanks played the Johnnies a pretty sharp trick and made them believe we had a much larger army than we had. Whenever a freight train arrived at Bridgeport you would see the tops of the box-cars just lined with blue coats, with their bayonets and swords shining in the open air. They were unloaded on the brink of the river so the Johnnies could see them leave the trains. Well, every day they laid there, they thought the Yanks were being re-enforced, but they were not ; at night you would see the same men loaded in the box-cars and sent back. Of course the Johnnies would not see them going back. This was kept up all the time the armies lay there, and the Johnnies certainly thought we had a great army, but all the same we did not.

Now I will relate a little story here that a good many young men would hardly credit, and it will perhaps astonish a good many old ones . About the middle of the Tennessee River there was an island just below the bridge, and every day the army laid there you could see at least fifty or a hundred men naked on that island playing cards, shaking dice and pitching quarters and dimes and other games. Now, this was a mixed crowd, about half Yanks and Rebs. The Rebs would give the Yanks four or five pounds of tobacco for a pound of coffee. Well, this thing was carried on to such an extent that it had to be stopped by the officers of both armies, as it was getting demoralizing to both sides. It took considerable trouble to enforce those orders, but it was finally stopped, but Rebs and Yanks would converse and trade while on picket duty, but when the Yanks got ready they crossed the river and made the Johnnies fly.

Dear readers, you must not expect to be given a history of the war, but I am compelled to give you a little so you can form some idea of how we proceeded with the railroad.

Well after the army moved across the river we proceeded with the road on to Chattanooga The bushwhackers kept falling in the rear of our army and keeping the train men lively. I think about five or six engineers and firemen were picked off in one week. About this time all engines on the road had from one to fifty bullet holes in her cab and jackets.

All around Chattanooga is high and mountainous. After the Rebs got there they had a little the advantage of us in the way of those mountains but we were too many for them and we soon got the mountains from them.

About this time there was a hospital train put on. Engineers and firemen were rolling iron to Nashville by the wholesale, but you bet after they heard of what train crews had to go through with we would only average about one out of every three that would venture out. I have seen lots of men sneaking over the L. & N. R. R., especially at Nashville, making their way back to the North, and I must confess I often wished I was one of them, but I made up my mind I would stay until the war ended or until death finished me.

As I was saying, the hospital train was put on and double crewed. I was assigned to it with old Charley Benteworth for a partner. It will be necessary to give you a slight description of this train so you may understand it. It consisted of three passenger coaches and a baggage car, but this baggage car was used by the doctor in charge as a kitchen and dining room car for the doctor and crew. Of course the doctor had several nurses and he also had part of the car for a drug store. The train crews stood a watch eight hours on and eight hours off.

I suppose a good many of my readers have heard how the Mississippi steamboat crews lived before the war. Well, I assure you they were not a comparison to the way we lived.

Our living consisted of sundry goods sent down for sick and wounded soldiers, and that consisted of the best that the North, East and West could provide.

Well, now boys, this hospital train was what we call a safety train. We carried the yellow flag. No soldier—neither Rebel nor Yank dared to fire into it, but bushwhackers did not respect any flag. We carried a good many sick and wounded Rebs in those cars. I remember one night I was out of Chattanooga, I was on watch. The same day our army had a little skirmish a few miles from Chattanooga and we were loaded down with wounded men. The night was very dark. About five miles from Chattanooga I was flagged down by a small squad of men. When first flagged I could not tell whether Yanks, or Rebs, or bushwhackers, but I soon found out. It was the bushwhackers, and the first thing I knew there were a lot of them up on my engine; they told me if I offered to move they would kill me. Well, I was pretty nervous, but I managed to keep right still. By-and-bye some of them came up to the engine and asked me what kind of a darned train I called that. I told them it was a hospital train, for all soldiers—Rebel or Yank. One of them asked about the yellow flag and wanted to know if the Yanks had hired some other nation to help them. I explained the flag to their satisfaction and they concluded they could not make much by taking such a train, so they told me to pull out. Well, you bet that throttle flew out, and away I went. Of course they had a talk with the conductor and brakemen, but as I am only writing my part, you will have to put up with it. When I got to the telegraph station I reported it to the operator, but the wires were down. He reported it to the post commander and men were sent out to rout them, which I learned afterward was done.

That night, after I went off watch, I went through the train to see the wounded. I heard one fellow in one of the berths making more noise than all the rest of the wounded. I thought he was some fellow slightly wounded and filled up on whisky, but when I got up to him and saw his condition, my eyes met a sight I shall never forget; he had both arms and both legs shot off. I asked if he thought he would get well, and he said, yes, certainly he would. I asked him how he would navigate without arms or legs; he said he would get around like a tumble-bug.

I never heard whether he got well or not, but hope he did. I arrived in Nashville O. K. We lay there a couple of days and then—you will here from me again.

*(To be continued.)*

## Swedish Locomotive Smoke-Boxes.

Railroad men who read engineering papers are often struck with the stability of the established rules about locomotive smokebox arrangements and exhaust nozzles in foreign countries. Here nearly every railroad has its own practice about the arrangement of draft appliances, and those most familiar with the subject are strongly impressed with the belief that there is still a great deal to be learned about the proper size and form of exhaust-pipes, smoke-stacks, and of all the parts that affect the generation of steam. In England most of the railway companies have settled down to a forked exhaust-pipe with single nozzle. D. K. Clark established a rule for exhaust-pipes, and English engineers have been contented to follow without question as to its utility.

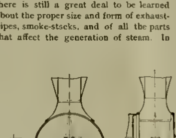
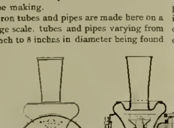


FIG. 1.



Section A B

FIG. 2.

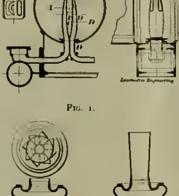


FIG. 3.

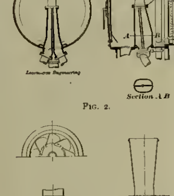


FIG. 4.

SWEDISH LOCOMOTIVE SMOKE-BOXES.

On the continent of Europe there is much more individual inquiry than there is in England, and we find in the reports of engineering societies considerable discussion respecting improved forms of draft appliances. The annexed engravings of smokebox and exhaust-pipe arrangements are taken from the *Bulletin de la Commission Internationale du Congres des Chemins de Fer* and illustrate appliances used on the State Railways of Sweden. As will be seen, they embrace annular, cylindrical and conical nozzles. The exhaust-pipes are of diverse forms, that with an enlarged body so successfully employed by Mr. McCrum on the Kansas City, Fort Scott & Memphis being represented. Some notes are given of experiments made with the forms of nozzles *C*, *A*, *B*, shown in Figure 3. The nozzle *C* was most successful. The enlargement of the smoke-box at the stack base appears to be a favorite form, but no information is given of advantages claimed.

## The Making of Boiler Tubes.

On the west side of the Schuylkill River, in Philadelphia, there are very extensive works that cover two or three large blocks with buildings. They are the works of the Allison Manufacturing Company, and are devoted to the business of car building and flue making.

In the course of a ramble through the shops I found them building a large number of hopper cars for the Pennsylvania Railroad. These cars are models of good design and have all modern improvements, including air-brakes and Janney couplers. The works are remarkably well arranged for doing the business at the least expense, the best of tools being employed in every department. Railroad men wishing to watch the operation of well-managed car works can have their desires satisfied by a visit to this establishment. To me the most attractive part was that devoted to tube making.

Iron tubes and pipes are made here on a large scale, tubes and pipes varying from 1 inch to 8 inches in diameter being found in course of manufacture. Nothing but the best of wrought-iron is employed for the making of the tubes turned out in these works. The company have made steel tubes repeatedly, by special order, for parties wishing to try tubes of this material, but they do not hold themselves responsible for anything but iron.

To a mechanic who has never seen a tube made there is something difficult to comprehend in the long uniform weld which is generally as strong as the rest of the tube. I had long experienced a curiosity as to how this skillful mechanical operation was performed, and I watched the work here with very much interest. Beginning with the first operation, I found that to be the cutting of sheet-iron into strips that were wide enough to form the circumference of the tubes to be made. These strips were then taken to a scarfing machine and the edges scarfed for welding. The scarfing machine is a special tool that takes hold of the strip of iron and pulls it rapidly through a set of jaws that cut the edges as clean as a lathe tool turns down a shaft. After being scarified the strips go to a long furnace where they are heated a cherry red heat. They are drawn out at one end and passed through a machine which bends them into tubular form. Then they are passed into another furnace and raised to a welding heat. As the hot tube emerges from the furnace an iron conical plug, drawn by a mandrel is forced through the inside, and the outside shell is firmly held by the clamps of a machine. By this means the scarified edges are squeezed together by a prolonged draw and the welding is effected. Some of the tubes go through this operation two or three times.

The next thing done is the cutting off the ends. In connection with this there is a very rigid inspection by an expert in search of defective welds. When any indication of a defective weld is found the tube is rejected, or if the defect is merely at the end that part is cut off.

When the tube passes the physical inspection it is taken to a hydrostatic testing machine and pressure applied to it. Ordinary locomotive tubes are tested under a pressure of about 400 pounds to the square inch. Pipes for ammonia, hydraulic and oil carrying purposes must sometimes be capable of enduring enormous pressure, and these are subjected to very severe tests. I saw some pipes tested with a pressure of 1,600 pounds to the square inch.

The Allison Company do a large business in the making of high-pressure pipes, and they have devised several improved forms of joints which do not reduce the strength of the pipe where the thread is cut. In one form the pipe is thickened at the ends, and in another what is called a "vanishing" thread is employed. The latter is cut so that the thread runs out from the center, gradually decreasing in depth, till at the shoulder there is no cut to cause the beginning of a fracture. This joint is reported to be as strong and as free from failure as the body of the pipe.

Any railroad man visiting Philadelphia can spend a half-day very profitably in visiting the works of the Allison Manufacturing Co.

A. S.

## Railroading in Costa Rica.

A railroad man writing from Costa Rica says: There is a main line here 117 miles long and a branch 20 miles long, all narrow gauge. The railroad is owned by English capitalists and operated by English rolling stock in the most miserable condition that could be imagined. They have twelve or thirteen English locomotives that are the most awkward and badly proportioned engines I have ever seen. About half the weight of some of them is on the forward truck, and they all have stationary grates set lengthwise of the fire-box, the same as in our old wood-burning locomotives. They go puffing up the mountain for two or three miles with a big Jamaica negro poking at the furnace every few minutes. Then they stall for want of steam and start the blower and injector. They never put water in the boiler when the engine is working. Sometimes this stop consumes half an hour. They have to stop about every fifteen or twenty miles to clean the fire, and this is done by pulling up some of the grate-bars and knocking the dirt through.

No running is done with freight trains after night. There are only three stations on the main line between Limon and San José. It is a miserable country for a white man to live in, and I advise all your readers to keep away from it.

A patent has been granted in this country to Robert Lindner, of Chemnitz, for an improvement in starting gear for compound locomotives. The Lindner starting gear is already in use on several compound locomotives built in the U. S., and recent improvements will make it still more popular.

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## Keep to Standard Screw Threads.

A highly important resolution was adopted by the Railway Master Mechanics' Association at the Saratoga convention which cannot be too strongly impressed upon the minds of all railroad men who are in any way influential in the ordering of railroad machinery. The resolution reads—"This association commends and emphasizes the United States standards, and urges upon all a rigid adherence to the same, and deprecates the use of over or under-sized bolts and nuts, and urges all railroad officers to discontinue the use of screws which are not of standard size."

We know of no subject concerning expense of maintaining rolling stock that is of more vital importance to railroad interests than this one. It is the key to that system of interchangeability which has done so much to reduce the expense of repairs and to facilitate the work of repairing foreign cars. Before the United States standards were adopted railroad companies were put to great inconvenience, expense and delay on account of the variety of screw threads in use. The men in charge of our railroad rolling stock twenty-five years ago were readily brought to see the importance and advantage of adopting standard threads, and they did so with remarkable unanimity, considering the prevailing tendency of railroad men to try and have something different from that of their neighbors. For years it became the practice to specify United States standard screws and nuts, and there was evidently no inclination to depart from the standard, and the only trouble experienced was with iron rolled too large for the standard sizes. The obedience to the standard may have resulted from the men ordering rolling stock not being familiar enough with the subject to venture on putting their own ideas of improvement upon the dimensions. Be this as it may, the standard sizes rapidly came into almost general use, and the railroad companies were great gainers by the improvement.

Of late years a change has been gradually creeping over the land. Many master car builders and superintendents of motive power have been specifying screw threads and nuts that are not standard. It has become a common practice to specify screw threads from $\frac{1}{32}$ to $\frac{1}{16}$-inch above the United States standard sizes, and taps and dies have to be made to suit. It is needless to say that these sizes are not standard at all, and that it is a misnomer to speak of oversize standards. If this practice is not arrested soon it is going to introduce hopeless confusion at points where cars with bastard screw threads have to be repaired away from home. The men who are encouraging the practice of leading railroad rolling stock again into the wilderness of strange-sized screw threads are performing evil service for the companies employing them. The head of the mechanical department often deceives the management by misrepresentations as to supposed advantages to be derived from "improvements" on established standards. We believe that every time this is done the railroad company is directly the loser. Railroad managers ought to examine very rigidly into every proposed change that specifies details which entail a departure from standard forms or dimensions.

It is passing strange that while all other lines of mechanical engineering are every year making decided progress toward the use of standard screw threads, bolts and nuts, railroad companies are wandering away from uniformity. There is every reason why it should be the other way, for no interests are so closely bound together for good or evil as the mechanical details of different railroads. In nearly all other lines of mechanical industry, except railroads, the taps, dies, bolts and nuts, made to standard sizes by manufacturers, are purchased in preference to being made by the users. A great many railroad companies, however, persist in making these things for themselves, and by doing so enjoy the expensive luxury of paying much more than the market price for an inferior article. It is safe to say that were the men who follow their own whims in making these things a little more directly interested in paying the bills there would be a greater tendency to work closer on business principles.

When criticisms have been sent home to the mechanical heads of railroads for ordering taps and dies that depart from standards, the excuse has repeatedly been offered that it was done to suit over-sizes of commercial iron. The Master Car Builders and the Master Mechanics' Associations both have standard limit gauges for iron, and if a purchaser accepts material of the wrong size he is demonstrating thereby that his business methods are bad. The vigilant and competent man gets the bar-iron of the proper size every time. There is no excuse for departing from standards, and every man who does it is certainly leading his company into trouble.

## Faults of Long Eccentric Rods.

In a letter published in our correspondence pages, Mr. E. A. Campbell, superintendent of motive power and machinery of the Houston & East and West Texas, raises questions about the utility of 10-wheel locomotives that have long eccentric rods spanning the forward axle. He sees no reason why the old stationary link should not be employed, and gives particulars of design by which that link could be used to make a simple form of valve motion.

In this connection we would say that the 10-wheel engine appears to be a necessity to cope with the growth of passenger traffic, but we have long favored a design of the valve motion that would dispense with the long eccentric rods. Seven or eight years ago while taking indicator diagrams from a 10-wheel engine with long eccentric rods we met with a curious distortion of the diagrams that we did not understand at the time. Later we found out that it was caused by the springing of the valve-rods when the valves got a little dry. The distribution of steam was made so bad as to afford a good reason for a change of design. The dreadful shaking and vibration set up in the long rods when an engine is running fast is proof that the design is mechanically defective.

Objections have been raised to a link motion made with short eccentric-rods on the grounds that the lead is very rapidly increased when the links are hooked up and that the motion wears badly. We believe that these objections rest on defects due to bad designing and that a skillful draughtsman can produce a motion with short eccentric-rods that distributes the steam satisfactorily and wears very well. Some 10-wheel locomotives built by the Brooks Locomotive Works for the Lake Shore & Michigan Southern have very short eccentric-blades and yet the engines are said to be successful in every respect.

With a view of eliminating the objectionable features of long eccentric-rods the Pennsylvania Railroad Company have adopted in a 10-wheel locomotive, built lately at Fort Wayne, stationary links, and the engine is reported to be working very well indeed. It appears to us that the use of the stationary link would overcome many of the difficulties experienced in scheming a good valve motion for a 10-wheel engine. The stationary link with short rods would certainly be a better arrangement than the shifting link and rods spanning the forward axle. As there is no increase of lead when a stationary link is pulled up, there is no objection to the use of short eccentric-rods. The steam distribution can be adjusted without difficulty and a good wearing motion can readily be designed.

## Rolling Stock of the Chicago Elevated Railroad.

We understand that an application was made by the officers of the Chicago South Side Rapid Transit Railroad to Col. Hain, general manager of the Manhattan Elevated Railroad of New York for the loan of one of the locomotives recently built by the Pittsburgh Locomotive Works for the latter company. The intention was to make a comparative test of a good simple Forney engine with the compound locomotives in use on the Chicago road. Col. Hain was anxious to oblige the Chicago people, but there is so much business to do on his own roads that he could not see his way to spare one of the engines.

There are good reasons for believing that the experiment of equipping the Chicago elevated railroad with nothing but compound locomotives is going to prove very expensive. It is the kind of an experiment that no sensible engineer would have recommended. A progressive man of good judgment might have recommended a small proportion of the locomotives to be compound so that their merits and shortcomings could be tested by comparison with simple engines. That is as far as a man had a right to go with a type of engine that had not been a recognized success on the peculiar service of handling elevated railroad trains. In starting out an entirely new enterprise like an elevated railroad there is always certain to be more or less difficulty with everything strange to the men doing the work. Ordinary business sagacity would in a case of this character dictate the use of appliances as well known as possible.

The compound locomotives on the Chicago elevated road have been extremely unpopular with the men, and to a great extent they have been opposed by everybody except those immediately interested in ordering them. The engines have caused considerable trouble, much of it no doubt arising from prejudice and from the fact that the enginemen did not understand the machines they were working.

The performance of the engines that were most skillfully handled leads us to fear that the service of elevated railroads where stoppages have to be made at brief intervals is not adapted to compound locomotives. Cylinder condensation wastes more steam than the saving effected by increased expansion can balance. The cylinder area exposed to chilling influences is so large that serious annoyance has arisen from the volume of condensed water that has to be carried to the terminal points. The engine starts out with the cylinders cold. The runs are so short that the cylinder metal is scarcely heated when it is time to shut off steam. The cylinders keep cooling again and are ready to act as condensers when steam is applied for the brief period it is continuously in use. If the engines had long runs between stations they would probably give economical service under the peculiar conditions of very frequent stoppages they appear to use more coal than simple engines would consume in doing the same work.

We could find no feature in which these engines are superior to simple engines for suburban railroad purposes. The exhaust makes quite as much noise as that of the New York elevated engines, and the engines do not start more quickly or with less jerking.

There has been considerable difficulty with the driver-brakes on the engines. It was said that they were not applied properly, and the leverage was so great that wheel-sliding resulted. The Westinghouse automatic air-brake is not an unmixed success on these elevated trains. It releases very well, but causes more surging in stopping than the vacuum-brake. The vacuum-brake is so successful for this kind of service, handles the trains so smoothly, releases so promptly and costs so little for repairs, that the question of merit could not have been considered when another brake was specified for the rolling stock of the Chicago elevated road.

## Wanting Longer Hours.

For years there has been steady agitation in labor circles for reduction in working hours. The general tendency has been to demand a reduction of the time to eight hours a day. In view of this it is strange to tell that the machinists of the Union Pacific system have asked an increase of the working hours from fifty hours to fifty-four hours a week. The men making this request intimated that they were willing to submit to a reduction in the force sufficient to equalize the increase of working hours. It may safely be asserted that the men agitating the change expected that the other fellows were the men who must go if the request were granted.

A movement of this kind on the Union Pacific is the more surprising since the Knights of Labor are very strong on that road and their policy has been in the opposite direction. The request was not granted. The reply given by the management of the Union Pacific was that under an agreement with the Knights of Labor reductions could be made only in hours and not in the number of men employed. This seems to us a very just arrangement. It was said that to increase the hours as requested it would be necessary to discharge between 500 and 600 men on the Union Pacific system. A move of that kind would be granted only by unanimous consent of the men. As the depression of business that keeps the working hours on the Union Pacific so short is not likely to last long, it would be a great hardship all round to send so many men adrift.

## To Prohibit the Employment of Plug Operators.

There is a very sensible movement among railroad trainmen in Pennsylvania, led by the Brotherhood of Locomotive Engineers, that calls for the enactment of a State law prohibiting inexperienced telegraph operators from having charge of the movement of trains. The collision at Harrisburg in the end of June, when twelve persons were killed, is the immediate cause of the agitation, for an inexperienced telegraph operator in charge of the signal tower was really the cause of the accident, although the blame was pushed on to other shoulders. A bill has been drawn up which provides that all operators employed on railroads in the State of Pennsylvania shall have at least one year's experience and shall not be under 20 years of age. Where block signals are employed the operators are required to become familiar with the system before being put in charge. The railroad companies will do all in their power to prevent this bill from becoming a law, and it will require extraordinary efforts on the part of trainmen to get it pushed through. The Legislature of Pennsylvania is dominated by railroad companies, and few of the leaders are liberal enough to perceive that a law to promote the safety of travelers is for the best interests of railroad companies even when it makes the employment of efficient help compulsory.

## To Make Station Agents Meek.

We are informed that the Railway Agents' Association of America has inaugurated a new plan of operations. Letters have been sent to officials everywhere, asking approval of this plan. They are signed by the Secretary, R. W. Wright, of Cleveland. The new scheme is to take the control and direction of agents out of the hands of the operating superintendents, and place them under the direction of the traffic managers. Mr. Wright says: "We feel that it is the duty of every official to encourage a movement which will keep the station service from the dominance of radical labor agitators." This, he thinks, can be done by placing the freight and ticket agents under control of the traffic department. He believes that neither the appointment nor the removal of an agent should be made without consulting with these officials, and that the jurisdiction of the operating department should be confined entirely to the duties which fall to an agent's lot in this direction. In other words, this is a movement on the part of the agents to be taken from under the authority of general and division superintendents.

We suppose that the Railway Agents' Association think that an underpaid station agent will be happy under control of the traffic officers, no matter how little he may be paid for responsible services. We think the scheme will fail. The proper way to make station agents contented is to treat them as they deserve, and this is seldom done.

## Crucible Steel for Boiler Plates.

Since the discussion at the Master Mechanics' Convention on boiler steel and the impression given out that some crucible steel sheets had given extraordinary mileage in fireboxes, there has been a tendency to regard crucible steel as being particularly valuable for boiler purposes. We believe that this impression is at best a fallacy and that there is no kind of steel so well adapted for fireboxes as the open hearth steel that is commonly in use. It seems certain that the tendency to break down prices has brought into the market steel of inferior quality, which is not well adapted for use in fireboxes. Many railroad officers are now saying that they are prepared to pay any reasonable price for good boiler steel and their eyes are turned toward crucible steel as the material that is going to realize all their expectations. We would caution our friends not to be precipitant in patronizing this material for fireboxes. Those who are considering the merits of crucible steel will do well to study a report that was submitted to the Master Mechanics' Convention in 1888. In that report the following points were made about crucible steel

"The crucible process of making steel is the oldest, commercially speaking, and for some purposes the best—that is, when steel is wanted in small quantities of considerable purity. It is a failure when large masses of homogeneous character are required, as is the case in boiler plate. Its shortcomings in this respect are due to the process of manufacture, which, as is well known, consists in melting wrought-iron, etc., in a crucible holding generally from 80 to 125 pounds. To obtain a mass large enough to make boiler plate, it is necessary to pour the contents of from 20 to 50 crucibles into one mold to form an ingot. As the 'steel' is made in each crucible, it follows that in 30 crucibles we have 30 different kinds and grades of steel in the one sheet. The result, when subjected to the trying conditions found in a locomotive firebox is, of course, disastrous in the majority of cases, as homogeneity or absolute uniformity of the metal in this service is one of the most important elements found in long-lived fireboxes."

## Railroad Business Last Year.

From "Poor's Manual," received this month, we find that in 1891 there were 167,845 main track miles of railroad in the United States, an increase of 4,487 miles over that reported for the previous year. The number of locomotives in use was 33,563, an increase of 1,751 in one year. The number of passenger cars was 23,083, baggage, mail, etc., 7,368. Of freight cars there was reported to be 1,140,737 owned by railroad companies.

The figures presented in the various statistical tables of the Manual show that the business of railroads during 1891 was exceptionally good, and they also indicate that there has been great improvement made on the physical condition of railroad properties. The passenger mileage, which represents individuals carried one mile, reaches the enormous figures of 13,316,925,239, and this does not include the Elevated Railroads of New York. It may give a better idea of what great travelers Americans are, to say that over thirteen millions of our people traveled above 240 miles by rail last year on surface railroads. The average fare paid was 2.184 cents per mile. The passenger mileage increased 6.4 per cent. over that of the previous year.

The tons of freight carried during the year was 81,210,154,523, being an increase of 2.6 per cent. over the business done in 1890. Considering the number of cars in use to do the amount of hauling performed, there was a rather small average mileage got for each car. If we reckon each car capable of hauling 15 tons of freight, the average mileage per car would be 4,800 during the year, or 16 miles per day. The average freight-train load was 164½ tons. The average charge made per mile for each ton of freight hauled was 0.929 cent.

The total earnings for passenger, freight and other business was $1,125,534,815, and the net earnings was $350,807,370, so that close on 68.8 per cent was spent in operating expenses. This is a high ratio of operating expenses considering the efforts that have been going on to reduce the expenses of moving trains. The train loads have steadily gone on increasing and the expense of power every year gets less according to the amount of work done. It is then an interesting question to investigate why the operating expenses keep so high in proportion to the gross receipts? The answer is found very readily. The general freight agents, in their scramble for business, take freight at rates which leave no margin for profit. When a ton of freight is hauled at less than 1 cent per mile, the business will be done at a loss on many lines. If the average charges for freight had been raised from .929 of 1 cent to 1 cent, this small advance would have reduced the ratio of operating expenses about 2 per cent. The owners of railway property do not make big returns on their investments, for the average interest paid on bonds was $4.25 and on stock $1.85 per cent. We do not see that there is much inducement for people who have saved money to put it into railroad securities.

In another column, our correspondent, Mr. Wood, directs attention to a very detailed and interesting style to certain various forms of brake-levers that cause great inconvenience and annoyance in the handling of trains, and cause serious damage to wheels. The subject deserves to be thoroughly ventilated. No railroad company can afford to retain in use inferior brake-gear, and we trust that the criticisms made by this and other correspondents will have the effect of consigning all bad forms of brake-gear to the scrap heap. It is very short-sighted policy for a master mechanic or master car builder to keep in use brake-gear that has been demonstrated to be defective. If enginemen who are annoyed with the brakes on their tenders not working properly will read the letter from Mr. W. W. Wood, in this paper, and that from Mr. Synnestvedt, in our August number, they will probably get information that will enable them to understand what is wrong. If the facts are then laid before the proper authorities we feel certain that in nearly every case the proper remedy will be applied.

The question raised by a correspondent about one wheel being slid flat has excited much attention, for, besides the letters which have appeared, there are five or six that we cannot find room for. The points made in most of the letters that do not appear, refer to flattening of a single wheel being caused by sand running out at only one pipe. While thanking correspondents for the attention they have given to this subject, we would prefer to let it drop now unless something novel comes up, like the explanation given by one writer in this issue, where through the defects of truck and brake gear, one wheel was raised entirely off the rail when the brake was applied.

## NEW BOOKS.

STREET RAILWAYS, their construction, operation and maintenance, a practical hand-book for street railway men. By C. B. Fairchild, New York, Street Railway Publishing Co.

This book deserves to become a manual on street railways, for it is the best and most comprehensive work that we have seen on a subject about which there is not much reliable literature. While the book contains a great deal of technical detail, it has been so skillfully written that an ordinary reader interested in the wonderful development of the street railway system of transportation follows on, chapter after chapter, with keen interest. The author says that he has "endeavored to treat each topic in a simple manner, having in mind the needs of men who may engage in the service, and who must necessarily learn the business by first studying the alphabet." We confess that the alphabet of street railway operation is made very simple, and will, no doubt, meet with the deserved appreciation. The first part of the book is devoted to chapters on electric traction; cable traction; horse traction; steam, air and gas motors; inclined planes, elevated roads, car building; and track construction. The remainder of the book is taken up with executive matters. Each part of the book has features peculiarly valuable, but we think that on electric traction will be found of most use by the many men who are trying to learn something about this part of street railways. This chapter gives an elementary treatise on the development of the dynamo, and then works along to the application of this power transmitter to the operating of street cars, giving numerous illustrations of dynamo construction and of all the minor parts connected therewith. We think it would be a good plan to make a hand-book of this chapter for the benefit of men engaged on operating electric cars.

STANDARDS OF LENGTH and their practical application. By George M. Bond. Pratt & Whitney Co., Hartford, Conn.

This is not a new book, but it has lately reached our desk by the courtesy of the author. It contains a resumé, covering the methods employed for the production of standard gauges to insure uniformity and interchangeability in every department of manufacture. There are also the reports of Professor Rogers, that of the committee on standards and gauges of the American Society of Mechanical Engineers, that of the Master Car Builders' Association, also the report of the special committee appointed by the Franklin Institute. Besides these very valuable reports there are lectures on measurements, by George M. Bond, who is the most accomplished expert living on this subject. The book appears to contain nearly everything of value that has been done or said concerning accurate measurements. It would be good for railroad companies if all the men in charge of the designing or repairing of machinery were familiar with the leading facts concerning measurements and interchangeability that are to be found in this book.

EXPERIMENTAL ENGINEERING for engineers and for students in engineering laboratories. By Rolla C. Carpenter, Associate Professor of Experimental Engineering, Cornell University. John Wiley & Sons, New York. Cloth $6.00.

This is a somewhat ambitious book of over 700 pages, devoted in a great measure to the describing of methods followed in making all sorts of tests required in engineering. The work has been done with considerable care, but yet it has the stamp of a compilation of papers contributed to technical societies. For persons engaged in testing departments the book is likely to become a manual, for it contains information relating to all branches of experimental work in convenient form. Being the work of a college professor the book is naturally bristling with mathematical formulæ. The subjects treated are as varied as the ramifications of engineering science. There are several chapters devoted to the testing of material, which will be read with interest and profit by railroad men, and the parts relating to testing of lubricants, heating value of coals, the steam-engine indicator, and the injector present good material for study. The book as a whole is not made for reading. It is profusely illustrated.

SYSTEMS OF CAR LIGHTING. By A. M. Wellington, W. B. D. Penniman and Charles Whiting Baker. Profusely illustroted. *Engineering News*, New York.

This book consists of a reprint of a series of articles that appeared in the *Engineering News*, and deals very extensively with all the systems of car lighting employed in this country and in Europe. It deals with oil lamps, gasoline carburetters, compressed gas and electric lighting, showing the merits and disadvantages of the various systems. Every person who has any influence in deciding what system of lighting shall be used on railroad cars, ought to study this treatise. It is certain to throw a clear light on a subject that is indifferently understood by many who ought to be familiar with all the systems that are offered for adoption. All the articles are clear, sensible and practical, and good illustrations are used to make the text easily understood.

DYNAMOMETERS AND THE MEASUREMENT OF POWER. A treatise on the construction and application of dynamometers, by John Flather, Professor of Mechanical Engineering, Purdue University. John Wiley & Sons, New York.

This book, from beginning to end, is devoted to describing the construction, performance and purpose of power measuring apparatus. It is intended for the use of students, and like most books written by college professors, it is not of consuming interest to a reader. Students are not likely to be allured away from their pillows to finish reading the book, but nevertheless, they will learn a good deal by carefully studying its pages.

The Master Car and Locomotive Painters' Association will hold their annual convention at Detroit, Mich., beginning on September 10. The programme of work to be done indicates that a valuable convention will be held. Much of the work of this association falls upon the secretory, Mr. Robert McKeon of Kent, O. The work is a labor of love and is done with remarkable zeal and efficiency.

## Master Mechanics' Report.

The report of the proceedings of the twenty-fifth annual convention of the American Railway Master Mechanics' Association has been received. It is a volume of over 250 pages and contains a large number of illustrations, the reports on compound locomotives and on boilers for high pressure being profusely illustrated. An exceptionally good opportunity for judging of the merits of the various annual reports of this association leads us to the conclusion that the report for 1892 is far ahead of any previous ones in the engineering value of papers and discussions presented. The report on compound locomotives and the long discussion thereon form a highly important addition to the literature on this important subject. The reports are all so good that it seems invidious to select any for special commendation. The discussion on tests of steel and iron is scarcely second in interest or value to that on compound locomotives. The report is got out in a very attractive style, on excellent paper, is well printed and has a good index. It is for sale by the secretary at this office. Price $1.50.

We have received an illustrated catalogue of Norton's improved ball-bearing railway and bridge jacks. It shows this valuable jack in all the variety of forms for which it is constructed. We understand that the business has been very much extended of late and that numerous railways are using the jack with marked success. The West End Street Railway of Boston has made this jack their standard and have a large number in use, the order being to carry one on each car. This is one of the largest street railway corporations in the country, and they are very careful in making thorough tests of all the appliances they adopt.

"Well Worth Reading," is the title of a pamphlet issued by B. F. Mahler, of the Lodge & Davis Machine Company, Cincinnati, Ohio. The good words consist of the report made by LOCOMOTIVE ENGINEERING, of the paper read by Mr. B. E. Davis, M. M., of the Boston and Maine, at the New England Railway Club, on tools and machinery for railroad work. They are certainly words that will stand reading a good many times to advantage.

The Field Water Purifier Company have recently added to the list of railroads on which they have their device the Grand Trunk and Chicago and Alton, and have also fitted up one of the large new iron steamers lately launched by the Detroit Dry Dock Company. The business is rapidly increasing on the roads where their device is at work.

Persons interested in engineering books should apply to Spon & Chamberlain, New York, for their monthly catalogue, which embraces every month books that engineers ought to keep the run of. One of the latest books issued by the firm is "Electricity, its Theory, Sources and Application," by John T. Sprague.

We have received a copy of a letter written by Mr. McConnell, superintendent of motive power of the Union Pacific system, regarding Falls Hollow staybolt, which he has been using with much success for locomotive boilers. This form of staybolt seems to be making rapid progress into favor with railroad men.

We have received from the Forrest Silver Bronze Packing Co., a voluminous list of copies of testimonial letters concerning this excellent packing for stuffing-boxes. We have personally examined some of the high speed locomotives which are using this kind of packing and obtained the very best impression of its utility.

## PERSONAL.

Mr. James Cunningham has been appointed master mechanic of the Buffalo division of the Philadelphia & Reading.

Colonel F. J. Hecker, president of the Peninsular Car Works of Detroit, is also president of the Police Commission of Detroit and a member of the Board of Health. He wields great influence in municipal affairs.

We have received several pleasant calls from Professor Alexander D. Romanoff, of the Institute of Engineers, St. Petersburg. Professor Romanoff is on a visit to this country as a government officer for the purpose of inspecting all our systems of inter-communication.

Some of our California exchanges have discovered on the Pacific Coast a lady blacksmith, and, of course, they want her to show off at the World's Fair. Her name is Miss Ray Beveridge, and she is reported to have more than a smattering of the blacksmith trade. We doubt it.

Mr. J. O. Pattee, who has for some years been at the head of the mechanical department of the Great Northern Railway, with the title of master mechanic, has been given the title of superintendent of motive power, his jurisdiction extending over the entire Great Northern system.

Mr. Henry C. Gould has been elected vice-president and general manager of the Gould Coupler Co., and Mr. F. P. Huntley, for many years employed in a confidential capacity by Mr. Chas. A. Gould, in his various manufacturing enterprises, has been elected secretary of the Gould Coupler Co.

Mr. S. W. Huston has been appointed superintendent and master mechanic of the South Side Rapid Transit Railway, Chicago. He was previously master mechanic of the Cornwall Railroad, and went there from the Pennsylvania shops at Altoona, where he went through the improver training.

A Chicago paper publishes a portrait of John F. Enright, a fireman on the Chicago & Eastern Illinois, and a picture showing him rescuing a child from the front of the pilot of his engine. Mr. Enright displayed extraordinary nerve and coolness and deserves all the credit newspaper attention can bestow.

We notice by a paragraph in the New York *Tribune* that $37.50 has been received for the Fresh Air Fund from Mr. F. W. Coolbaugh on behalf of the Railway Master Mechanics' Association. This money was collected at the Saratoga Convention and represents half the fund; the other half going to Chicago.

Mr. M. M. Reid, general foreman of the Norfolk Southern road at Berkeley, Va., is a near relative of Joseph Hume the celebrated British statesman. Mr. Reid is a man of strong personality and is a worthy member of an illustrious race. He is a cousin several times removed of Mr. Balfour, late Secretary for Ireland.

We understand that Professor A. T. Woods, of Washington University, St. Louis, has accepted an editorial position with the *Railroad Gazette*, with headquarters in Chicago. Professor Woods is author of a book on compound locomotives, and is particularly well informed on matters connected with railroad rolling stock.

W. H. Doane, the well-known president of J. A. Fay & Co., wood-working machinery manufacturers at Cincinnati, Ohio, recently presented $25,000 to the Denison University to be used in building an academy hall for that institution. Mr. Doane is a public-spirited and progressive business man as well as a philanthropist, and he is constantly performing benefactions that will make his name live long after he shall have passed away.—*The Timberman.*

Mr. E. T. Silvius, master mechanic of the Jacksonville, St. Augustine & Halifax River Railway, was a printer in his youth. He still takes a lively interest in matters connected with the printer's art. When he and John A. Hill, who was also a printer, get together they make their hearers believe that there must be great art and mystery connected with the slinging of letter type.

Dr. Webb, president of the Adirondacks and St. Lawrence Railroad, has a small inspection locomotive that he rides over the road on. He is ambitious to know how to handle a locomotive and runs the engine a great part of the time. The Doctor has taken instructions in the art of locomotive engine running from William Buchanan, James Macbeth and Nat Sawyer and it is reported that he is likely to excel all his sponsors, especially on speed.

Stephen Pratt, one of the oldest locomotive engineers on the Chicago, Milwaukee & St. Paul, is said to have died of the heat last month. How more enginemen do not die from heat exhaustion during heated terms, like what the country has experienced lately, is something wonderful. Scores of people were prostrated daily of the heat in every large city, yet enginemen who have the heat of the boiler added to that of the sun, are very seldom reported to be injuriously affected.

A report is in circulation that the N. Y. & N. E. will employ girls as waiters on its dining cars instead of colored men. It will be a novel experiment, but if it enables the traveler to get meals without hiring the waiters to bring them to him, it will be a popular departure. We are inclined to doubt the accuracy of the report, however, since Nicholls has ceased to be superintendent. If he was still there it would be a likely experiment.

It has been suggested to us that a very readable and amusing article might be written on deep-sea fishing, and Mr. R. C. Blackall, vice-president of the Master Mechanics' Association, has been mentioned as one who could describe the sensations with the accuracy of one who has been there. A party of railroad men went out fishing on the New England coast last month, and several of them obtained experience that was more novel than agreeable.

A great many master mechanics are running over with theories about the necessity for improving and training enginemen, and they theorise so much about it that they have no time to reduce any of the principles to practice. Mr. John Bean, master mechanic of the Cleveland & Canton road, does not theorize a great deal, but he is a host in practice for good works. He has lately got up a large club of readers of LOCOMOTIVE ENGINEERING among his men and has raised enough money to buy the valve-motion model for the instruction of engineers and firemen.

Mr. Joseph Whitlock, who used to be master mechanic of the Housatonic Railroad, was taken ill last fall with some sort of lung trouble. He went to Florida and hired a house boat, and went to live on one of the rivers, spending all his time fishing, hunting and sleeping. He returned North in the spring entirely recovered. When Mr. Whitlock took mechanical charge of the road which he served for so many years it was in a semi-insolvent condition. Power was badly needed at one time, and locomotive builders would not trust the company with engines. They were, however, ready to take Mr. Whitlock's indorsement, and he became security for the engines that were required. The management treated him shabbily afterward.

When the combination was effected by which the Philadelphia & Reading Company secured control of the Central of New Jersey and the Lehigh Valley roads, it was rumored that President Roberts, of the Pennsylvania road, had opposed the deal so vigorously as to give offense to Drexel, Morgan & Co., and that these capitalists were likely to use their influence to effect Mr. Roberts' removal. These rumors are again revived. It is reported that Mr. Roberts is willing to retire if he is permitted to name a successor satisfactory to himself. The gossip has been stimulated afresh by the sudden departure recently of A. J. Cassatt for Europe. He had arranged to take his family to Long Branch and Saratoga for the season, but it is said that he came home and directed preparations for a departure for Europe in three days. This has given rise to the report that the foreign stockholders of the Pennsylvania had selected Mr. Cassatt as the successor to Mr. Roberts. The natural choice of Mr. Roberts for his successor would be Frank Thomson, first vice-president. It is said that Drexel, Morgan & Co. are working to effect a combination between the Pennsylvania and the Philadelphia & Reading systems, and that the removal of President Roberts is necessary to the working out of the contemplated changes.

## George M. Pullman.

We often hear it said that American business men keep the fires of their energy burning so fiercely that they become physical wrecks while still young. There may be a fraction of truth in this, but it is certain that some of the men who have done the most stupendous work connected with the building up of our railroad system, display little diminished vigor after long years of ceaseless devotion to business. We were forcibly struck with this lately on meeting Mr. George M. Pullman in Chicago. The detail work of building up the vast sleeping-car business has fallen in a great measure on the President of the Pullman Palace Car Company, yet, with sixty odd years, he looks as fresh and healthy as an English squire with nothing to do but amuse himself. Mr. Pullman raised himself from the position of a workman, as many others of our most successful business men have done. What he has accomplished is within the possibilities for every American boy gifted in the same way.

Mr. George M. Pullman was born in Chautauqua County, New York, in 1831. When a boy he learned the cabinet-making trade, and remembers with pride that he was a first-class workman. When he was twenty-two years old, a change in the Erie Canal called for the moving of a great many houses and Mr. Pullman saw there was money in the business and undertook the work. When this was finished, in 1859, he removed to Chicago to follow the business of house-moving. Before this time his attention had been directed to the discomforts of night travel, and he revolved in his mind a variety of plans for providing sleeping accommodation to passengers. Shortly after going to Chicago he arranged with the Chicago & Alton Railroad Company to convert two of their day coaches into sleeping cars. This work was successfully carried out and Mr. Pullman personally attended to the operating of the cars, doing much to make them popular with the traveling public. They slowly worked their way into favor. In 1863 he began building the first new sleeping car, the "Pioneer," that comprised all his ideas of what a car of this character ought to be. It cost $18,000, an enormous sum for those days, but it proved a success and really was the pioneer of the comfortable sleeping-car service that has taken away the dread and discomforts of night travel, turning transportation into pleasure and luxury.

The Pullman Palace Car Company was organized in 1867, and has been one of the most successful companies in the country. The company now operates about 2,000 sleeping, palace and dining cars and builds a large proportion of passenger and freight cars used by railroads. The village and shops of Pullman were built in 1867. The town has about 12,000 inhabitants, of whom over 5,000 work in the car shops.

In talking about the success achieved, Mr. Pullman said his motto had been "have the best of everything." His early aim was to have a sleeping car that in every respect would be far ahead of anything else. In that he succeeded and its reward came. As the business increased he followed the same policy and aimed to keep in front with the best cars and the best service. This is the policy that still actuates the company.

## F. D. Adams.

When we were preparing the group of portraits of the elder members of the Master Car Builders' and Master Mechanics' Associations for our June number, one of the first persons to be thought of was Mr. F. D. Adams, master car builder of the Boston & Albany Railroad. By some misunderstanding our request for a photograph was not received. We regretted this sincerely, for a group representing the master car builders without Mr. Adams

being in it was conspicuously incomplete, and numerous friends promptly informed us about the prominence of the omission.

We are now pleased to present the portrait of Mr. Adams to our readers. To those who are familiar with the work done by the Master Car Builders' Association, Mr. Adams requires no introduction. He has been one of the most zealous workers in the improvements effected on railroad rolling-stock by the Master Car Builders' Association, and he was for long years a member of the Executive Committee. The Interstate Commerce Commissioners credit Mr. Adams with much of the work performed in the adoption of a standard car-coupler by the Master Car Builders' Association. Throughout his whole connection with the association he has been a firm and consistent advocate of the adoption of appliances calculated to reduce the dangers to the men handling cars.

Mr. Adams is a native of Connecticut and was born in 1822. In spite of his seventy years he is hale and hearty and unlike most old men he is still in the van of those pushing forward improvements in car construction. At nine years of age on the death of his father, he was bound out until he reach the age of twenty-one to a citizen of the town who was both a farmer and carpenter. Seven or eight years of this servitude were devoted to learning the builders' trade, his renumeration being $20 per year. Several years before this apprenticeship expired, he was put in charge of the business. When he was twenty-five years of age, he went to work as carpenter in the Norwich Car Company's Works. This was one of the first car works in New England. After spending some three years working at the bench here and having worked himself up to the very high pay of $2 a day, he and a fellow workman determined to strike out into the unknown. They started to look for work and landed after a weary pilgrimage by boat and foot in Philadelphia. Mr. Adams failed to obtain work in that city and walked back to Norwich and after a time returned to work in the car shops there.

Shortly afterward, Mr. Pierce, who was the owner of the Norwich Works, determined to launch out in a branch establishment which he located at Ramapo, New York. Mr. Adams was detailed to design and build these works, including a dozen dwellings for the workmen. This was the beginning of the present Ramapo Foundry Company's Works. Passengers on the Erie Railroad passing through the mountains of Rockland County, near Ramapo, can obtain a glimpse in the woods of a large frame building that may readily be mistaken for an overgrown barn. This was once the Ramapo Car Works, and was built under Mr. Adams' supervision.

The enterprise did not prove successful and when failure came, Mr. Adams moved to Buffalo and engaged himself as subcontractor with the Buffalo Car Company. This company failed in 1857 and Mr. Adams lost about $3,000 which the company held belonging to him. He then struck out for the Western wilds and settled at a place called Wayne, near Detroit. Here in company with a friend he chartered a small steam saw mill, and half starved trying to make a living with this for a year. He then loaded his earthly possessions on a single ox-cart and drove it some twelve miles through almost a trackless wilderness to a railway station, from which he returned to Buffalo. Shortly afterward, he took charge of the Buffalo and Erie Railroad Car Shops. On returning from the West the train he was on met with the memorable accident near Hamilton on the Grand Trunk Railway, where fourteen lives were lost and scores injured. Mrs. Adams was seriously injured in the wreck and for many months was a great sufferer. Mr. Adams was the last person taken from the wreck and he too was dangerously injured.

In 1870 Mr. Adams became superintendent of the Ohio Falls Car Works, where he remained two years. In 1872 he left there to become master car builder of the Boston & Albany, a position he still holds. The cars of his road are the best monument of Mr. Adams' ability. His shops at Allston, Mass., are models of convenience and neatness, and everywhere display indications of excellent management. His success in his department is attributable to his sympathy with the men's interests and welfare; firmness of purpose; progressive ideas, and promptness in recognizing merit in devices for the betterment of his equipment.

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Mr. Arthur Pennell has just closed a contract with the Union Pacific Railroad to erect, maintain and operate a plant for treating the water at Bitter Creek, Wyoming, and guarantees that the water shall be free from scale, corrosive matter or a tendency to foam. The Bitter Creek water contains per U. S. gallon, sulphate of soda, 25.05 grains, carbonate of soda, 48.90 grains. The plant is to be capable of furnishing water at the rate of 50,000 gallons for each twenty-four hours.

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The report has reached us that sixty-five engineers, brakemen and fireman have been discharged from the Mexican Central Railroad because they were Brotherhood men and that more will be let out.

## An Unwelcome Visitor.

We are indebted to the *Railway Age* for the striking picture that illustrates an exciting phase of railroad life in some parts of India. Our enterprising contemporary says that the picture is from a drawing by R. P. W. Strong in the

AN UNWELCOME VISITOR.

London *Graphic*, illustrating a disagreeable incident to which railway men in India are occasionally exposed. It was at a small "up-country" station that the tiger appeared one day and for a while made things very lively, until help came (in the shape of white men with rifles) from headquarters. The telegram of the native station agent summoning help was delightful in its conciseness. He wired, "Tiger jumping about platform. Please arrange."

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Railroad managers do business with a much higher hand in the British Isles than their peers are permitted to assume in this country. We learn from an English exchange that Mr. Conacher, general manager of the North British Railway Company, has consented to receive a Linlithgow deputation in connection with the application of the Council for cheap summer fares and better train arrangements for Linlithgow. Now, if the members of a City Council in this country wanted an interview with a railroad manager in relation to giving him a few hints about how to conduct his business, they would demand a pass for the party and intimate beforehand that they intended making it particularly sultry for the railroad magnate if he did not display a spirit properly toned to grant all the concessions asked for.

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An improved iron brake-beam has been patented by D. L. Barnes, Chicago. The novelty is in the method of securing the truss-strap to the compression member of a brake-beam, which consists in bending the ends of such strap entirely around the ends of the member and passing the brake-heads over both strap and member.

## A Great Educator.

We clip the following from a late issue of the *Catoctin* (Md.) *Clarion*, and are gratified to find that this is only one of many Southern papers that have very kind words to say of LOCOMOTIVE ENGINEERING.

"A GREAT EDUCATOR.—Few even of those given to thinking of the practical problems of the present scurrying age, have a measurably accurate idea of the numberless and complicated problems that grow out of the immense railroad interests in this country. Not least among them all is that by which the wonderful motive power of the myriads of giant motors, the steam engines, are developed, cared for and improved. If one would gain an intelligent idea of the amount of thought and careful research that is bestowed upon the locomotive engine, he should read that great publication, LOCOMOTIVE ENGINEERING, a monthly published in New York city, a copy of which now lies before us. It contains not only the latest developments in this branch of steam engineering and scientific discussions of the thousands of practical questions that arise, but interesting and instructive accounts of real happenings in the life of these reckless phaetons of the iron ecliptic. It is the very best stranger that has visited us in years and we shall be pleased to see more of it."

---

The July number of LOCOMOTIVE ENGINEERING has reached us. It is an admirably illustrated monthly, and its value to engineers must be incalculable. The contents are varied and interesting, but more particularly to those in whose interest it is published. How so large and expensively illustrated a monthly can be furnished subscribers at $2.00 a year we do not know, but it is done. Among the articles we notice two that relate to scenes of the late war. The first is "Locomotive Running Among the Bushwhackers," and the other is "Train Running for the Confederacy." Thus, both sides are represented. Besides these there are other articles in the number that will be found interesting to the general reader.—*Southern Reporter*.

## ALL KINDS OF WANTS.

*The [illegible] using this column is 25 cents for each insertion.*

WANTED—Position as salesman for railway supplies. Large acquaintance with general managers, superintendents of motive power, master mechanics, master car builders, purchasing agents, and railroad men generally. I am a hustler and can give good references. Address, F. C., LOCOMOTIVE ENGINEERING, 5 Beekman Street, New York.

WANTED—Position in stores department of a railroad. Have had long experience in charge of store department. Best of references. Apply to W. G., 912 Temple Court, New York.

WANTED—Copy of third annual report of Master Mechanics' Association. Will pay good price. Send to C. E. R., 9 N. Munn Avenue, East Orange, N. J.

WANTED—Agents on every railroad in the country to solicit subscribers for LOCOMOTIVE ENGINEERING. Send for rates to 912 Temple Court, New York.

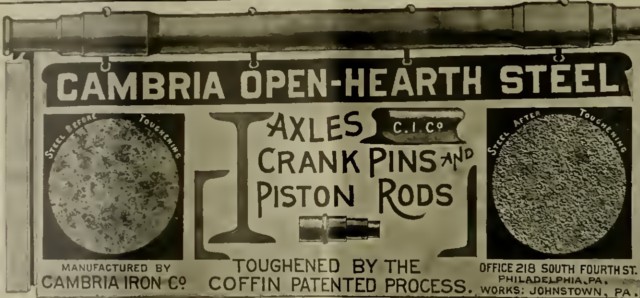
A FIRST-CLASS draughtsman and mechanical engineer wants a position. Is thoroughly familiar with car and locomotive designing. Accustomed to working out and putting in form designing ideas of superintendent of motive power. Apply to F. S. C., office of this paper.

A LOCOMOTIVE engineer who is well posted on air-brakes, combustion and locomotive mechanism wants position as traveling engineer. Good references. Address, No. 912 Temple Court, New York.

WANTED—A master car builder with long and valuable experience wants position. Apply to C. B., office of this paper.

A RELIABLE man who has been assistant superintendent of locomotive works wants a position. Is thoroughly familiar with piece-work and the prices. Would take position as inspector. Apply to B. A. Y., office of this paper.

WANTED—Persons interested in reading good mechanical literature to send for bound volumes of *The Locomotive Engineer*. Four years in one volume. Price $5.00.




Kalamein Boiler Tubes not affected by alkali water.

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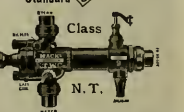

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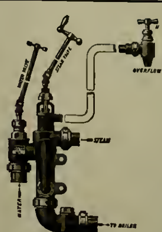


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Branch Offices: Hamilton Building, Pittsburgh, Pa.; No. 80 Broadway, New York; [illegible] Chestnut Street, Philadelphia. ROBERT W. HUNT, M. Am. Soc. C. E., M. Am. Inst M. E., M. Am. Soc. M. E., late Gen. Supt. Troy Steel and Iron Co. JOHN J. CONE, Engineer of Tests. A. W. FIERO, Inspecting Engineer. G. W. G. FERRIS, C. E. JAMES C. HALLSTED, C. E.

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**Galena Engine, Coach and Car Oils, the Standard Lubricating Oils of America.**

SAFETY, SPEED and ECONOMY are the results of the use of Galena Oils. COLD TEST, 10 to 15 BELOW ZERO. These oils do not freeze in the coldest weather, while they are adaptable to the hottest climates.

In the use of Galena Oils there is an entire freedom from hot boxes, except when these are caused by mechanical defects.

The adoption of Galena Oils as standard railway lubricants by a large majority of the leading railways of this country is an evidence of their superiority, while the fact that the same roads use these oils to-day that used them more than 20 years ago, is an evidence of their uniformity from year to year and year in and out.

Galena Oils are in exclusive use upon three continuous lines from Boston and New York to the Pacific coast, and upon one continuous line from the City of Mexico to New York, thus demonstrating their adaptability to all temperatures and climates. Being entirely free from gum, these oils are not affected by dust and sand as other oils are.

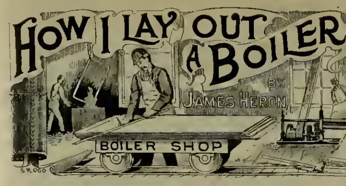
We also furnish our customers SIBLEY'S PERFECTION VALVE OIL, which is also used exclusively upon a majority of the leading railways of America.

**GALENA OIL WORKS, Limited,**

CHARLES MILLER, President,

CHICAGO BRANCH OFFICE, Phenix Building, 138 Jackson St.

Franklin, Pa.




## Laying Out Boiler Sheets.

Figs. 13 and 14 are the same as Figs. 11 and 12, last paper, but made more plain for benefit of student. Fig. 15 will show why we require a sheet the shape of Fig. 16 when flat, to form Fig. 13. Suppose we take a sheet and roll it up to radius required without cutting to shape, which has been and is still done in many places, while others make templates by using light iron and getting shape from boiler and marking plate from template so made. Fig. 15 shows this plate in place. You will see by lines you have too much stock at back end and not enough at front. My object in giving this figure is to help you to more clearly see through Figs. 13 and 14. *A, B, C, D, O*, and 1, 2, 3, 4, o, Fig. 15, shows the same view as Fig. 13, but I made sectional view of boiler, and lined the same off back and front and divided into four parts instead of eight, as Fig. 13, to simplify matters. This view also gives you the method of finding width of sheet required when ordering material.

Now, if you follow perpendicular lines of opening in boiler, where taper sheet should be, also lines of square sheet placed in opening where horizontal lines cross, it will give the amount of material to be cut off or added at each point.

I think I explained fully in last paper the object of drawing views 13 and 14, so I will now go on to Fig. 16. Our plate required to make this taper sheet or gusset sheet must be $118 \times 60\frac{1}{2} \times \frac{1}{2}$ in. Draw a line $4\frac{3}{8}$ in. from edge of sheet lengthwise. This is for your flange or lap. Find center of sheet and draw center line by squaring from line at edge. This will be back end of sheet. Plan of boiler shows double row of rivet holes in this sheet, so that the first thing one must do is to allow $4\frac{3}{8}$-in. for flange at this edge, as we require that much for lap of inner and outer sheet and space between centers of holes. As at *K*, Figs. 14 and 16, measure distance from *O* to *A*, Fig. 13, and measure off same distance along center line, Fig. 16, as at *A, O*. Draw line full length of sheet. At this point do not draw line $4\frac{3}{8}$ in. from edge full length. A short line or center mark is sufficient. I should have told you to take measurement at *O* to *A*, and strike that line the full length of sheet, and square your center line from that, as the other line would confuse you at ends of plate, and is of no use, as you can see by engraving. Mark your line *A O*, as on sketch. Make distance *O O*, Fig. 16, the same as *O O*, Fig. 14. This means the full length of line on slope, not including lap or space added for flanging.

Get distance from 1 to *O*, as at *N*, Fig. 14, mark off along center line. Make center marks at all points you have measured off. Strike or draw line full length of sheet at last center found. This will give you points *K, O, A*, 1, o on center line.

Now we want length of sheet. We find radius of small end, $28\frac{1}{2}$ inches inside or 59 inches diameter, to which we must add thickness of plate $\frac{1}{2}$-inch, making diameter $59\frac{1}{2}$ inches or $59.50 \times 3.1416 = 186.92 \div 2$. We only require length of half the circumference, which is 93.46, or $93\frac{1}{2}$ inches nearly. The length of large end can be found in a similar manner, but we have two radii to figure on and have to find the area of a circular sector, which is too lengthy to go into at present. The method I use is quicker and simpler and just as accurate. This plate when rolled and flanged is same size and shape as back sheet from center of boiler up. When I lay down view of back sheet, as at Fig. 4, March, 1892, paper, I run distance from center to center of boiler around circular part, and this gives me the size required, assuming we have lengths required. Measure off same on flat plate on lines marked *P* equal distance each side from center of sheet.

Now space off sheet back and front as at Fig. 13, *A B C D* and so on, and 1, 2, 3, 4. By setting your dividers where spaced off at Fig. 13, you will come out nearly right, but may vary a little on account of thickness of material, but you must have the same number of spaces on view laid down on flat plate. You must space off along lines marked *P*. I take a piece of letter paper and mark lines *A* to *O* and o to 1 as at *N*, Fig. 14, and carry paper to flat plate as at N, Fig. 16. Take paper to other end of plate and do the same. Mark letters *A O* and o 1 on your plate and paper so that your paper letters, or letters on paper will correspond with letters on sheet, and not get your paper wrong way about. Now draw your lines from marks you transferred from paper parallel with sheet, and where your lines cross make center marks. This will give you the regular line of curvature. Draw your line of curvature by holding flexible straight-edge at center marks. Now you must get your lengths of sheet along this line of curvature then draw end lines, which will be your center of boiler and top row of rivet holes in lap. The row of holes shown above is for welt-strip as shown in plan of boiler. Those still above that are for crow-feet, to brace irregular circle.

Note hole back and front on center line of flat plate. These holes correspond with holes on center line on top of wagon top and cylinder of boiler. This must bring every part to fit accurately. Having done my best to make this matter as clear and simple as possible I left half of view of flat plate without curvature line, so that it would be more easily understood. I will take up dome sheet next paper.

J. Heron

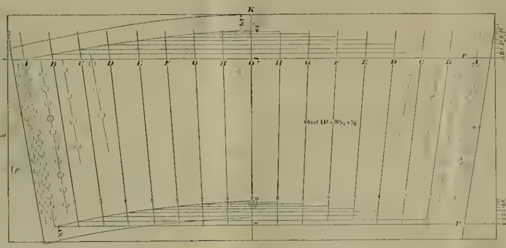



*Fig. 16.*

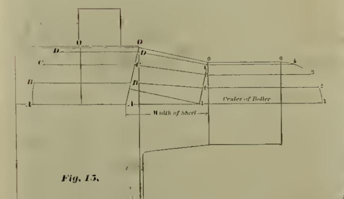



*Fig. 15.*

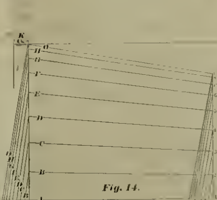


*Fig. 14.*

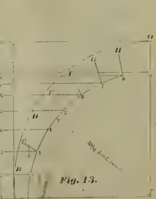


*Fig. 13.*

## Iron Better than Steel for Tubes.

There seems to be no clear reason why steel should not make as good stay-bolts and tubes for boilers as iron, but there is nothing more certain than the fact that it does not. Steel tubes are more or less used in this country but the parties using them would probably consult the interests of their employers by selecting good iron tubes instead.

Those interested in this subject will find edifying reading in the report of experiments made by an English engineer who took a practical way for satisfying himself of the relative merits of steel and iron for the material of tubes. The most conclusive experiment was made by putting two tubes in a pair of plates bolted together, the tubes and the fittings in each case being the same. The structure was heated in a furnace to a dull red heat, and dropped into water of a temperature about 100 degrees F. After cooling, it was found that the steel tube was so slack in the hole that when water was poured upon the joint it ran between the plate and the tube. The iron tube was tight.

On Irish railways women are much employed as booking clerks, and in Dublin tickets are given almost entirely by women.

## ORDERS FOR WESTINGHOUSE ENGINES

### DURING JULY, 1892.

### COMPOUND ENGINES.

| | | | H. P. |
|---|---|---|---|
| Wilmington City R'y Co. | 6th order, | Wilmington, Del., | 330 |
| Brooklyn City & Newtown R. R. Co. | 1st " | Brooklyn, N. Y., | 330 |
| " " " | 2d " | " " | 330 |
| " " " | 3d " | " " | 330 |
| " " " | 4th " | " " | 330 |
| Allegheny County Light Co., | 49th " | Pittsburgh, Pa., | 330 |
| " " " | 50th " | " | 330 |
| Ramford Bros. Silk Mfg. Co., | 4th " | Paterson, N. J., | 200 |
| St. Louis Smelt'g & Refining Co., | 6th " | St. Louis, Mo., | 130 |
| Newport News Shipbuilding and Dry Dock Co., | 9th " | Newp'rt News, Va. | 130 |

| | | | H. P. |
|---|---|---|---|
| East End Electric Light Co., | 22d order, | Pittsburgh, Pa., | 130 |
| Brookline Artificial Ice Co., | | Brookline, Mass., | 85 |
| Drexel Institute, | 4th " | Philadelphia, Pa., | 85 |
| Alliance Mill & Elevator Co., | | Milnor, N. Dak., | 85 |
| Solvay Process Co., | 1st " | Syracuse, N. Y., | 65 |
| " " " | 2d " | " " | 65 |
| Arlington Hotel, | 1st " | Hot Springs, Ark., | 65 |
| " " | 2d " | " " | 65 |
| J. P. Curtiss, | | New Britain, Ct., | 65 |

Total, 19 Engines, aggregating 3 480

### STANDARD ENGINES.

| | | | H. P. |
|---|---|---|---|
| Thomas D. Whitaker, | 3d order, | Booneville, N. J., | 200 |
| Detroit Motor Co., | 2d " | Detroit, Mich., | 200 |
| Dunnell Mfg. Co., | 41st " | Pawtucket, R. I., | 150 |
| American Sugar Refining Co., | 10th " | S. Boston, Mass., | 150 |
| Morris Machine Works, | 6th " | Baldwinsville, N Y | 100 |
| St. Louis Smelting and Refining Co., | 7th " | St. Louis, Mo., | 75 |
| W. E. Peck & Co., | 1st " | New York, | 75 |
| " " | 2d " | " " | 75 |
| Chicago & N. W. R'y Co., | 1st " | Chicago, Ill., | 75 |
| " " " | 2d " | " " | 75 |
| John Bromley & Son, | 8th " | Philadelphia, Pa., | 75 |
| Ramsdell Paper Mills, | 9th " | Salisbury Mills, NY | 75 |
| *Linden Paper Co., | 1st " | Holyoke, Mass., | 60 |
| " " | 2d " | " " | 45 |
| Jarvis Paper Co., | | Claremont J'n, NH | 45 |
| O. G. Cowles, | 2d " | Osceola, N. Y., | 45 |

* Subject to countermand

| | | | H. P. |
|---|---|---|---|
| Rio Grande Smelting Works, | 4th order, | Socorro, N. Mex., | 45 |
| S. D. Warren & Co., | 25th " | Cumberland Mills, | 35 |
| Westinghouse Machine Co., | 18th " | Pittsburgh, Pa., | 35 |
| Dunnell Mfg. Co., | 42d " | Pawtucket, R. I., | 35 |
| St. Nicholas Building, | 1st " | Pittsburgh, Pa., | 25 |
| Chicago & N. W. R'y Co., | 3d " | Chicago, Ill., | 25 |
| Westinghouse Air Brake Co., | 29th " | Wilmerding, Pa., | 25 |
| C. G. Boult, | | Ahnapee, Wis., | 25 |
| East End Electric Light Co., | 23d " | Pittsburgh, Pa., | 15 |
| James Stewart & Co., | | St. Louis, Mo., | 15 |
| St. Nicholas Building, | 2d " | Pittsburgh, Pa., | 10 |
| Rich Electric Ceating Co., | | Mt. Vernon, N.Y., | 10 |
| Crane & Co., | 3d " | Dalton, Mass., | 10 |
| Morris Machine Works, | 7th " | Baldwinsville, NY | 10 |
| West End Street R'y Co., | | Boston Mass., | 5 |

Total, 31 Engines, aggregating 1,845

### JUNIOR ENGINES.

| | | | H. P. |
|---|---|---|---|
| Pencoyd Iron Works, | 12th order, | Pencoyd, Pa., | 50 |
| B. F. Stoner, | | Bellwood, Pa., | 50 |
| Macatawa Park Association, | | Holland, Mich., | 35 |
| R. F. Livengood, | | Delavan, Minn., | 35 |
| Engler & Hamlke, | | Bristol, S. D., | 35 |
| Franklin Glazier & Son, | | S. Glastonbury, Ct | 35 |
| M. B. Potter & Co., | | Hitchcock, S. Dak | 35 |
| John L. Onninger, | | Amsterdam, N.Y | 25 |
| Agent, | | Sydney, Australia | 25 |
| David Bradley Mfg. Co., | | Chicago, Ill., | 25 |
| Whitall, Tatum & Co., | 5th " | Millville, N. J., | 25 |
| Pencoyd Iron Works, | 13th " | Pencoyd, Pa., | 25 |

| | | | H. P. |
|---|---|---|---|
| Agent, | | Sydney, Australia, | 15 |
| Jackson Pulp Co., | 2d order, | Jackson, Mich., | 10 |
| Texas Elevator and Compress Co., | | Dallas, Texas, | 10 |
| Agent, | | Sydney, Australia, | 10 |
| Albert Hermann, | | Paris, France, | 10 |
| Jules Senn, | | Lyons, France, | 10 |
| Agent, | | Paris, France, | 10 |
| Fontaine Crossing Co., | 5th " | Detroit, Mich., | 5 |
| Crystal Ice Co., | | Youngstown, O., | 5 |

Total, 21 Engines, aggregating 485

**Grand Total for July ...... 71 Engines, aggregating 5810 H. P.**

### RONEY MECHANICAL STOKER--Recent Orders.

| | | | Stokers. |
|---|---|---|---|
| Carnegie Steel Co., | 10th order, | Pittsburgh, Pa., | 16 |
| Baltimore City Pass. R'y Co., | | Baltimore, Md., | 14 |
| Joliet Enterprise Co., | 3d " | Joliet, Ill., | 12 |
| Westinghouse Air Brake Co., | | Pittsburgh, Pa., | 12 |
| Cheney Bros., | | S. Manchester, Ct., | 8 |
| Pittsburgh Plate Glass Co., | 5th " | Pittsburgh, Pa., | 8 |
| Allegheny County Light Co., | 3d " | Pittsburgh, Pa., | 8 |
| Kerr Thread Co., | | Fall River, Mass., | 7 |
| Paige Tube Works, | | Cleveland, O., | 6 |

| | | | Stokers. |
|---|---|---|---|
| Niagara Falls Paper Co., | | Niagara Falls, N.Y., | 5 |
| Linden Paper Co., | | Holyoke, Mass., | 4 |
| National Rice Milling Co., | | New Orleans, La., | 4 |
| Chicago Cold Storage Exchange, | | Chicago, Ill., | 4 |
| Rumford Falls Paper Co., | | Rumford Falls, Me., | 3 |
| Otis Falls Pulp Co., | | Otis Falls, Me., | 3 |
| Decatur Gas Light Co., | 3d order, | Decatur, Ill., | 2 |
| Pittsburgh Water Works, | | Pittsburgh, Pa., | 2 |

**WESTINGHOUSE, CHURCH, KERR & CO., Engineers.**

## Making Solid Cast-Steel Wheels.

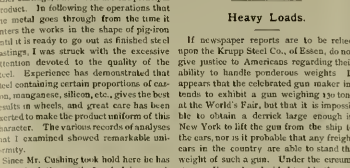
During a recent visit to Boston I called upon my old friend, Mr. G. W. Cushing, who is now manager of the American Steel Wheel Co., and in the course of the visit learned a good deal about the making of solid cast-steel wheels.

I found a regular Bessemer steel plant in operation, producing metal for a great variety of purposes. For railroad work there are draw-bars, knuckles, gearing, buffers, levers, crossheads and numerous other castings, but wheels are the principal product. In following the operations that the metal goes through from the time it enters the works in the shape of pig-iron until it is ready to go out as finished steel castings, I was struck with the excessive attention devoted to the quality of the steel. Experience has demonstrated that steel containing certain proportions of carbon, manganese, silicon, etc., gives the best results in wheels, and great care has been exerted to make the product uniform of this character. The various records of analyses that I examined showed remarkable uniformity.

Since Mr. Cushing took hold here he has reorganized the methods of doing work and effected great improvements in the pouring of castings, more particularly in the casting of wheels. The steel wheel patterns were formerly for single-plate wheels, but after studying out the matter thoroughly Mr. Cushing designed the double-plate pattern shown in the annexed engraving and that is now the standard form of wheel. The mold for this wheel is so formed that the metal runs directly into the tread of the wheel and extraordinary measures are taken to facilitate the escape of the gases from the steel. The improved methods of casting have resulted in producing wheels that are entirely free from the defects of piping and blow-holes that have done so much to retard the success of steel castings. A very exhaustive series of experiments were carried on under Mr. Cushing's supervision to find out means of producing more reliable castings, and the discoveries made are said to have led to the most satisfactory results in practice.

The wheels are cast in chills which appear to solidify the casting, although it is not chill-hardened like a cast-iron wheel. After being taken out of the sand the wheel is placed in an annealing furnace and kept there at a very high heat. This annealing operation appears to have a material effect upon the nature of the metal, for the fracture of pieces that were examined before and after annealing showed as great structural change as that of steel before and after treatment with the Coffin toughening process.

The works of the American Steel Wheel Co. are at present at South Boston, in an inconvenient location. The company are building first class works at Garwood, N. J., about fifteen miles from Jersey City. The plant to be put up there will embrace the latest improvements in furnaces and in all the apparatus necessary for doing the work of making steel castings. A. S.




AMERICAN SOLID STEEL WHEEL.

## Heavy Loads.

If newspaper reports are to be relied upon the Krupp Steel Co., of Essen, do not give justice to Americans regarding their ability to handle ponderous weights. It appears that the celebrated gun maker intends to exhibit a gun weighing 130 tons at the World's Fair, but that it is impossible to obtain a derrick large enough in New York to lift the gun from the ship to the cars, nor is it probable that any freight cars in the country are able to stand the weight of such a gun. Under the circumstances Krupp has decided to ship the gun on his own cars loading the gun on the largest freight steamer.

We regret the difficulties that beset Mr. Krupp in his endeavors to exhibit at Chicago, but are inclined to doubt the fact that a crane to do such work could not be procured. We also feel certain that the bringing over of the cars is another case of "shipping coals to Newcastle." Some machine tools lately shipped from Philadelphia were as heavy as the Krupp guns and there was no difficulty experienced in handling them.

## A Startling Brake Test.

The late Emperor Dom Pedro, of Brazil, once gave audience to a young engineer who came to show him a new appliance for stopping railway engines. The Emperor was pleased with the thing and said:

"We will put it at once to a practical test. The day after to-morrow have your engine ready; we will have it coupled to my saloon carriage, and then fire away. When going at full speed I will unexpectedly give the signal to stop, and then we will see how the apparatus works."

At the appointed time the Emperor entered his carriage and the engineer mounted his engine, and on they went for a considerable distance; indeed, the young engineer began to suspect that the Emperor had fallen asleep, when the train suddenly came to a sharp curve round the edge of a cliff, on turning which the driver saw, to his horror, an immense bowlder lying on the rails.

He had just sufficient presence of mind to turn the crank of his brake and pull up the engine within a couple of yards of the fatal block.

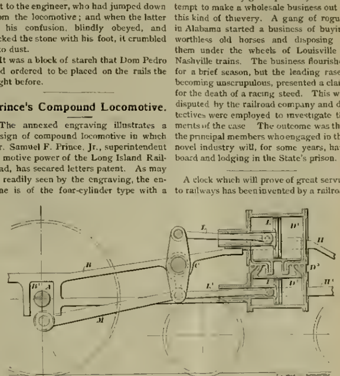
Here the Emperor put his head out of the window and asked what they were stopping for. The engineer pointed to the piece of rock, on seeing which Dom Pedro burst into a merry laugh.

"Push the thing on one side!" he called out to the engineer, who had jumped down from the locomotive; and when the latter in his confusion, blindly obeyed, and kicked the stone with his foot, it crumbled into dust.

It was a block of starch that Dom Pedro had ordered to be placed on the rails the night before.

## Prince's Compound Locomotive.

The annexed engraving illustrates a design of compound locomotive in which Mr. Samuel F. Prince, Jr., superintendent of motive power of the Long Island Railroad, has secured letters patent. As may be readily seen by the engraving, the engine is of the four-cylinder type with a rocking shaft as a means of transmitting the power from the pistons to the crankpin. Trunk pistons are employed and no crosshead is necessary. The arrangement is, to say the least of it, novel as applied to a locomotive, and it strikes us as having several commendable features.




PRINCE'S COMPOUND LOCOMOTIVE.

## Advantage of a Tests Department.

The advantage of a railroad company having a good department of tests was lately illustrated in a curious way. A new car remarkable for its cleanliness, was recently adopted by the Pennsylvania for the transportation of butter. The first car load, delivered in New England, was refused by the consignee on the ground that the butter was spoiled. The shipper positively asserted that the butter was in first-class condition when it left Chicago, and the Pennsylvania saw no recourse but to make good the loss. Before paying the shipper, however, numerous samples of the butter were shipped to the Pennsylvania's extensive laboratory for analysis. The chemists promptly reported that the butter had absorbed the odor of the shellac on the new car until it was unfit for use. The Pennsylvania promptly changed the painting on the car and suffered no further loss, where almost any other railroad would have lost car after car without discovering the cause. The Pennsylvania watches over details with the exactitude of a bank.

## Systematic Stock Killing.

A great many farmers are extremely willing to sell poor stock at high prices to railroad companies under the pretense that they have been struck by trains. A great many animals that have died from natural causes have been paid for by railroad companies. In districts where the railroads are not fenced no cattle or horses die of any complaint except that of the pilot, and railroad companies quietly submit to the imposition.

The most disgusted farmer we ever met was one who led an old dilapidated mare into a cattle guard to be slaughtered, and the train stopped and the crew jerked the animal out with a switch rope. The owner tried again and the same thing was repeated with the addition that he was landed in jail the next day.

These kinds of tricks are to be looked for among poor but dishonest people. The courts have lately given publicity to an attempt to make a wholesale business out of this kind of thievery. A gang of rogues in Alabama started a business of buying worthless old horses and disposing of them under the wheels of Louisville & Nashville trains. The business flourished for a brief season, but the leading rascal becoming unscrupulous, presented a claim for the death of a racing steed. This was disputed by the railroad company and detectives were employed to investigate the merits of the case. The outcome was that the principal members who engaged in this novel industry will, for some years, have board and lodging in the State's prison.

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A clock which will prove of great service to railways has been invented by a railroad man. As a train rushes through a station the hour and minute hands whirl around like a flash to the correct moment, and a red bull's-eye flashes into the dial. Five minutes later the red light turns green, and in five minutes more the green light disappears. The engineer on the next train can tell exactly to the moment how many minutes ahead is the train that precedes him. The clock is a perfect timekeeper, and when the train passes drops the signal light.

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The Patent Office has issued three patents on valves for automatic air-brakes to the Boyden Brake Company of Baltimore. The application for one of these patents has been pending since September, 1889. The patents relate to improvements in triple-valves and have been pending for some time. The Boyden triple-valve is a very simple and efficient device and has the merit of being original.

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The Pintsch Gas Lighting Company have sent out a card with a map of the United States, showing the places where Pintsch gas works have been established. They also make some points respecting the advantage of using this form for car lighting. It is said to be safe, economical, effective and simple in operation.

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We have received from the National Machinery Company of Tiffin, Ohio, a new illustrated catalogue of the machinery which they make. It is got up in first-class style and will be a convenient reference for the class of railway men who have to deal with the purchasing of bolt, nut and forging machinery.

The Q. & C. Company of Chicago, have issued a very handsome souvenir of the World's Columbian Exposition, giving excellent wood cuts of all the buildings.


## Iron vs. Steel for Fireboxes.

*Editors:*

Having read a discussion between the agents of the Low Moor Iron Company and steel manufacturers, in the June issue of the LOCOMOTIVE ENGINEERING, I beg to submit a few items of interest, which are doubtless known to many master mechanics.

Steel certainly has the advantage over iron in flanging. It is worked much easier and far less heat is required than in good strong iron. During the many years that steel has been made, it does not yet appear that the manufacturers understand it thoroughly. We put a first-class flange-steel into a firebox, which may stand all the requirements of a first-class article, and in a little while it cracks from one end to the other. There is no warning given for such crackings; to all outward appearances it is a perfect plate when put in. The magnitude of this evil is well known, alike to users of the best and highest grade steels, as well as to those using the cheapest.

Charcoal hammered iron has not this tendency, but sometimes shows blisters. These blisters are the results of imperfect welding, for which the manufacturers have no excuse except carelessness in manufacturing.

The intimation that the Low Moor brand is the only good iron made is not well founded. The Tennessee Charcoal Bloom Iron made in Kentucky is equally as reliable as the imported Low Moor. This brand of iron has been made into firebox plates for many years, and is still in use. This high grade charcoal iron when properly made (though more difficult to work) makes a more reliable firebox, and will outlast steel a number of times over.

A WESTERN MASTER MECHANIC.

## Power Absorbed by Locomotive Machinery.

*Editors:*

I notice that a communication has been criticised by Mr. Johnson, of Topeka, and a Youngstown gentleman. I am undoubtedly to blame for not explaining the matter clearer. I intended showing that one of the difficulties of high speed was the great proportion of power absorbed by the engine itself, and as a detail of this the power required to keep the pistons, crossheads, etc., in motion. That there is no loss of power by the use of the crank, which is the point, I take it, that Mr. Johnson calls attention to, will certainly not be questioned, and I have no remembrance of saying there was, nor that it is possible to destroy a force once created, which I believe he also calls attention to, nor that action can exist without an equal reaction. But before the work stored up in the piston, etc. during the first half of the stroke can be delivered in the last half, it must be created and made to exist, and it was this that I intended calling attention to, that is, that high speed is difficult because of the large amount of power required to keep the engine, alone in motion. If my memory serves me correctly, I indicated a light engine at a little over sixty miles per hour, which showed a horse-power of nearly 500.

Because stored-up force is returned it is of little value if there is no surplus to put into a train. As the Youngstown gentleman says, heavy reciprocating parts are used in automatic high-speed stationary engines, forming a reciprocating fly-wheel, that is, a mass to absorb the force put into the piston during the first part of the stroke before the valve is closed, and shortly afterward, when the pressure is high in the cylinder, which force will be given out at the latter part of the stroke when the cylinder pressure is low, due to expansion. This has been a recognized necessity for years, and its value, I believe, first appeared in pumping engines known as "bull engines," which were supplied with a weight, because of the absence of a fly-wheel for this purpose.

But my Youngstown critic is wrong if he believes that heavy reciprocating parts are "the thing" on the locomotive where the mass of the engine itself serves as a fly-wheel.

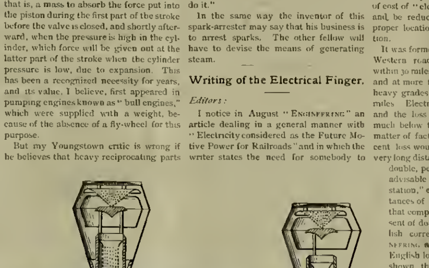
High speed requires a well counterbalanced engine, and heavy reciprocating parts are in the way of good counterbalancing, as any one is aware who has had this work to do for the locomotive. While it is quite possible to counter-balance a stationary engine perfectly, it is impossible to do the same for the locomotive, as the conditions are not similar, and the heavy reciprocating parts favored by the Youngstown gentleman would prove the destruction of the locomotive and the track.

FRANK CORBETT.

## An Effectual Spark-Arrester.

The annexed engravings show a spark-arrester which is about the latest invention in this line, and was got out by J. W Curran, Marshall, Tex. The invention appears to combine nearly all the devices that have been employed for spark-arresting. It has the diamond stack with provision for carrying the sparks back to the firebox, a perforated lift-pipe like what is used in the Smith spark-arrester, and an extension front with diaphragm and netting. The device ought certainly to prevent spark-throwing, but a man familiar with the running of locomotives naturally asks, how is draft obtained for the generation of steam? The invention reminds us of an anecdote about a testy old gentleman in England who was tortured with a gouty toe. The family doctor failed to give relief, and the sufferer eventually ordered him out of the house and talked of giving a big reward to any one who would cure the troublesome toe. A man called on him one day and offered to make a contract on the no-cure-no-pay principle. An agreement was made and the man appeared next day with a set of surgical instruments and told the 'squire that he was ready to perform the cure. The foot was laid bare and the 'squire asked, "Now, what are you going to do?" "Why," replied the man, "I am going to cut off your foot." "Cut off my foot!" exclaimed the sufferer, "you are mad! How can I walk without my foot?" "That is no business of mine," replied the man, "my business is to cure your toe and I can do it."

In the same way the inventor of this spark-arrester may say that his business is to arrest sparks. The other fellow will have to devise the means of generating steam.



NEWEST THING IN SPARK-ARRESTERS.

## Writing of the Electrical Finger.

*Editors:*

I notice in August "ENGINEERING" an article dealing in a general manner with "Electricity considered as the Future Motive Power for Railroads" and in which the writer states the need for somebody to "rise up" and present the problem of electrical railroading understandingly to the "railroad army," as "Sinclair has presented the problem of train resistance; in an understandable way."

Doubtless we may wait, as in the case of steam railroading, before the electrical problem will be *clearly presented* to the "army," but the "train resistance problem" applies to each.

The electrical system as applied to railroads will doubtless become familiar in the near future, but in the meantime it may be far more troublesome to officials than is now the compound locomotive matter. We will need to prepare to meet the electrical power question and to deal with it in a progressive spirit, settling the troublesome details as they appear. Electricity will not wait for leaders, those who take hold in earnest and work out practical points, as has been done in steam railroading, will, by their determination to overcome difficulties at the start, win one-half the battle, and doubtless as many paths will open to the active workers as in the former instance. Conditions of service will change, requirements will change to meet the new conditions, and in general there is likely to be an adaptation to the new power in all mechanical plans and arrangements. Hence, it seems less necessary to consider in experimental talk or practice a preservation of the old system. Something better *will* appear and that is the thing to consider and apply to use

Those who, in the past, have been through the "old mill" will, as a consequence of their experience, take a conservative view of the new order of machinery and be most likely to look and work with unprejudiced minds for results in the new field.

To my view a most important change will result in the adoption of the central station system and the *concentration of power* at difficult places on railroads, as for instance, near heavy grades or where traffic may be centered for useful or any convenient purpose; and the adoption at all the stations of the proper form of compound condensing engines in which the best possible results may be reached in the use of steam power; the result of which will *more* than compensate for the loss which is at present considered in the sum of cost of "electrical power transmission," and be reduced in amount also by the proper location of the central power station.

It was formerly considered necessary on Western roads to place water stations within 30 miles distances at the maximum, and at more frequent intervals in case of heavy grades or of bad water within 20 miles. Electrical stations may be placed and the loss of power transmission be much below the present estimates. As a matter of fact, I am informed that 30 per cent loss would now be experienced in a very long distance transmission, more than double, perhaps, what might be found advisable in the actual use of "power station," except on roads with long distances of level track. It may be said that compound locomotives are at present of doubtful utility, and your English correspondent in August ENGINEERING appears to have this view of English locomotives, but it cannot be shown that compound, stationary or steamer engines are unsatisfactory when properly designed for the service. They are used the world over in all sorts of service as compound and compound-condensing engines, and it is folly to regard them at all in an experimental light. They long since passed that stage; as they doubtless may on steam railroads for special service, and certainly have done in electrical station service all over this country.

Mistakes in electrical power stations undoubtedly have been made in the selection of suitable engines, and may be again, but there being given a fair understanding of various requirements, power can be supplied to meet the probable minimum and maximum duty under best conditions with compound condensing engines, or a number of small compound engines, where these seem desirable in a central station, as is now often the case in electric lighting and power plants.

The Thomson-Houston Co., at their Lynn works, which, by the way, employs 4,000 men, have a locomotive department, and are there planning and constructing the electric-power locomotive frequently referred to in the newspapers for use by the B. & O. Railroad. While the exact tonnage is not made public, they are designed to displace the "steam locomotive" at present used in local service at a point near Baltimore.

A recent *Electrical World* notes that a project is on foot for an electric line between Brussels and Antwerp, and which proposes to run trains of one car, each holding 60 people, at a speed of 66 miles per hour, time 20 minutes and at intervals of 10 minutes. The present steam roads make up 16 trains daily each way. The conditions are said to be favorable and the only notable point is the proposed speed.

St Paul and Minneapolis are served by an electrical railway at more frequent intervals at a less speed, because mainly of its being entirely a suburban road, running and discharging passengers at all points along the distance of 11 miles. Omaha is supplied with a very complete and nice-

working electric system, which doubtless will extend as required. In Boston there are motor cars throughout the city reaching well into the suburbs, and considering the crowded conditions of the streets of Boston, this system is wonderfully well managed and accommodating. Here are modern motor cars, seating 34 and taking on 80 passengers; and they may well be styled the people's carriages, as a Yankee girl was heard to remark of them. These roads are destined to extend beyond the suburbs to *25 miles or more*.

In the progress above referred to and in the near prospect, it seems to point to a favorite method in the new transportation system, but it is practicable, of course, to add one or more cars to the motor car to make up the "electric train," as is now done on cable roads, wherever used. Fast time within the limits of a city like Boston will not be practicable on surface roads, but in the long stretches of suburban districts, even now satisfactory speed is obtained, and high speed may be made with no material *damage to track or road bed*.

The "army" of workers on the present steam roads may not soon be affected by the certain advance of electricity, as the natural expansion of the country constantly going on makes room for a new order of things without any apparent disagreement between the two systems; but eventually it will affect them seriously and they should note the signs of the time and prepare to *accept results*, or possibly to control and profit by them. "Hitch your wagon to a star," is an Emersonian maxim, but it is well nigh a reality by reason of the adoption of electricity to carriages, which is being done in Boston, and it may be practicable for the ordinary person to own his own electrical carriage, and even the "army" may do so yet, as freely as in the case of the bicycle. When this happy time comes, the writer may be able to invite his friend, your correspondent, J. E. F., to ride, provided he "gets there" in advance of the young man.

G. W. Cushing.

*Boston, Mass.*

## A Way to Reface Roughed Tracing.

*Editors:*

Until, lately, when obliged to alter a tracing, I have first removed the ink with a steel scraper, so far as could be done without injuring the cloth, completing the erasure with a sand rubber, and restoring the surface as well as possible by rubbing hard with a piece of white paper until the cloth again appeared glazed.

This gives fairly good results, but takes much time, and the new surface is apt to become soiled.

A short time ago I learned of a better method, as follows:

After the erasure is complete scrape some French chalk on the tracing cloth and rub it in lightly until the cloth will retain no more. This will produce a surface nearly equal in every respect to the original.

Of course it is premised that the erasure has been made without injury to the texture of the cloth, as no surface can repair any damage to that.

I have tried this method on both new and old tracings and always with success.

French chalk is commonly used by tailors, and can be obtained in small sticks at any drug store.

Frank M. James.

*Haverhill, Mass.*

## Ten-Wheel Engines. Stationary Links.

*Editors:*

Now that the different railroads are catering to large ten-wheel locomotives for passenger trains, will you state for the benefit of myself and readers of your paper, if there is any economy in the use of such locomotives to the railroad company, or are they used on account of having heavy trains to pull on heavy grades? I have been a M. M. for many years and am getting old in the machinery department. It has long been a question in my mind if there exists any economy in locomotives of that class. I see one or two great faults, to wit

Those long eccentric blades crossing forward axle. I tell you when those long blades get to vibrating I imagine you are in danger of losing your motion.

Now, will you tell me why we could not go back to the old-time stationary link with movable blocks? Then we could have an arm running over the top of forward axle and get our clevis-rods back of forward axle. Now, is there any reason why this would not work? You would only have two more joints than you have now.

You all know, who understand this link, that it was a good motion for fast engines. You remember this link was the first link adopted to take the place of the old V and drop-hook motion.

Now, the second I should think would be the clevis end of parallel rod end, the rod reaching from middle or main driving-wheel to back-wheel. Now, I think when sizes are worn down, one smaller than the other, the slip of wheel must make a tremendous strain on those rods and hammer the main pin. Now, please answer this through your paper and tell all the boys to join in.

E. A. Campbell,
Supt. M. P. & Mach'y.

*Houston, Tex.*

The Result of a Collision Between Trains on a Foggy Day.

## Frost Lighting and Westinghouse Air Get Mixed.

*Editors:*

For the benefit of all interested in air-brakes, we will relate a circumstance that happened on the E. T., V. & G. An engine and four cars are running on a short run. The cars are kept in the run and are not changed. Engineer reported brakes would release in 10 seconds after being applied, and handle put on lap. Equalizing and discharge-valve was overhauled, with no relief. The engine was then coupled to other cars and brakes held perfectly on lap, demonstrating defect was not on engine. The original cars were equipped with the Haberkorn triples and governor attachment. The engine was then coupled to its own train, same result; brake would release on lap. Then commenced a chasing up one side and down the other. The M. C. B. and road foreman of engines, both experts, rendered frantic by the guying of the S. M. P., who happened along that way. This would make a good puzzle. But as few roads use the Frost Dry Carburetter system of lighting, it would be unfair to put it as a puzzle. This system of lighting is done by a light air pressure passing into large cavities, where gasoline is held in cotton wicking and vaporized into illuminating gas by air and heat. A large reservoir is suspended under car and connected to train-pipe with a check. This reservoir is four times as large as an auxiliary reservoir. This is charged to full train-pipe pressure, and then air is fed to carburetters by a diaphragm regulator set to 2½ pounds. The check is supposed to hold all it gets from train-pipe, thus cutting it off when train-pipe pressure is reduced in application. Two gauges were applied; one to auxiliary reservoir and one to train-pipe. Brakes were applied, and as soon as auxiliary reservoir-pressure and train-pipe pressure had equalized, the gauge on train-pipe was observed to increase slowly till it released brakes. The trouble was then located. The check between train-pipe and Frost lighting reservoir was found to have been broken—a small piece broken from valve. The reservoir being so much larger and containing a much larger volume of air than auxiliary reservoir, it fed its pressure very fast through the small opening in broken check-valve, releasing train-pipe pressure and releasing brakes. The Haberkorn triples were removed and Westinghouse triples substituted. The result was precisely the same. The Haberkorn governor attachment is a fine move in the direction of instantaneous release. It is as quick as vacuum.

A. T. Hooker,
General foreman, E. T., V. & G.

*Chattanooga, Tenn.*

## One Wheel Slid Flat

*Editors:*

I notice in your July number on page 231 a query in relation to *one flat wheel*, which seems to bring forth several comments as to cause. Although I do not often care to discuss a great many questions that come before us, but as this has attracted my attention several times and I have not found one answer that I think correct, I will state my views for the benefit of those who may have more time and better opportunity to experiment than I. I had a tank truck on my engine with a wheel flat on one side, and I could not at first account for it. But I made up my mind to solve the mystery, which did not take long. I watched the wheel when I applied the brake, and found that when the brake-shoe clamped the wheel it would raise it clear from the rail and it would slide in this way and not drop down until the break was released. In another instance I noticed a similar working of a brake on a gondola coal car, that when the brake was applied one wheel came up clear off the rail at least one-half inch, and did not drop down until the brake was off. I examined the car, but could not see why it should do this, unless it being a very rigid brake and one brake-hanger some shorter than the opposite one, and the metal in the brake-shoe was very soft, so when it became a little warm, would stick or hang so as to raise the wheel when the brake was set. Perhaps some one else has noticed similar actions of brake which may be of help to others.

Geo. P. Stewart.

*Palestine, Texas.*

## Lining Guides by Counter-bore.

*Editors:*

In the July issue of your paper I see an article about lining guides by the counter-bore of cylinder, where Hugh R. Crawford says the method laid down by P. H. Zwicker, in his "Revised Practical Instructor," is a delusion and a snare, and also says he has been asked by engineers and young mechanics several times in the past few months if the method is correct. Well, let me say as far as the engineer is concerned, it is all right if he knows these things, as they are good things to know, but the average engineer does not trouble himself to know. If the guides on his engine are lined by cylinder or counter-bore he gets there all the same.

But I must say Mr. Crawford's way of learning the young idea how to shoot is a bad one, and if my boy was going to learn to be a machinist I would take care and not place him under such an instructor as Mr. Crawford seems to be.

I say, Mr. P. H. Zwicker is right, I don't care how much the cylinder is worn on the bottom, which every good machinist knows is caused by the bull-ring dragging the bottom of cylinder, I will venture to say that he never found a cylinder worn as much in the back end as in the front. If he has, he has found more than I have, and I have run a few lines through cylinders myself. Another thing, he does not say whether he sets his line in center of cylinder in front end and stuffing-box on

back end If he does take this for example Take a pair of dividers and make a circle sixteen inches, then make another one, say five feet. Then draw a line from center to center, then take and drop down one-eighth of an inch from center of one and then draw another line. I would like to know if that is the center of cylinder? I guess not. Then, on the other hand, set the line to the cylinder worn out in the bottom one-eighth of an inch. He says Put up your guides, put in your piston and key it in crosshead. Now, Mr. Crawford, how about that neck-ring and gland, and how about the center of that back cylinder-head? If the neck-ring fits like it should for what it is intended, you could not get it in because your guides are an eighth out of line. I have seen guides lined up this way, and I have seen the wool pulled over the foreman's eyes about that unruly neck-ring, and I will tell you how it was done. Take care, Mr Crawford, I have been all along there It was this way Piston shoved in, neck-ring was put in its place, then piston was keyed in crosshead (great care taken to keep its neck-ring in place) until packing was put in stuffing-box and gland screwed up. You can get your cylinder packing in; no trouble about that (but oh, what a job). Now, is this the right way to line up guides? I think not. This is a delusion and a snare. If the line had been set by the counter-bore in front end and stuffing-box in back end, as center of stuffing is the center of counter-bore, there would be no trouble of cross-head and piston not working all right. Let me say right here, such works as P. H Zwicker, or any other mechanical works, you can bank on them being right They are not got up to gull the young mechanic. They are out on their merits, but my advice to the young mechanic is if the shop foreman tells you to line up guides by Mr Crawford's method, do it. They are responsible for the job. If not, be governed by the counter-bore and you will have no trouble. I have seen so many articles in the LOCOMOTIVE ENGINEERING about guide lining, and when I saw this one by Mr Crawford I could not keep from chipping in. The article written by Mr. Hitchcock is a good one, and shows he knows his business in the manner he handles Mr. Dolbeer's method of putting up guides without a line, which is one of the slimmest methods I ever heard of.

I got hold of a set of guides once to take down and line up that had been put up by Mr. Dolbeer's method, and I will here tell the readers of your paper about them. I lined up my guides with a line. When I got them done I found guide too high for pump one-fourth of an inch. This engine had two pumps on her which were not taken down.

Now, if these guides had been put up in the first place with a line, the very fact of taking down the guides and then putting them up would not put the pump out of line as it was Well, I run over my work again to be sure I was right before I told the foreman of the trouble, and he was like some more foremen I know of, who know it all themselves and do not allow the men to know anything He laughed at me and I heard him mutter something about a chump, and went so far as to run my work over before he would be convinced that such was the case, but it was there Therefore the pump had to be raised up and branch-pipe shortened, but before doing this we tried to work a hollow plunger, but pump was too much out to admit of it. These guides were lined up the first time by the Dolbeer method.

SAM MASLEY.

*Palestine, Tex.*

## Faults of the Link Motion.

*Editors:*

In your issue for August, I observed a communication on link motion which seemed somewhat vague, but still I seemed to comprehend its meaning, at least, I thought so

It seems to be the desire of most engineers to pull their trains with reverse lever as near the center notch as possible, in fact, if the engine could not pull her train in the first notch, it was not uncommon to have the reach-rod lengthened out until she did, which gave her a later cut-off.

We have a class of 17 x 24-in. engines in passenger service which will pull their trains with from 6 to 7-in. cut-off, valves have $\frac{3}{4}$-in. outside and $\frac{1}{64}$-in. inside lap, and $5\frac{1}{4}$-in. travel and $\frac{1}{16}$-in. lead.

Now, beginning with forward dead centers, forward motion and reverse lever in first notch out of center, we find front port open to extent of lead, which in this case is $\frac{1}{16}$ in.; and, proceeding, we find that the port is open to its fullest, which is ½ in at 2 in. of piston travel, and cut-off at 6 in., when the valve closes, port moving ahead, leaving the steam to work expansively until released by the exhaust cavity at 15 in. of piston stroke. You have now had 6 in. of boiler-pressure steam, supposing throttle to be wide open and 9 in. of expansive steam. But, now, when we consider that the moment the steam is released from the front end of cylinder (yes, and before) the back port is closed, with piston moving back for the remaining 9 inches, which causes a back pressure which is sufficient to lift the valve, and must be more than the boiler pressure until back port begins to open, which it does at 22 in. of piston stroke, and we are ready to proceed with the back end in the same way. Now, it hardly seems reasonable to me to think that these 9 inches of compression are necessary to cushion the reciprocating parts of an engine which does not run faster than it would when reverse lever is in the corner notch, when compression does not begin until more than 23 in. of piston stroke.

Of course, the throttle is not open so far when in the corner, but it seems to me that it would be a greater economy if the engine was worked at, say, $\frac{2}{3}$-in. stroke, or, at the most, at about 15-in. cut-off, when compression begins at about 21 inches.

I hardly think it possible to get results from a link motion to compare with a Corliss engine, where they keep the steam working expansively for nearly the whole stroke, and employ an extra valve to control the exhaust. In the modern marine engine an adjustable cut-off valve is employed, which is worked independently from the main valve by the cut-off eccentric, main valve being always at full stroke. This appears to be the only way to get desirable results from an engine where it is wished to use boiler-pressure steam, and the engine works too strong at an advantageous stroke.

But the link motion will never be discarded until something decidedly superior is designed, which is hardly probable; but to see a good cut-off valve introduced on the American locomotive is the hope of

*Green Bay, Wis.* S. P.

FIRST RAILROAD STATION IN AMERICA

## The Oldest Station in America.

The house shown in the annexed engraving stands on the brow of a hill overlooking Schenectady, N. Y. It is in the midst of a quiet rural scene that savors more of stillness and repose than the stirring surroundings of noisy railroad life yet it was once the scene of the most active railroad life on this continent, having been the principal station house and operating headquarters of the Mohawk and Hudson Railroad, the first railroad chartered in America and the first one built in New York State. There is no doubt that this is the oldest station building in the country It is a very modest structure compared with the pretentious buildings now dotted over every line in America, but it possesses historic interest second to none in this line.

The charter for the building of the Mohawk & Hudson Railroad was granted in 1826. The Erie Canal had been opened the previous year and the Empire State was enjoying extraordinary prosperity, the improved means of transportation contributing in no small measure to the growing welfare of the community The whole country was unusually prosperous under the beneficent policy of the Adams administration, and New York State had a particularly enterprising executive in Governor Clinton. The time was propitious for promoting improved means of intercommunication and courageous capitalists cheerfully risked means in the building of the railroad that was to unite in more than fraternal bonds the waters of the Mohawk and Hudson Rivers.

There were untold difficulties in the way of pushing this enterprise, for when it was undertaken there was not a railroad in the world in the sense that the Mohawk & Hudson was intended—that is a railroad for general transportation of passengers and freight.

In 1831 part of the line was opened for traffic and a portion of it near Schenectady was operated by inclined planes and cables The building shown in our engraving was erected on the part operated by locomotives The window that was used for the issuing of tickets is still there, the glass marked with a diamond ring. Around the house are pavements made of the stone blocks first used as ties for laying the rails upon.

For those who are inclined to look up the railroad scenes possessing historical interest there are few places now more worthy than this one A pilgrimage to the spot would be a day agreeably spent.

It is sixty-two years ago this month since a wonderful train passed here drawn by the De Witt Clinton, the first locomotive built in America. The locomotive was about the size of a modern fire engine, and was run by David Matthews, who helped to build the machine and who is still alive. The running of the train was a great event, for the passengers were the leading men of the State who had come to take ceremonial part in an event which was of greater importance to mankind than anything that had ever happened before.

### Bad Brake-Levers.

*Editors:*

A few years ago, many of the railroads in this country used a standard tender brake-gear almost identical with Mr. Synnestvedt's sketch in the August number, differing sometimes in detail but possessing the absurd features of a *dead* brake-lever.

Brake-levers have a double or compound fulcrum and are connected directly with the source of power. With the Hodge and Stevens systems of leverage adopted by Westinghouse and the railroads generally, a "floating" brake-lever is used, that is, the lever has no fixed fulcrum, the brake-rod connections forming compensating fulcrums. The push-rod from brake-cylinder piston is attached to one extreme end of brake-lever, one of the brake pull-rods connects at the opposite end and the other pull-rod is connected to the lever at an intermediate point and when power is applied one rod pulls out to its limit and becomes a fulcrum for the other rod.

The pull-rod nearest the connection to power has the greatest leverage and develops greatest braking force. The weight on both trucks of a passenger or freight car is about the same and means are employed to equalize the unequal leverage, but with a locomotive in service, the weight on forward tender truck is continually lessened as the fuel is used and the standard car brake-gear may be simplified to advantage when used under a tender by connecting the pull-rod from forward truck to the end of brake-lever opposite the power and the rod from rear truck to the proper point on the lever and nearer the connection with piston power, thus throwing the greater braking force to the wheels bearing the greatest load.

A lever can have but two general fulcruming points. With a *dead* brake-lever there is a fixed, immovable fulcrum-pin about the center of the lever and when the brake is applied the pull-rod having the least slack forms the other fulcrum, while the other pull-rod may not have sufficient power to draw its shoes against the wheels.

Whenever one of those ancient forms of leverage is discovered, it is claimed that it is a relic of a previous administration and most generally is, but it would be in the line of economy to remove them. I knew of a passenger train which stopped for a crossing when within a mile of the terminal station, and when brakes were released the tender-brake failed to let off, it had an independent auxiliary and triple; a dead brake-lever was used and the forward pull-rod fulcruming gave the entire braking power to its shoes. The front end of tender was light of coal and the front four wheels skidded the mile without giving a resistance noticeable to the enginemen. When the train stopped at the station the brake was still "stuck," while the shoes on the wheels of the rear truck could be moved laterally with the foot. The resisting power of this brake was so slight that the men on the engine didn't know that it was set when pulling a nine-car vestibule train, but I was informed that on the return trip those four forward wheels developed flat spots.

This tender brake-gear differed slightly from Mr. Synnestvedt's "frightful example." A 36-inch *dead* brake-lever had the pull-rods connected to each extreme end with the push-rod attached twelve inches from the fixed central fulcrum, and with very little slack in the gear, it can be figured just about how short the piston travel was and how great the auxiliary pressure that the releasing pressure had to overcome.

Another bad feature is that closing up the slack in brake-gear and getting a shorter piston travel decreases the effectiveness of this kind of brake, and when both driver and tender-brakes are supplied from a single auxiliary, the driving wheel tires suffer from the effect. Put an engine thus equipped on a fast scheduled local passenger run. The engineer must make the time, but after running past several stations, he gets suspicious of the tender-brake and has the slack taken up. The brake holds better for about one single trip and then is as bad as before, will only hold on one truck, and in his desire to make the tender-brake efficient, the engineer will often have its piston travel so shortened as to give a greatly increased force to the driver-brakes and when he shortens their piston travel he makes the stops all right, but after a short while is requested to give an explanation of why he ground off his driving wheel tires so soon and also as to why he has so many flat wheels under his tender, and usually he can't give it.

WILL W WOOD.

### Air-Brake that Set in Full Release.

*Editors:*

You request, in the last issue of your paper, that all puzzles be accompanied by the solution, written on a separate sheet, for insertion in the number following the publication of the problem. The reasons are obvious, so I beg leave to send the following explanation of the peculiar case cited in a communication I sent you last month (July.)

As is frequently the case the difficulty lay in a combination of circumstances or conditions, no one of which by itself would have been sufficient to cause the trouble encountered. The engine was equipped with all the latest improvements in the air line, including a bell-ringer operated by compressed air from the main drum.

The governor stopped the pump at 70 lbs. train-pipe pressure, but partly on account of the small brass packing ring being a very tight fit, would not allow the pump to start again until quite a reduction had been made in the train pipe. The follower-plate in the bell-ringer was loose, causing a large loss of air from the main drum through the leakage around it. With the valve handle in the working position the excess pressure remained practically constant (that is about 20 lbs. above train-pipe pressure), until the train-pipe accumulated about 70 lbs., when the governor stopped the pump.

The leakage from the main drum through the bell-ringer reduced the pressure in the main drum to a few pounds less than there was in the train-pipe, when that pressure began to reduce also by back leakage into the drum through the engineer's valve. This caused the brakes to drag slightly, and of course, when the engineer pushed the valve handle to full release position, the higher pressure in the train-pipe equalized with the air in the main drum, reducing the train-pipe pressure sufficiently to cause quite a heavy application of the brakes and at the same time start the pump, which by rapid action soon released them again.

After this experience I made some experiments to see how far the main-drum pressure could be reduced with the valve handle in the running position, before the rotary valve would raise and allow the train-pipe pressure to flow back into the drum, and I found that while there was considerable variation with different valves, with some this did not occur until there was nearly 10 lbs. difference in the pressures.

PAUL SYNNESTVEDT.

*Chicago, Ill.*

### Relyea's Brake Puzzles.

*Editors:*

In explaining my last air-brake puzzle will say that the cause of trouble was in main steam-valve bush. If you refer to Plate D. C. you will see that the main steam-valve bush, 25, has a collar just above the exhaust-ports which projects into the bore of cylinder far enough to strike the shoulder on the cylinder-head, that enters the bore of cylinder. In putting in the new bush, I did not file off enough of the collar to clear the shoulder on the head, and withal, I filed it a little beveling, so that when I put on the head the shoulder pressed against the collar just enough to spring the bush and hold the valve when it moved up. I chipped off the collar a little more, put on the head and the pump worked all right.

Here is the "nut" I promised last month. The engine on which I found this "new" difficulty is equipped with train signal apparatus, as well as all the latest Westinghouse equipment. I got on the engine to examine the brake-valve, and found the handle on lap, and red pointer which indicates drum pressure was down to 10 pounds and the black pointer stood at about 50 pounds train line pressure. Thinking perhaps the gauge might be out of order, I hit it with my hand to see if the black pointer would fall back to the red one, but it did not. I then put the handle in the release and the brakes went on; the pointers came together and the signal whistle began to blow and kept blowing at short intervals until I started the pump and got up a good pressure; the pointers both went up evenly. I then put the handle on lap and stopped the pump, and watched the gauge and saw the pointer indicating drum pressure slowly falling back. I started the pump again to keep up the pressure, and began looking around the drum for a leak but found none. I then examined the pipe from brake-valve to drum, also every part of whistle-pipe and whistle-valve (Fig. 4, Plate 3 of instruction book) and found no leak. I next examined the pressure reducing-valve (Fig. 5, Plate 3 of instruction book) and found the difficulty. What was it? As it requires a reduction of pressure in chamber A of whistle-valve to blow the whistle, and the engine having stood in the house two hours, and the whistle not blowing once in all that time, while the air was leaking off why was this thus?

W. F. RELYEA.

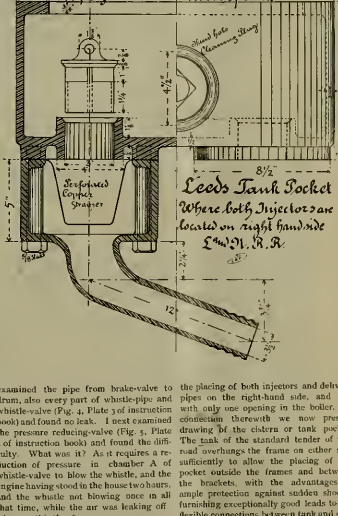
*Editors:*

In regard to Mr. Relyea's air-brake puzzle in the August number of your paper, I believe the trouble was with the hole in the gasket not being exactly in line with the port leading from the main-valve chamber to the port in the top head, which did not allow enough of steam to enter the reversing-valve chamber. There may have been a bad joint on the steam cylinder of the pump, which would let the steam in the small part blow into the cylinder or to the exhaust, and with the port partly closed with hole in gasket being out of line. This would not let the full pressure go into the reversing-valve bushing, and when admitted by the reversing valve into the reversing cylinder the steam would not be able to overcome the main valve. As it seems, the piston would go up and down with the aid of the hammer. I believe when reversing piston was up against its cap the area was somewhat reduced, so it was nearly on a balance, and with the help of a hammer it was able to overcome the main valve. I expect the gasket was a home-made one, which would account for the hole being partly out of place, and when Mr. Relyea cut it out to the proper place it would give plenty of steam to the valves on the top head, and would make the pump work all right.

*Galveston, Texas.* TEXAS

### Louisville & Nashville Tank Pocket.

In the March issue of LOCOMOTIVE ENGINEERING was shown a double check valve designed by Mr. Pulaski Leeds, superintendent of machinery of the Louisville & Nashville system, which permits



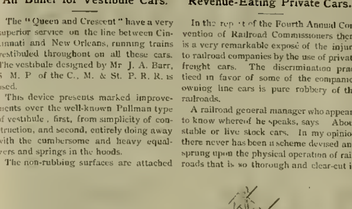

the placing of both injectors and delivery pipes on the right-hand side, and this with only one opening in the boiler. In connection therewith we now present drawing of the cistern or tank pocket. The tank of the standard tender of this road overhangs the frame on either side sufficiently to allow the placing of the pocket outside the frames and between the brackets, with the advantages of ample protection against sudden shocks, furnishing exceptionally good leads to the flexible connections between tank and suction pipes, plainly in sight at all times for inspection, and being entirely out of the way of the running gear. The drawing shows plainly the arrangement of the pocket-valve for shutting off the water, provision for keeping out sediment, the strainer and the hand-hole plug for cleaning. The nozzles are placed at an angle of about thirty degrees to the center line, drawn lengthwise through the pocket, thereby keeping the hose pipes sufficiently apart to prevent chafing. This pocket is made of brass, and rounded off on the outside at the front, to conform to the shape of the deck at the point where fixed. These pockets have been in use for some time, and are entirely meeting the expectation of the designer.


## Air Buffer for Vestibule Cars.

The "Queen and Crescent" have a very superior service on the line between Cincinnati and New Orleans, running trains vestibuled throughout on all these cars. The vestibule designed by Mr J. A. Barr, S. M. P. of the C., M. & St. P. R. R. is used.

This device presents marked improvements over the well-known Pullman type of vestibule, first, from simplicity of construction, and second, entirely doing away with the cumbersome and heavy equalizers and springs in the hoods.

The non-rubbing surfaces are attached




BARR'S VESTIBULE AND MEEHAN'S BUFFER.

to the cars by means of a simple parallel motion similar to the familiar parallel ruler, but in this device the motion from the platform buffers is transmitted to the upper portion by means of rods and in order to have these rods stiff enough to keep the tops always together without springing apart, they would have to be quite large and heavy

Mr. Meehan, S. M. P. of the Q. & C., got over this difficulty by putting on these air buffers. They are a little larger than the well-known Norton door-check The cylinders are suitably connected to the air-brake pipe of the car and are giving excellent results, always keeping the tops in contact, and absolutely keeping out the weather, which a good many of the other vestibules now in service do not do, and at the same time is sufficiently flexible to meet all requirements. The drawing is sufficiently plain to require no further explanation.

Since the first application, the device has been very much simplified, doing away with the two angles in the pipe. The pipe will enter the side duct and a passage will be cased in the side of the cylinder to the back end of the piston, which will admit of the unscrewing of backhead and taking out the piston without taking down the pipe.

## Revenue-Eating Private Cars.

In the report of the Fourth Annual Convention of Railroad Commissioners there is a very remarkable exposé of the injury to railroad companies by the use of private freight cars. The discrimination practiced in favor of some of the companies owning line cars is pure robbery of the railroads.

A railroad general manager who appears to know whereof he speaks, says "About stable or live stock cars. In my opinion there never has been a scheme devised and sprung upon the physical operation of railroads that is so thorough and clear-cut in its effect in the way of depleting legitimate revenue, and such a rigorous leech upon the earnings of railways, as the use of these cars. There were, in the early days of railroads, schemes by which the earnings of certain roads were divided with what is known as "fast-freight lines," but in the majority of such cases there was some slight benefit This cannot be said of the palace stock cars. I have never been able to see wherein the railway companies derive any benefit, either directly or indirectly by their use I consider that every dollar paid by the railway companies for the use of these private cars is absolutely sunk or thrown away, as they do not in any manner increase the traffic to the roads to the amount of one dollar. There is, I understand, now in use about 20,000 palace stock cars that are not owned by railroad companies. If the run of these cars will average fifty miles per day each, they will earn per day $7,500 or $2,700,000 per year If my theory is correct, this amount represents the increased net earnings the railroads would derive from the use of their own cars. The use of the private stock cars is still a further burden, inasmuch as they are, in my opinion, largely responsible for a more or less demoralized condition of rates, also for the increased expense in the handling or moving of the live stock traffic. Before these cars came into use, thirty-seven hours—Missouri River to Chicago—was about the average schedule time, allowing five hours for stop-off, for feed and rest. But this reasonable time would not do for the cars of private corporations or individuals, and, as many large shippers are interested in the property, it is easy, by using one road against the other, to bring about faster or special schedules, and as a result increased mileage for the cars. Now, something from the standpoint of the shipper Until within the last four or five years railroad companies furnished, and live stock shippers were perfectly satisfied with, the improved common stock car then and now in use, and this would be the condition to-day if the so-called palace stock cars had not been introduced. Further, my experience is that there are but two classes of shippers that prefer the palace to the common car first, the shippers that own stock in the car company; second, those that have long runs (that is, runs that exceed thirty hours), in which event they can, if they so desire, evade the twenty-eight hour law, and thus run their stock into market famishing for food and drink to an extent that insures an extraordinary fill before weighing to the buyers. It is true that most of the so-called palace cars possess facilities for watering and feeding, but, to quote the language of the writers of the inclosed clipping (two large cattle shippers). "They are simply to make a bluff at complying with the law. The troughs are seldom used; it is impossible to use them practically." "The poor cattle, instead of drinking water every twenty-eight hours, as intended by the law, are in luck if they see water once in seventy-five or eighty hours."

## Making Good Cast-Iron Wheels.

To the ordinary observer or even mechanic the making of cast-iron car wheels is not an operation that excites consuming interest; yet a visit, which the writer made some time ago to the New York Car Wheel Works at Buffalo, is remembered as one of the pleasantest and most interesting hours spent in a manufacturing establishment. Here the fact was very forcibly brought home that there are car wheel works and car wheel works. Some of these places excite a keen desire to be somewhere else; this one made me regret not having a whole day to devote to watching the work done.

The New York Car Wheel Works, of which Mr P. H. Griffin is president, follow a specialty of making machined car wheels, and the appliances in use for handling and grinding the wheels make the establishment peculiarly attractive to a mechanic.

There are a number of grinding machines in use and they are of a pattern entirely different from the car grinding machines that are on the market. Car grinding machines have generally been made so that wheels might be ground after they were on the axle. As the greater part of wheels sold are not mounted on axles, it was necessary here to devise means of grinding the wheel true without the aid of an axle. This was not a simple problem, but it was worked out with consummate skill.

They first bore the wheel. This is done with a chilled reamer that has six cutting edges, with 24 inches of cutting face. This is certain to make the hole true. This tool deserves to be better known among those who handle many wheels It is pushed through the iron about as fast as a power-driven auger is pushed through a pine stick

After the wheel is bored it is slipped upon an expending mandrel and secured on the face-plate of a very strong lathe specially designed for this work. Emery wheels that move radial to the center of the lathe are advanced together to the tread of the revolving wheel, and it is trued up in a few minutes.

This company appears to have devoted very intelligent attention to the selecting and mixing of iron with a view of obtaining great strength combined with chilling qualities. Mr. Griffin remarked that there is as great difference in chilled iron as there is in the various unchilled grades, although this fact is not generally understood. I was shown samples that were harder than the hardest tool steel. They have succeeded here in making test bars that had a strength of 90,000 pounds to the square inch, a strength exceeding that of any other metal within the elastic limit.

Their method of cleaning the wheels after they come out of the annealing pit is unique. Each wheel is placed in a box and subjected to a tremendous sand blast which cleans it thoroughly in a few seconds

The statistics furnished by several railroad companies of the mileage made by wheels turned out of these works, show three or four times the mileage usually credited to cast-iron wheels. This result is evidently obtained through several causes. First, the iron employed in making the wheels is properly adapted for the purpose. Then the grinding of the wheel makes it perfectly round and not so liable to have its life shortened by sliding or flange cutting as a wheel out of round The wheels are perfectly balanced, which is another point in their favor, and they are bored true, which saves them from several destructive agencies

The additional cost of these properly made and correctly finished wheels is very little more than that paid for the commonest kind of cast-iron wheels. Why railroad officers prefer the poor article to the good one is one of the mysteries that the ordinary mind cannot grasp The finished wheel gives a longer service than the poor one and is much the cheaper in the end. It makes the cars ride much more smoothly and reduces the repairs of running gear, besides being much easier on the track Yet for a dollar or two in first cost the cheap wheel is generally preferred.

A S

## World's Fair Passenger Cars.

The problem of building temporary passenger cars to carry the crowds of people during the World's Fair has been very well worked out by the Illinois Central people. They are preparing to build 245 cars that have framing and trucks the same as the standard freight car of the road. They will be arranged with seats like the summer street cars that have the seats crosswise. The cars of course will be entered from the sides The length of each car is 35 feet over sills There are 16 seats, the whole capable of holding 96 persons. It is estimated that there will be less than 300 pounds of dead weight required to accommodate each passenger, which is extraordinary low. It will be done, too, with perfect safety, for the cars are of a very strong design.

The sills are the same as the ordinary box car, and they are strongly trussed to give vertical stiffness. The posts are so arranged that windows can be placed opposite each seat The cars will of course have Westinghouse air-brakes and Janney couplers.

When the necessity for using these cars for passenger service is over, they will be converted with very little work into express cars for the large Southern fruit and vegetable trade done by the company

A number of new sleeping cars were put in service last month by the Chicago, Milwaukee & St. Paul. The cars are handsome and their looks convey ideas of comfort, although they are not so ornate as some of the other sleeping cars in use. The drawing-room seats are covered with dove-colored broadcloth.

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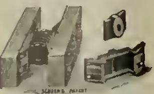


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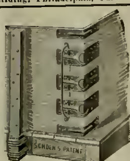


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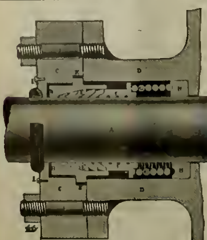

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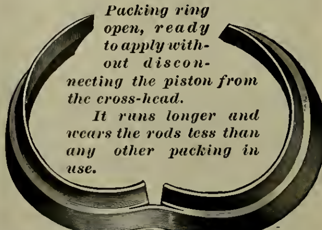

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E

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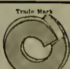


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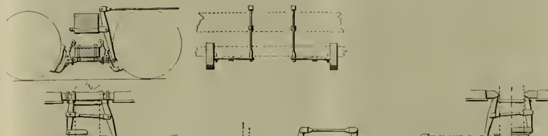
## Brake Rigging Without Beam.

In connection with the novel brake rigging shown in the annexed engravings, Mr. James McGee, of the Houston & Texas Central, writes · I will endeavor to explain the object of this brake as far as possible and its working. A brake-beam of any kind on a car has always been a source of annoyance and always in danger of being broken or torn off by obstructions on the track, whether hung inside, between the wheels, or outside, and up to this time there has never been anything offered as a substitute for the brake-beam, this being the only one that seems to fill the place of the brake-beam and doing away with all the objections to same, and furnishing a more reliable brake in its place.

By referring to the cut it will be seen that it is simply a system of levers so con-



Novel Brake Gear

structed as to equalize the power applied to each wheel perfectly. Any amount of power can be had by this system of brakes that is necessary, according to the weight of the car. The power exerted on these levers by the application of the Westinghouse air-brakes is figured out for the light weight of a car weighing 24,000 lbs. As the wooden brake-beam even when trussed has been deemed not sufficiently rigid for the application of air, metallic trussed brake-beams of different patterns have been gotten up for the purpose, which are sufficiently rigid to meet the demands made necessary by the application of air, but they do away with none of the objections had to the brake-beam. It is claimed that this brake meets all the requirements in the way of rigidity, there being no deflection, the levers being made sufficiently strong to have no deflection whatever, and will perform all that any pattern of metallic trussed brake-beam will, and is less liable to get out of order, being close and compact, and there is no danger of its being injured by any obstructions on the track. The parts are so adjusted that there is very little slack from the wear of the shoes. It is found that the actual cost is no more than the ordinary wooden brake-beam without the truss, when connected with the Westinghouse air-brake. This being the case there is no reason why it should not take the place of the brake-beam on all cars.

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The Washburn Car Wheel Company of Hartford, Conn., are now filling an order from the Chicago & North-Western for the equipment of 120 passenger coaches. They filled an order from the same company of about the same size last year. These wheels are made of cast-iron centers with crucible steel tires which are welded to the cast iron centers by pouring the molten steel around the centers when hot, making a solid wheel. Mr. Adams of the Boston & Albany has had them in service for many years, and his reports show an increasing mileage each year, the average mileage in passenger service in 1889 reaching over 200,000. After being condemned for passenger service they go under freight cars.

## Electric Car Triumphs.

The operating of electric cars appears to be making rapid headway in New England notwithstanding the popular opposition of the trolley system, which certainly is dangerous. An item in a late Boston paper says:

A man can now sit in a trolley car and ride through a delightful country from North Attleboro to Providence, covering over one-third of the distance from Boston to the Rhode Island metropolis.

That this is only the beginning of an enterprise which will yet connect Boston and Providence through electric cars over a distance of 44 miles, almost goes without saying.

Thus do inventions and enterprise gradually make it possible for the poor as well as the rich to enjoy a summer day's outing on wheels for a comparatively small expenditure.

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The Mexican railway, says the *Railway Age*, has had some metal box cars built for it by the Ashbury Railway Carriage & Iron Company of England. The cars are entirely of iron and steel. All sills are of steel channels and the cross ties and transoms of steel I beams. The flooring is of iron plate, the body framing of steel angles and ties and the siding and roofing of corrugated galvanized iron. The trucks —with rigid bolsters—are of Fox solid pressed steel. The truss-rods extend only from transom to transom. A spring side bearing is used. Link and pin draw-bars with double conical draft springs are used. The cars are fitted with the Westinghouse automatic brake.

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Secretary Arthurs, of the Mt. Vernon Car Manufacturing Company, writing to this office, says. "We are very busy in our works, as we have been all the time since starting. We just recently turned out an order of Mobile & Ohio box-cars, Paducah, Tennessee & Alabama coal cars, and have just recently completed an order for 500 Louisville & Nashville box-cars. We are at present working on orders for Evansville & Terre Haute flat and coal cars 36 feet long, of 70,000 lbs. capacity, frost-proof refrigerator cars for Union Refrigerator Transit Company, St. Louis, Chicago & St. Paul box-cars. We have recently built an addition to our foundry 50 x 125 feet, largely increasing our wheel capacity. We are now making this one of the special features of our business, and are furnishing such roads as the Louisville & Nashville, Illinois Central, Mackey system and others with their supply of car wheels."

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A fireman on the Southern Pacific, writing from California, says that the practice is rigidly followed there of promoting firemen by seniority and that there is no inclination among the men to learn anything about the locomotive or its attachments to make themselves efficient when called upon to take charge of an engine. He cites several anecdotes illustrating the ridiculous ignorance about the business of men who were put in charge of locomotives. If the letter is true the most ignorant man has as good a prospect for advancement on the Southern Pacific as the man who labors to acquire information about the business. The supreme power for promotion is the determination to wait. This is not the only road where staying qualities are the most valuable.

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In the course of an article on tungsten steel the *Iron Age* says: "Mushet's special" has been on the market for so many years that it is probable there are but few users of tool steel who are not familiar with its peculiar qualities. The majority, however, are not aware that it owes its property of becoming and remaining hard when cold, without the necessity for any hardening process, to the fact that it is an alloy of tungsten and ordinary carbon steel. Its extreme strength and hardness are due, principally, to the large percentage of tungsten, which it is possible to incorporate as a perfect alloy.

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According to a recent letter from Japan, there is a fair chance for American locomotives in that country. The engines now in use are, with two exceptions, of English make, but the correspondent attaches great importance to a competitive test made with American engineers in the cab. It is well known that foreigners deem the American locomotive a powerful rival, and strive to check its steadily-growing popularity.

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An incident of train service that attracted wide attention last month was the running of a train from San Francisco to Washington loaded with $30,000,000 of gold coin. As a gold dollar weighs 25.8 grains troy, the sum of money carried by the train would weigh 110,571 pounds, or a little over 50 tons. That would have been a heavy haul for train robbers.

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The Cooke compound arrived in Chicago over the Pittsburgh, Port Wayne & Chicago August 3. It made a fine run from Crestline to Chicago, hauling the Columbian Express, a train of fifteen heavy passenger and sleeping cars, and making up thirty-five minutes on the running time. For this train a double header is necessary to make running time when it is as heavy as the one just noticed. The engine is now running on the Illinois Central. It has been placed in freight service for a few days, and will then be put into passenger service.

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The Richmond Locomotive Works are busy with a variety of orders, mostly for Southern roads. Among the engines in course of construction are some for the Chesapeake & Ohio, and two for the South Bound road.

## A Bow-Wheeled Railroad.

In a recent issue, the *Railway Age*, which is devoting a great deal of attention to the illustration of railway machinery, gives a very striking picture of the Meigs elevated railway system in operation. There is a fearful-looking train which resembles five overgrown oil tanks with windows at the sides, rushing along on a sort of single-beam elevated structure. The way the wheels are arranged put one strongly in mind of a badly bow-legged man. We are afraid that this style of elevated railroad will never progress far beyond the pictorial stage. Yet it is just the kind of a scheme that will strongly appeal to a certain class of capitalists. The more absurd a thing may seem to an engineer the more certain is it to receive financial support from a speculative class of capitalists, who are numerous.

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The Brooks Locomotive Works have received another order for locomotives from the Great Northern. Seventeen consolidation and eight six-wheel switchers will be built. These works have also received an order for one consolidation engine for the Duluth, Mississippi River & Northern.

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The Baldwin Locomotive Works have received orders from the Brainerd & North Minnesota for five passenger engines; from the Clarion River road one double-ended bojie engine weighing 100,000 lbs., and from the Great Northern five freight and two passenger Vauclain compounds.

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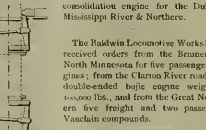
The Illinois Central are in the market for two compound suburban locomotives, to be of the same power as the 18 x 24 double-ender Hudson engines now operating the suburban business. They are going to try the Cooke compound on their famous heavy suburban trains.

## Connelly's Axle Lubricator.

The annexed engraving illustrates a form of car axle and crank pin lubricator invented and patented by Mr. J. T. Connelly, Milton, Pa. The form of the lubricator can readily be understood by a glance at the cut. The patent claims made for the invention are.

The combination, with a journal provided

Fig 1.



Connelly's Axle Lubricator.

with a central longitudinal bore and with one or more transverse bores extending from said longitudinal bore to the periphery of the journal, of a plug secured in the open end of the longitudinal bore and provided with a central longitudinal bore of less diameter than the main bore of the journal, and with one or more transverse bores coinciding with the corresponding bores of the journal.

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The Chicago & Northwestern about August 1st ordered from the Schenectady Works 15 more 10-wheel engines similar to the 35 received during last spring.

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The Rhode Island Locomotive Works have delivered two compound locomotives for the Minneapolis, St. Paul & Sault Ste. Marie

The Wisconsin Central are in the market for 30 passenger cars.

In accordance with a law passed by Congress the famous ocean steamers, the *City of Paris* and the *City of New York*, will soon begin flying the American flag. There appears to be an unpatriotic sentiment among a certain class of Americans to employ foreigners in every responsible position connected with our mercantile marine and, of course, an attempt has been made to permit the British officers who now handle the ships referred to, to retain their positions when the vessels begin running under the American flag. We are now pleased to notice that Mr. Egbert P. Watson, proprietor of the *Engineer*, New York, has elicited the information from our government officials that neither engineers nor other officers of the ships will be permitted to hold their positions unless they are American citizens.

The Midland Railway of England has adopted the Pintsch light as the standard method of illuminating their passenger cars. They have already caused the erection of three gas plants at various points along their line, and have ordered lighting equipment for 886 cars. This railway has abandoned the use of the electric system of lighting which they have had in use for a number of years as they found it both too expensive and unreliable for service, and after due consideration have taken up the Pintsch system as being the cleanest, safest and most economical method of car lighting.

A correspondent writing to the Joseph Dixon Crucible Company, Jersey City, about the use of graphite, says "I have used handhole and manhole gaskets eight to ten times by carefully smearing the surface next boiler shell, taken out at periods of three to four weeks, using steam pressure as high as 100 lbs. In packing water glasses, by putting a little graphite and oil in the gasket they would vulcanize as soft as lamp wick and retain their elasticity until the glass was changed, when the old rubber could be removed without trouble, while by the old way, I have spent much time in digging out the rubber baked hard as vulcanite. Another thing I used it for was, after putting back my handhole plate or plugs in back connection, I carefully brush away all the soot and ashes; then with a small brush paint a good coat of graphite over flange, stud and nuts. After running boiler from three to six months, and using coke for fuel, with forced draft, the nuts can be removed without trouble, as the heat has not been great enough to burn the head."

Everything on the German railroads is regulated in military style. There is a time and place for everything. Even the cars must go into the shop after running 160,000 kilometers, whether they need it or not.

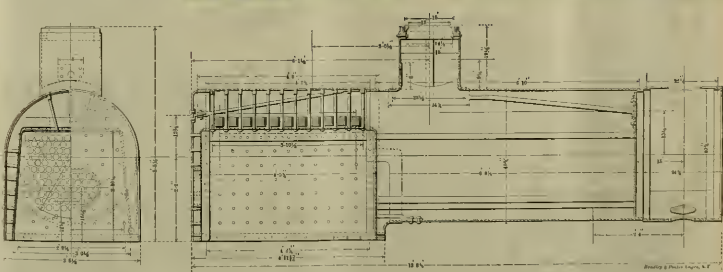
## Coxe Locomotive.

The annexed engravings give a perspective view of the finished engine and a sectional view of the boiler of a dome locomotive designed and built for the Delaware, Susquehanna & Schuylkill Railroad. The engine was designed by Mr. Daniel Coxe, superintendent of motive power, assisted by Mr. William J. Goyne, chief draughtsman for Coxe Brothers & Co., who made the drawings. In the designing, the leading idea was to get as much power as possible in a wheel base of 66 inches.

These engines were built to take the place of four-wheel engines that were formerly employed hauling cars to the coal breakers from distant workings, and they are a decided success. Among improvements effected on the new engines are the use of high nozzles without an extension smoke-box. This is a success, the engine throwing practically no fire even when working in the corner on a heavy grade. The cinders are removed daily through a small hand-hole in the front. Solid-end bushed rods, main as well as side rods are used, with very large wearing surface. The straight shoes are without adjustable wedges.

There is such a disposition among the engineers to "monkey" with and improve their machines that it seems the only way to stop it is to make things so they cannot be adjusted at all. The actual tractive power of the engine has been merely guessed at as yet; but in pulling cars it is just about 50 per cent. more than the four-wheel mine engines.

The firebox is a peculiar combination of crown-bars and radial stays. It is a particularly strong boiler and unusually convenient for a small engine. The saddle tank has a capacity of 425 gallons. The engine is equipped with two No. 6 Rue injectors and Nathan's double-sight lubricators.



Coxe Locomotive Boiler.

A curious case concerning the duty of railroad companies in relation to intoxicated passengers, has just been decided by a court in Ireland. A passenger came to a station in a helpless condition of intoxication, and in that condition was helped into a carriage by the railway employés. During the journey that followed, the intoxicated man got out of the carriage while the train was in motion and was killed. His wife sued the company for damages for the loss of her husband and a verdict was given in her favor. The decision appears to be that railroad companies have no right to help intoxicated persons into trains, where they are in danger of losing their lives. The Irish court appears to have great consideration for people who make themselves helpless by the use of intoxicating liquors.

Train robbers sometimes make mistakes with the people they expect to fleece with impunity in cars. A recent dispatch from Denver says: Last night, as the Denver & Cheyenne train on the Union Pacific stopped at the coal chutes at La Salle, two masked men entered one of the cars, and with loaded revolvers ordered the passengers to hold up their hands. Hands in profusion went up instanter, and the fellows were on the point of collecting toll from the astonished passengers when one of the latter opened fire upon the "hold-ups." The latter returned the fire, but one of them getting hit, both jumped from the cars and fled. As near as could be ascertained, the man on the train who opened fire on the "hold-ups" is a member of one of the Wild West shows that have been exhibiting at Denver the last two weeks, and with the show was going to Kansas City.

The editor of *Industry* has a way of making difficult questions plain which we admire. In regard to the Free Coinage of Silver problem he says: "The present ery of free coinage divested of its sophistry, means a privilege of taking 90 cents worth of silver to the mint, and by coining, have it converted to $1.29, in other words, adding a fictitious value of about 39 cents, less seigniorage, if any, to every dollar, or to state it still more plainly, to raise the price of silver 33 per cent by Act of Congress.

A runaway engine on the Chicago, Milwaukee & St. Paul road, on August 5th, caused great consternation near Williamsburg, Iowa. An engine and caboose collided with a dirt train, and the engineer and fireman, seeing disaster, reversed the engine and jumped. The reversed engine piled up the cars of the dirt train and then started backward wild. After killing a horse and a cow it was stopped at Conroy, ten miles north.

## A Test of Constancy.

By Sam Short.

Perhaps it was to answer in season for some of my sins, or perhaps it was the result of a rambling disposition, that shortly after the war I found myself running a locomotive on a poverty-stricken railroad in Georgia. At its best the place was a quarter of natural banishment for a man with any taste for social enjoyments; for sectional prejudices were then at their height and it was made particularly disagreeable to the hated Yankees, of whom I was a representative. After I became a little acquainted the days and nights of my season of isolation from social joys were cheered by the acquaintance of a Scotchman named Donald Fraser, who was boarding at the same hotel. This man was manager of a cotton mill and had been once a railroad man, which attracted him toward brothers of the craft.

Mr. Fraser had been all over the world and carried with him the graces that travel gives to the right kind of people. Some people who travel appear to gain nothing by the experience beyond learning the names of the places where they have been. They would not lose anything by going round blindfolded. Their eyes do not appear to convey impressions to the brain. They bow to the fashion of travel, and their description of every place and country is, "Oh, it was lovely."

Donald Fraser was a different kind of traveler. He belonged to the class that have the gift of seeing—a gift that appears strongly developed among the natives of mountainous countries. Mr. Fraser possessed another rare gift, that of describing what he had seen and of story telling. In early life he had been an engine-driver on a Scotch railway. From there he went to India, as many of his countrymen did, when railways were opening up in Asia. Then he went to sea as a marine engineer, and left that to go railroading in South America. Eventually he found a more restful haven in that Mecca of ambitious workmen, the United States He was a great reader, and took in every department of literature, from mechanics to theology. What he read always seemed to remain within the grasp of his retentive memory. A keen observer of men and things, his mind was loaded with reminiscences drawn from every quarter of the globe.

A man of this sort was a treasure in a region where excess of leisure was cruel oppression to men who found no pastime to while the weary hours away. Fraser appealed to my sympathies on the first evening of our acquaintance by telling me that no country on the globe gave privileges to workmen equal to those enjoyed in the United States. He was an enthusiastic admirer of our country, its institutions and the ways of the people; and was ever ready to give free expression of his views.

One evening as we were all seated around Fraser in the smoking room of the hotel, waiting to get him into the story telling mood, one of the boys asked:

"Why did you come to leave Scotland, Mr Fraser? It's said to be a grand country, and its history makes fine reading for people who like poetry and romance."

"Aye, aye, lad, it's a fine country to read about," he answered, "and it's a noble country to think of as your native land, but it's a better country for a poor man to leave if he is ambitious to be more than a workman all his days, and fears to face the winter of life with penury as his companion."

"Was that why you went away to seek your fortune?" persisted the questioner.

"Yes, and no," said Fraser. "I had sometimes thought that there were better countries than Scotland for a steady industrious man, but I had worked into a pretty good job, and might have remained in it all my working days as many others do, if it had not been that something happened which switched me off the well-beaten path."

"What happened? Tell us the story," came from several voices.

"It's not much of a story, and the motive power that 'sent me over the sea' has been in active force ever since the world began.

"More years ago than I care to count I reached what appeared to be the height of my ambition when I was promoted to drive a locomotive on the Scottish Midland. Few men of my years had seen less care or had fewer misgivings as to the future. Before entering railway life I had been three years at the blacksmith trade Indoor life was daily punishment, for I inherited rambling habits from a Highland ancestry. It is hard to curb in three generations the habits that never have been restrained since the race began.

"In passing, I may say that the Highlanders have been greatly given to following the callings that lead them moving about. As trainmen and sailors and steamboatmen they have made a mark for their race.

"The change from the shop to the foot plate was to me as gladsome as the escape from a cage must be to a soaring lark. A good mother had brought me up to look upon hard work as my natural birthright and a thing that was a blessing to those who learned to enjoy it. Perhaps it was this inspiration that made me the happiest and most contented trainman who ran through the great Valley of Strathmore. That was before the something happened which I spoke about at first.

"The Valley of Strathmore, as people familiar with the geography of Scotland know, extends northward from Perth for 60 miles and embraces some of the finest farming country in the British Isles, besides some of the noblest scenery. Like every naturally rich region it led to much strife for possession in early days, and scenes of strife make stamps on the earth that the sons of man hanker to look upon. The Valley of Strathmore is rich in scenes of historical interest and dotted with buildings that are land-marks in the history of the country I shall not impose upon you a talk on Scottish antiquities, although in my youth I contracted the fad of Burns' friend, Captain Grose, and spent many an hour—

"'By some auld howlet-haunted biggin'
Or kirk deserted by its riggin'.'

"My 'shop' days were often devoted to looking up the ancient relics within reach. The Sedlaw hills form one bank of the valley. Here we have the wood-clad hill of Dunsinane where Macbeth had his stronghold and which was invaded by soldiers carrying Birnam wood. To railroad men there is a more interesting object on the Sedlaw hills than the scene made famous by Shakespeare. The Dundee & Newtyle Railway, the first line built in Scotland, crosses this natural obstacle to transportation. It was in the early days a mixed railway, for part of it was operated by locomotives and part by cables. There was no twisting round to get up and down the hills. The early British engineers believed in going direct to the terminus, and this road was the best illustration of what their policy led to. The cars were pulled up the hill side by a cable operated by stationary engines. On reaching the top a locomotive was hitched on, which pulled the cars to the next 'bank' and handed them over to the cable again.

"I had looked forward to a ride over this line, partly to watch the way it was worked and at the same time to examine an ancient tower in the neighborhood. A bright August day found me enjoying the pleasure anticipated.

"I had spent a delightful day. There were many novelties to be seen in the operating of the road. The old tower exceeded my expectation and I set it down as dating back from the days of the Roman invasion. To settle any question of this kind is naturally a great satisfaction to a youth with a hobby, and I felt that I might yet find something worthy of putting before the Antiquarian Society—an ambitious thought scarcely to be cherished without awe.

"Full of ambitious communings I wended my way to the train that was to take me back to Perth. In the carriage sitting on the opposite seat was a girl whose face quickly distracted my thoughts from the glories of antiquarian research. A man seated on my side of the car was drunk and noisy, and he persisted in addressing his conversation to the girl She had a mobile, speaking face that seemed to express eloquently the emotions of amusement, disgust, shame, resentment and appeal, that were at different times aroused by the words and actions of the drunken man. While in repose there seemed nothing striking about the face, but the excitement roused it into animation and beauty.

"Offering myself as a protector of suffering beauty was a little out of my line, and bashfulness for a time kept me from interfering. To cause a scene in a small car compartment by trying to restrain drunken revelry is generally more painful to those you want to protect than to the offender. We had stopped at one of the inclines and the excitement outside took the man's attention out of the carriage for the time being. But I had made up my mind that should he become offensive again I would try to quiet him. As a preliminary, I motioned to the girl to change seats with me, which she readily did, as the change took her away from facing the man. In the act of changing seats I stopped at the window to watch the process of attaching the cable to the train. As I stood looking the train was pushed to the brink of the inclined plane and by some blunder the cable connection was missed The train had scarcely begun to move when I realized like a flash that the cars were running away. I threw open the door, pulled the girl after me and jumped off The train was 'falling' down the hill side and had gained considerable velocity before we got out.

"A railroad train is going very fast when a nimble trainman cannot jump off without injury. Jumping off a train is something like swimming—easy for one but hard for a pair. In getting off I tried to save the girl from a hard fall and she landed very well, although we did not come to the ground in a dignified fashion. I was not so fortunate, for my arm was broken in the fall. Even with that injury I had reason to be thankful that I did not share the experience of the people who went down with the train.

"The accident was a nine-day talk and I came in for more attention than my retiring disposition relished For ten days I was in Dundee infirmary with others who had been multilated in the wreck. At the end of that time I went home.

"The day after my return to Perth I received a note intimating that Mrs. Clementina Urquhart would be pleased to have me call upon her. The missive was of a particularly stiff and dignified character. I learned that the writer was the mother of the girl I had helped out of the carriage, and that she was one of the proudest and poorest ladies recognized as belonging to the Perth gentry.

"I called on Mrs. Urquhart next morning, feeling more like a criminal than like one worthy of thanks. She received me in a most impressive and ceremonious fashion, and made her daughter, who was no worse of the jump out of the carriage, express formal thanks for the service I had rendered I was abashed and confused with the interview and stammered my regrets at having done anything, at which the girl laughed and the mother looked severe. But that did not prevent her from taking out her purse and offering to pay me for the service I had done to her daughter.

"I had not been reared among the gentry of my native town, but I had enough innate refinement to be shocked and offended at the offer made me by Mrs. Urquhart, and rose quickly to go, full of rage. The lady made some sort of apology and managed to detain me long enough to let me know that I must never presume on acquaintance with Miss Urquhart on account of the unfortunate occurrence that had brought us together. I answered that such a thing had never entered my mind, and took an abrupt departure. I was pleased to see that the girl appeared mortified at the shabby way her mother acknowledged the service I had rendered

"Paying attention to girls was entirely out of my line, and I was far from being so foolishly ambitious as to aspire to a girl away above my social position. But somehow the treatment I had received from Mrs. Urquhart, and being forbidden to see the girl, made me think about her. While I was still idle with my broken arm and rambling round, I accidentally met the girl and she stopped and apologized for what had been said, and expressed the hope that I would believe her to be grateful for what I had done. We chatted pleasantly together for a few minutes and the offense of the mother was forgotten in the sweet appeals made by the daughter's blue eyes.

"This might have ended my connection with Miss Urquhart and saved no end of heart aching and unsatisfied longings had it not been that she lived in a cottage close to the railway. When I began running again I naturally looked for the girl as I was passing At first I seldom saw her but one day she recognized me and smiled. After that I rarely passed in daytime without receiving a nod or smile from the girl, and we gradually came to have that kind of acquaintance. There came to be a dangerous element of secrecy about the acquaintance, for when the mother was about I was not recognized. This nettled me at first, but like every element of opposition it egged me on to think about the girl.

"I found that something new had come into my life. Six months ago my work and my antiquarian studies filled the measure of my existence, and I longed for nothing out of reach. Now my work and my hobby palled. Even reading failed to satisfy. My whole heart appeared to be centered into the brief glances I would have of this girl. I felt oppressed and humiliated at not being better able to restrain my thoughts and feelings, and from day to day kept making resolutions to conquer myself again by a vigorous effort. But day after day passed and the nod and smile from the girl dispelled all my efforts at mental control. One day it suddenly dawned upon me that I was in love with Madge Urquhart.

"It seemed like insanity. I might as well be in love with one of the Queen's daughters. Our social positions were so different that the hope of stepping over the society barriers that lay between us seemed pure madness. All this I understood, but like the moth to the candle I was drawn irresistibly toward the light that was to scorch me.

"I continued to meet the girl after a time. The meetings were repeated secretly. We vowed love and constancy to each other and closed our eyes to the future. Some busy mischief-maker found out that a sooty engine-driver was clandestinely walking in the woods with the only daughter of one of Perth's proudest mothers, and carried the news to where it would cause most excitement. It did raise a storm.

"There are certain quiet, weak-like persons whom everybody is ready to abuse and bully with impunity. They are deficient in self-assertion and appear to fall before every form of aggression, but they are not conquered or suppressed, they have only bowed before the storm, and came up again as serenely as if no tempest had passed.

"Madge Urquhart was that kind of a girl. Her willow-like nature seemed to settle down before the tempest of her mother's coarse wrath, but an hour afterward she was perfectly serene and stand-

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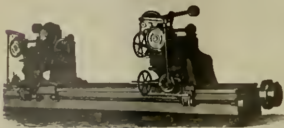

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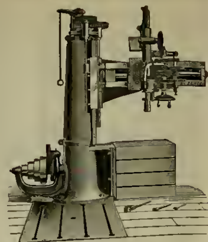

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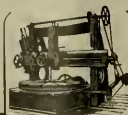

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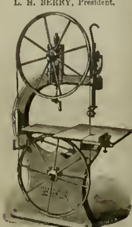

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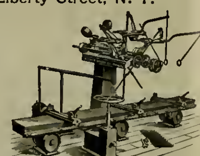

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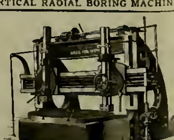

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ing in the same position she was in before the storm began.

"She would promise nothing to her mother, but when she met me again it was to let me know that we must meet no more. She was willing to wait until I should be in a position to marry her and give her the home of a lady, but she would meet me no more secretly.

"The prospect of an engine-driver ever reaching a position to make what in Scotland is considered a home for a lady, was so remote that I gave it up. I resolved to try something else. At this time the government of India was building railways and giving golden inducements for British railway men to go there. I determined to go to India in hopes of attaining a position that would enable me to offer a suitable home to the girl I loved. She agreed with me that it was the right thing to do, and promised to wait until I should send for her.

"I went out to India in 1856 and had not got settled there when the mutiny broke out. It would be a long story to tell of the horrible experiences I went through in that dreadful country. Nearly all the Europeans in the place where I was were murdered, and word went home that I was one of the unfortunates. Two years passed before I had the opportunity to write home, and I received no answer to letters written to Madge. I concluded that the will of the mother had triumphed and that the girl had given me up.

"A man does not lose his life, or his senses even, when in a strange land he is forced to believe that the girl he loves has jilted him. It is needless to tell of the looked-for letters that never came, the deferred hope that brought no comfort and the constant longing that found no response.

"I remained in India five years and then returned to my native land. My first search was for news of the girl I left behind me, but my quest was in vain. Mrs. Urquhart had left Perth a few months after I went to India, and I could find no tidings of where she had gone. She appeared to have no relatives in the place, and I searched a long time without a clew, but eventually learned that she had moved to Edinburgh. Thither I went, and after another search I discovered that she remained in Edinburgh but a few months and that she had gone to England, to what part I could not find out. I went to several of the larger cities and inquired among the Urquharts, a name that is not common, but without success. The family had vanished as completely from me as if the earth had opened and swallowed them. One day while I was discouraged with disappointment, I met an old acquaintance who was chief engineer of a tramp steamer. He was about to ship a crew and I went with him. That led me to rambling, and since that day I have seen many countries, but I have never seen or heard a word of Madge Urquhart."

That was Fraser's story. He received the only tribute his hearers could bestow, sighs of sympathy. However unwilling we may be to give voice to romance, we all heartily admire those whose lives show examples of devotion and constancy.

The Georgia Central did not come up to my ideas of what a comfortable road to run on should be. A few months' experience running on kinked rails, with engines that were very poor scrap, convinced me that a change of climate would help the shakes that were beginning to make my life a burden.

I started North and to my surprise and vexation found that the malaria went with me. For several years I kept moving from place to place, bent on finding a locality where the chills and fever did not thrive. I was like Christian in the "Pilgrim's Progress," toiling along with the malarial burden on my back, and it seemed for a time that the celestial or some other gates would be reached while I was still shaking.

During this season of unrest I had been advised that Quebec was the place to cure ague, and to Quebec I went. I would have gone to Alaska if it had been recommended. Well, people laugh at the irrational things those who are sick will do in trying to get themselves cured. It is like a drowning man grasping at a straw. I was a good subject for the cranks who have a cure for every disease. I tried them all and was grateful. In the same spirit I went to Quebec and did not get cured.

One evening I was sitting in the boarding-house, debating with myself where I should go next when a fellow-boarder came in and began talking about a dreadful runaway accident he had seen. The driver of a carriage had lost control of the horses in descending one of the precipitous streets. The carriage had been dashed over a ledge of rocks and two ladies instantly killed.

We were naturally on the look-out next morning to learn from the papers particulars of the accident. My interest in the case was suddenly intensified on reading that the ladies were Mrs. Urquhart and her daughter, a music teacher in the city; that the mother was dead, but that the daughter was alive with some prospects that she might recover.

On making inquiries my hopes were suddenly chilled by the information that Urquhart was a common name in Quebec. I was, however, determined to find out if this was not the Miss Urquhart in whom I was interested on account of my friend Fraser.

The ladies had been taken to a hospital and the survivor was in no condition to answer questions. But I set to work with zeal; found out where they had lived and learned that the name of the mother was Mrs. C. Urquhart. By skillful use of a few of Her Majesty's coins, and pretending that I was a newspaper man, I prevailed upon the servants in the house to permit me to visit Miss Urquhart's room. On a quaint-looking dressing-case there was a pocket Bible. On opening it I read the words "Madge Urquhart, Perth, 1855."

The servant appeared astonished at the small amount of curiosity I displayed concerning the room. Half a minute after entering it I was hurrying to the telegraph office. I wired Fraser that his long lost girl was found.

Next morning I regretted having revived the hopes of my friend, for it was reported that Miss Urquhart was dying. Second thoughts convinced me that I had done the right thing in sending for Fraser, if he should only have the melancholy satisfaction of following the lady to her last resting place. Day after day I haunted the hospital gates torn with suspense about the condition of the sufferer. Morning after morning I learned that she was still alive, and encouraged to hope that she would survive at least long enough to see her old lover. It was nearly a week after the accident before Fraser arrived. The girl was still alive.

I need not protract the story. Two months afterward my friend carried Miss Urquhart to the Sunny South to recuperate, but she had changed her name.

Since that time a native of the South named Sam Short Fraser has grown to manhood. His name is testimony that his parents were grateful.

PASSENGER TRAIN RAN INTO A FREIGHT TRAIN THAT WAS BACKING INTO SIDING

During a recent visit of President Van Horn of the Canadian Pacific Railway to a place on the New Brunswick Division, his special train was run a distance of 127 miles in two hours and thirty-three minutes, that being the quickest time ever made over the division. The train was pulled by a locomotive recently built by M. M. Haggerty, at McAdam Junction. The Canadian papers have had a great deal of commendation to make about the run.

## Failed to Inspect the Road.

The Railroad Commissioners of Vermont had a curious experience lately. They went out to make the annual inspection of the Bennington & Glastonbury road, which is about nine miles in length, and runs up into one of the world's "end places" in the Green Mountains. It was built twenty years ago for the purpose of getting off an immense track of timber lying in the several townships. No regular trains have run over the railroad during the last year and a half, and it is probable that the line will be abandoned in time. A large portion of the timber has been cut off, and as a consequence it does not pay to operate the road. The rails are badly bent and worn and many of the ties are so rotten that they will not hold a spike.

When the party got about half way along this interesting railroad the engine jumped the track, and for a time it appeared as if the remainder of the trip must be made by walking. The incident happened on a steep ascending grade, and the car was uncoupled and ran back by gravity. The commissioners have for the present deferred inspecting the whole of the line. The locomotive is supposed to be still in the ditch.

## Short of Rails.

Section Foreman Mike, of the —— Railroad, had begged frequently for supplies. He was especially short of rails for repair work. Matters ran along for some time, track not improving and supplies growing scarcer and scarcer. One day the superintendent was out on the road, and while on Foreman Mike's section the train was suddenly brought to a standstill by a flag. On inquiry as to the cause, the superintendent was quietly informed that there was a bad rail just ahead, and that the train would have to be held until the section gang could take out a good one from just behind the train and make the track safe. This settled it. A car load of new rail was sent to that foreman at once.

A very convenient and satisfactory device for displaying placards which show the destination of trains or cars, has been adopted by the Fitchburg Railroad at their Boston passenger station. They stretch a piece of telegraph wire alongside of the track at about 10 feet and 2 inches from top of the rail, so it will stand about 2 feet from the side of the coaches. Intermediate guy wires or supports are used as necessary. Placards are then furnished with hooks that will hold the cards at right angles to the coaches. This arrangement enables the station master to place his cards in the most conspicuous position possible, without in the least interfering with the movement of the passengers, and where they can remain until the train has departed. The advantages of this plan are certainly obvious, as they overcome the objections to placing cards in any manner on the coaches or upon a movable stand, which is always in the way. If properly stretched and guyed the wires, it is claimed, are not unsightly, and a card for each coach can be hung upon them without causing them to sag.

The best handles of small tools are made from the wood of the apple tree, which is extremely hard when dry and possesses a fine grain. Moreover, it does not check easily after it has been dressed. In the case of a plane, while the handle proper will be of this wood, the best wood for the block in which the cutting part of the plane is fastened has been found to be second-growth beech which has grown in a clearing. The trunk of such a tree below where the branches start is used for this purpose with the best results.

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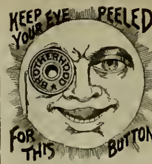


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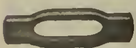

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**The Only Buckle Made that has a Perfect Wrench Hold.**

**The Central Iron and Steel Co.**
BRAZIL, IND.

# THE FIELD FEED-WATER PURIFIER.

This device will not successfully handle **all waters,** but there are **none** that it will not improve. In a **large majority** it will demonstrate great economy.

The apparatus can be made at railroad shops at small expense.

A trial is solicited at our expense.

Cut showing Purifier for locomotive; connects with the regular feed.

This water purifier is now in use and on trial on the following railroads:

**Wisconsin Central,**
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**Atchinson, Topeka and Sante Fe,**
**Chicago and Western Indiana,**
**Chicago and Grand Trunk.**

We refer to each of them.

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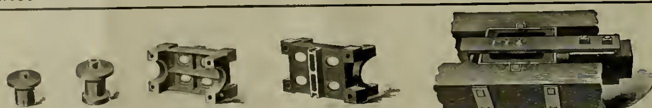

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# DRAW-BAR ATTACHMENT.

This Company guarantees its device for One Year from application against breakages. If the Yoke or Strap Style is used, we guarantee against Spring breakages and Pulling out of Drawheads or Couplers.

*No other device offers as many good features as the Butler.*

**IT HAS THE FEWEST NUMBER OF PARTS.**

**IT HOLDS THE DRAFT TIMBERS TOGETHER.**

**Simplicity and Strength are thoroughly combined in this attachment.**

These Elements reduce breakage to the lowest point and make repairing easy.

**It requires the least number of bolts and costs less to apply.**

Is being applied to more CARS than any other device on the market.

**Butler Draw-Bar Attachment Co., Cleveland, O.**


(85) H. P., Hillsdale, New Jersey, writes

We have an engine equipped with air-brake, the driving-wheels being 60 inches diameter. If we reduce the driving-wheels to 48 inches how will it affect the power of the brakes? *A.*—Not any.

(86) R. B., St. John, N. B., says

Our climate here is very damp and there is much difficulty experienced in preventing the tin car and cab roofing from rusting out. Can you suggest a remedy? *A.*—The best coating for tin roofs that we have heard of is the Lee composite paint.

(87) A. C., Trotwood, O., writes

How much of the revolution does the crank-pin of a locomotive make while the piston is traveling half-stroke, the full stroke being 24 inches, and the length of main rod 66½ inches. *A.*—The means of finding this out will be found in Sinclair's Engine-Running, page 211.

(88) O. C., Wymore, Neb., says.

My engine has an equalizing discharge valve that does not show over-pressure at all times when handle is in running position. Again the red hand will show 140 pounds, with train line at 80 pounds. It is either no over-pressure at all or it is all excess. What is wrong? *A.*—We suspect that our correspondent gets the handle on lap instead of on running position.

Apprentice, Huntington, Ind., says.

(89) I have an engine running 400 revolutions per minute. I desire to have shaft run 120 revolutions. Please give rule to find size of pulleys. *A.*—Multiply the diameter of the driver pulley by the number of its revolutions per minute and divide this product by the revolutions per minute of the driven pulley. The quotient will be the size of the driven pulley.

(90) B. E., Sydney, N. S. W., asks

1. What is the highest temperature at which the Sellers new injector will work water. *A.*—About 125 degrees Fah. 2. How should a boiler of a locomotive that is to be laid up for temporary repairs be left. A. states that water should be run off and all plugs left out, B. states that boiler should be dried with small fire and plugs replaced. As A. and B. have equal votes we allow you to decide. *A.*—We vote in favor of taking out the plugs and leaving them out. A very good plan is to put some oil into the boiler before running off the water.

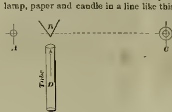
(91) Engineer, Chicago, writes:

What is there in the claim I sometimes hear made that the watches of engineers are liable to be damaged by the magnetism generated in the locomotive machinery unless they are protected? *A.*—The best answer we can make to this question is a statement made by Mr. E. M. Herr, an electrical expert, in a paper read before the Western Railway Club. He said "I have examined for magnetism the different parts of a number of locomotives in actual service, and although they were found in general to be magnetic they were so slightly charged as to render it almost certain they could have no influence upon the rate of a watch."

(92) P. R. L., New York, says

Can you give me an easy method for finding out the candle-power of a gas-jet or lamp?—*A.* Roll a piece of writing or other stiff paper so as to make a tube an inch in diameter and say one foot long.

Take a sheet of stiff white note paper folded once. Open it partly and stand it on end near the lamp to be measured. Light a common wax candle and place lamp, paper and candle in a line like this:




*A* is the position of candle, *B* the sheet of note paper, *C* gas or lamp to be tested, *D* the tube.

When these are in line, close one eye and look through the tube with the other at the projecting edge of the sheet of paper. The two parts of the sheet will appear unequally illuminated and the projection of the paper toward the tube will be readily seen. By moving the candle to the right or left, a point will be found where both sides of the sheet will be equally lighted and then the sense of the projection will disappear and the note paper will appear flat when examined through the tube. Next carefully measure the distance from *A* to *B* and from *B* to *C*. Divide the large sum by the smaller and the result will express the candle-power of the lamp *C*. For example, if it is 3 inches from *A* to *B* and 9 inches from *B* to *C*, the lamp at *C* has a photometric value of 3 candles.

## Air-Brake Lever Arrangements.

By Paul Synnestvedt.

On pages 44 to 55 inclusive, of the Westinghouse instruction book, will be found considerable instruction on this subject, but the writer has found in his somewhat limited experience that there are but very few men who have anything like a clear understanding of the principles involved, and some of them know absolutely nothing about it. Many are able to figure out a leverage of the standard Hodge or Stevens system, as the numerous formulæ given in different books all apply to that class, but when they are confronted with anything that is a little out of the common run of design they are at a loss to know how to proceed, and finally have to get some technical man to do the figuring for them, or else, not wanting to acknowledge ignorance, they "guess" at it, and the result is, as might have been expected, a design that is a disgrace to the community and a menace to the safety of the traveling public.

To find confirmation of this we need but to look around us at the different cars running on some of our most prominent roads, especially those belonging to private corporations or shippers. A few of the cases that have come under the notice of the writer may be of interest. One was a whole train of circus cars that were equipped with air-brakes, but only applied to one end of truck, there being no brake at all on the other end, the one equipped having a leverage of more than 100 per cent. of the weight carried by it, and this unevenly distributed on account of there being no dead lever, the lower tie-rod being attached directly to the beam. Another case was of some passenger cars that belonged to a road that had been troubled with flat wheels and remedied (?) the difficulty by gradually reducing the leverage until there was only about half of a brake left.

There seems to have been, however, the greatest amount of originality exercised on the tender-brakes, and some of them are indeed veritable wonders, fearful to behold, when we think of the amount of brain work that must have been expended in formulating the design.

There are some roads that have the rest of their equipment in very good shape; that have, I was going to say, dozens of different lever arrangements under their tenders, and still the writer has never been able satisfactorily to determine whence comes the existence of so great a variety. Some of them are wonderful combinations of wheels, chains, pulleys and yokes, and others again are so simple as to have no equalizing features at all; but as the adjustment of the slack is tighter or looser on one truck or the other, all of the power is thrown on sometimes one side and sometimes the other, resulting in the breaking of beams, sliding of wheels, and various other difficulties, cited as very peculiar by the expert in charge.

Probably the best way to get a good brake arrangement is to get the air-brake company to make it, but even then there is much more certainty of securing just the thing needed if the parties making the request are sufficiently well posted to understand what data are required, so that the designer will not have to guess at some conditions that may be very essential. For instance, when he is furnished with a drawing from which to work, he should also be told for what kind of service the car or engine is intended, what is the nature of the road over which it is to run, what proportion the load is of the light weight, whether it is to be used only on a line where the apparatus is such as to make it tolerably certain that the train-pipe pressure will be kept accurately within the limit prescribed, or whether it is likely to be used on one road having 70 pounds as a standard, and the next week on a road that has a standard of 90 pounds or possibly no standard at all except the watchful care of the engineer.

Finally, although generally this is not given much consideration, whether the wheels are cast or steel, and the kind of shoes that are used ought to be noted, for as is well known there is a great difference in the holding capacities of different shoes, and this again varies greatly with the kind of wheel used.

The proper method of procedure in laying out a design for a brake arrangement on a new car is, first, to put in the size and style of brake-beam lever that seems to best fit the construction of truck, then locate the reservoir and cylinder in the most convenient place, not forgetting the very important fact that the cylinder must be oiled occasionally and the triple-valve cleaned, and making due allowance of space so that they can be readily reached for that purpose, then proportion the cylinder levers so as to secure the proper amount of braking power on the car, tender or whatever it may be.

It is sometimes found that the construction of the car is such that an odd arrangement or proportion of brake-beam levers must be used on account of limited space, but it is preferable whenever possible, to make changes in braking power by alterations in the cylinder levers, and this should be done after having first located the cylinder and mapped out the general design. The fact that the brake-shoes wear must not be forgotten, and the piston must be given room for full travel and not as we found to be the case on one car, let it strike a beam at 7 inches stroke.

Finally the standards of the Master Car Builders' Association should be followed just as closely as possible, not only as regards general proportions of rods and levers but also in all minor details, in order to facilitate repair work and decrease the amount of stock necessary to be kept on hand.

## Recovery of Steel Rails from a Wreck.

Attempts to find treasure hid in the depths of the sea have often been costly failures. The Pacific Coast is, however, the scene of a very business-like transaction. An enterprising citizen of Spokane purchased a wreck and its cargo of steel rails. Thirty-five men are employed in the work of recovering property; four of the employés being professional divers, who receive $10 per day for four hours work, and $4 per day when not occupied, and whose suits cost $5 per day. When the tide is low the wreck lies in twelve feet of water, as against twenty-four feet at high tide. The men prefer working during high tide, as the lower portion of the water is then less agitated. Four rails, amounting to a ton in weight, are raised at one time, two engines doing the lifting, and in good weather from fifty to one hundred tons can be raised in a day. After the rails have been taken from the wreck, they are loaded in wagons, and hauled along the bank for five miles, after which they are placed on a private railway and conveyed for another mile to a harbor where they can be transferred either to railways or vessel. It is estimated that the cost of transportation from the wreck to Portland is $5 per ton, and the selling price from $50 to $60 per ton. As the cargo amounts to 2,300 tons, it will be a comfortable business transaction, provided all the rails are safely removed. It is stated that the rails have not been at all injured. Before being loaded on the ship they were covered with coal tar, and when this is removed the red sand of the blast remains attached to the steel.—*Railway World.*

After fifteen years' experimenting, the Pennsylvania Railroad Company has decided to discontinue the use of steel ties. The steel ties are found to be too light, and they cannot be kept in line or made to take hold of the ballast firmly. The company has placed an order with the Pennsylvania Steel Company for 2,000 tons of steel rails, weighing 100 lbs. to the yard. The heaviest rail now in use on the tracks of the Pennsylvania Railroad weighs but 85 lbs. The new 100-lb rails will be laid as an experiment on the mountain division of the main line.

A polite colored man in Orange, N. J., recently became possessed of a desire to sneeze while riding on a street car. To avoid offence, this sensitive individual thrust his head out of a window and came in contact with a center pole, during which connection his skull was seriously injured. This is not casting reflections on politeness. It would rather imply that trolley companies with center poles stuck with three inches of clearance ought to make certain that passengers will not be able to push their heads into danger.

A correspondent who says he is a fireman on the Pennsylvania Railroad sends some alleged data of water and fuel used by two-cylinder and four-cylinder compound locomotives, at work on the road, and asks us to explain the cause of the difference. The letter does not give name or address of the writer which we require as evidence of good faith, consequently we have to decline discussing the subject.

It is stated that secret instructions have recently been sent to the managers of all the Russian railways not to enter into contracts with foreign firms, nor to admit foreigners into their service.

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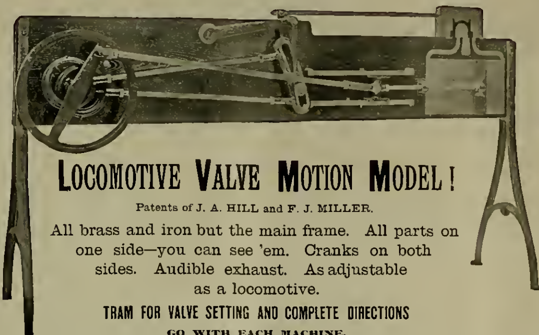
PRICE REDUCED TO **$60.00**

IMPROVED FOR **1892.**



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Patents of J. A. HILL and F. J. MILLER.

All brass and iron but the main frame. All parts on one side—you can see 'em. Cranks on both sides. Audible exhaust. As adjustable as a locomotive.

**TRAM FOR VALVE SETTING AND COMPLETE DIRECTIONS GO WITH EACH MACHINE.**

**Half size of 17 x 24 Engine.—A Machine, not a Toy.**

ESPECIALLY USEFUL IN M. M.'S OFFICE WHEN EXAMINING FIREMEN FOR PROMOTION.

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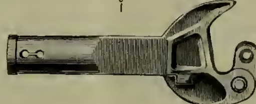

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A Practical Journal of Railway Motive Power and Rolling Stock.

VOL. V, No. 10. NEW YORK, OCTOBER, 1892. PRICE, 20 Cts. Monthly. $2 00 per Year.



## A London Railway Station.

The handsome photo-engraving on this page represents a corner of one of the train sheds of Charing Cross Station, at the outgoing end, showing a South Eastern express engine ready for her run with the boat train to Dover, and a suburban engine on the left.

An excellent specimen of English bull's-head rails, with their cast chairs, can be seen in the foreground; observe the wooden wedge that holds the rail in the chair.

These are the outgoing tracks for two of several platforms and the signals, seen over the suburban engine are for these two tracks alone; in front of where the engines padded stalls for two horses, a place for a carriage, harness and a compartment for the groom or coachman.

It is no uncommon thing for people of means, even moderate means, to take their horses with them if they go visiting in the country; surely, if they spend Sunday or a week at the sea shore.

By giving notice the day before you can torias, traps or dog carts into these special cars, the like of which there is not one in all America.

Horse-boxes are hauled on local passenger trains or fast goods trains, and a fixed fare per mile is asked.

The carriage having a cupola and a bay window, immediately behind the express engine, is a mail car.

At Charing Cross Station, London.

Charing Cross Station is just in the center of London, only a few blocks from the Houses of Parliament and Westminster Abbey on the one side and Somerset House on the other.

The station is reached by an elevated structure for a few squares to the approach of the bridge over the Thames.

stand there are numerous bridges, posts and targets with signals on them.

One peculiar thing seen in all these English stations is the horse-box platform At one platform at the inner end of the station, a track is given up to the loading and unloading of horses and carriages.

A horse-box is a four-wheeled car, with have a horse-box placed at any remote station for you, and at large ones they are always ready.

The writer had a room in the Charing Cross Station Hotel for a week, where he could see the outgoing trains, and remarked every morning from one to half a dozen coachmen loading carriages, vic-

The double ejector on the side of the arch of the express engine is the vacuum producing jets for the automatic brakes.

There is one thing about this kind of a mill, the engineer can't kick about the fireman's being too lazy to clean the paint on ceiling of the cab roof.

## The Underground Railroad of London--A Comparison.

*Editorial Correspondence.*

There has of late been no end of talk in America, and especially in New York, about the underground system of rapid transit, and thousands of articles written against the elevated system—Jay Gould's spider, Hain's alleged railroad on stilts, etc., etc.

While in London, I rode over all the underground system of the Metropolitan road, both on the engines, to study the road, and on the trains, to study the accommodations.

In the first place, the underground system starts off with the advantage over the elevated that it does not disfigure the streets. If you did not run across its stations now and then you would never suspect its presence under you. Stations are usually on corners and the train is often at one side of the street there, and in the open daylight, but it soon hunts a hole.

But its being off the streets is not an unmixed blessing, the elevated roads of New York can be seen from any cross street in the city, and a stranger in any locality knows that by walking to the structure he cannot get more than two blocks from a station as they are on an average, but five blocks apart. This is a great convenience.

The underground roads use condensing engines and the enginemen are all experts on smoke prevention, yet the trains are always close, dark, damp and muggy. It is practically impossible to ventilate them, while our elevated trains are the lightest and best ventilated that can be found.

The underground road charges per mile and has first, second and third class. A very large per cent. of their passengers ride third class and are charged the parliamentary fixed fare of one penny per mile—two cents American money; therefore, to ride ten miles, third class, on the underground, would cost 20 cents, while the same ride on the "L" can be had for 5 cents. The "L" is cheaper for long rides, yet the average fare per passenger on the underground is 3.40 cents, showing that a large proportion of the passengers travel but short distances.

The average speed on both roads is about 15 miles per hour, the average stops on the "L" are but 15 seconds each. I have no figures of those on the underground, but I venture the assertion that they are much longer. It takes a long time to close thirty or forty doors on the side of a train, and, the people having no one to hold a gate half open and yell "step lively, please," take their time.

The underground station is hard to ventilate, to keep clean and light, dust and dirt blow into it—it blows *off* the elevated station. The stations are not as clean as ours, and are the sole instance of the kind I saw in Europe, the surface roads have far superior and better kept stations, as a rule, than can be found in our country.

The underground brakeman (guard) can pronounce the name of a station just as vaguely as can the average Third avenue man—either of them give the password of some Chinese lodge, and both have forgotten the English language. The underground man is on the station platform and hard to hear. The advertising is worse there than here, and all stations are named "Sunlight Soap"—you can't find the name half the time.

The underground operates 34.15 miles of track, the "L" 36.21, but the underground has branches out into the country, mostly on the surface.

The underground employs 71 locomotives and 152 passenger cars of all classes, besides over 100 freight, horse and other cars. The "L" employs 243 locomotives and 950 passenger cars, using only enough freight cars to collect the ashes and dirt from the stations.

Trains on the "L" are much more frequent and less time is put in in waiting at stations.

The London road has great opposition in another underground system operated by electricity, in numerous tram car lines and omnibus routes, to say nothing of the suburban business of all the big roads, most of them coming into the heart of the city underground or elevated.

THE POWER.

The engraving on this page will give our readers an idea of the engines employed on the underground system. These machines are heavy, four-coupled, eight-wheeled tank engines, having cylinders 18 x 24 inches, with 5½-foot wheels. They have inside chests, as can be seen, and are arranged to exhaust up the stack, or into the water tanks, thus becoming condensing engines.

The large pipe seen extending back to the tender is one of the exhaust pipes, and just over the cylinder is shown the valve that controls the direction of the exhaust steam. This is operated from the foot-plate—one cannot say cab, all there is is the little sheet-metal board standing up on the boiler-head with two round glasses in it, called the "spectacle plate."

Where the exhaust pipe enters the tank can be seen an oval cast-iron pipe a couple of feet high. This is the final exhaust into the air and out of the one on either side comes a clearly defined puff of steam at each exhaust. This makes it very warm, damp and cloudy for the crew who are right in the steam.

The two arched steam pipes just ahead of the spectacle plate are those to the vacuum brake-jets.

Hot-water pumps are employed to feed the boiler, as the water gets too hot to be handled with the injector.

The engine can make but a few miles (one trip around the circle) before the water in the tanks becomes too hot to anywhere near condense the exhaust steam, then it is let out and a new supply taken from a crane. There used to be a great valve under these tanks, two feet in diameter, to drop the water quickly, but these were awfully heavy and clumsy, now they have an arrangement to drop the water in smaller volume all the way between two stations, so that they reach the plug with an empty tank.

These engines weigh 46 tons (of 2,240 pounds) or 103,040 pounds, which is more than twice as heavy as the power of the elevated, the biggest engine on the latter having but a 12 x 16-inch cylinder, weighing 47,000 pounds, and the great majority weigh less than 45,000.

The name on the buffer is the destination of the train, and there is a large number of combination signal lights on the buffers and at the end of the tanks that tell the destination of trains and distinguish the trains of other roads entering the city over these lines or running to connect with them.

The quarters of the crew are very cramped and hard. They are in an iron box having two gangways less than 18 inches in width, without roof, seats or cushions. The "driver" is on the left side and the fireman goes at his work left handed.

The fireboxes have large brick arches and a deflector-plate over the door. This is a sheet of ¼-inch iron about 2 feet long, bent to fit the upper half of the firedoor hole, and having on one end a ½-inch flange that prevents its dropping into the firebox. On this end is riveted a short iron handle. The firedoors slide from the center each way and are operated by a lever on the engineer's side. The fireman takes out the deflector-plate at each fire and sets it aside, replacing it after he gets his fire in. The engines steam pretty well, and great care is taken to prevent smoke. Coal and coke are both used, coke usually.

One curious thing I noticed about the exhaust pipe up the stack, and that was the absence of division between the exhaust pipes of the two cylinders. There is a copper pipe straight across the arch from one of the large valves in outside pipe to the other, and in the center, under the stack, there is a T with its open end four or five inches above the cross-pipe and nothing to prevent the exhaust from one cylinder from showing a back-pressure "hump" on the card of the opposite cylinder; but the wheel is so large for the speed run that it is said that no bad results can be seen, as each exhaust has plenty of time to get out of the way, but of course this is not used continuously. On the cylinder can be seen a small oil cup, used almost universally in Great Britain. This cup has a valve in its stem that is closed by the steam pressure and opened by the partial vacuum caused by the pistons after steam is shut off. Above this valve there is a very small cavity and above that a hollow stem extending up into the cup and filled with a woolen feeder. When the engine is using steam the feeder quietly gets in its work and fills the little cavity below the spindle, and this dose is drawn directly into the cylinder as soon as steam is shut off. There are usually other lubricators, often on the chests and often in the steam-pipes. A flat-valve throttle being used it is hard to handle unless means are provided to oil it.

Like other roads in the same country, they use short fronts, open stacks and no netting of any kind, this allows the use of a larger nozzle, and no fire is thrown.

Some of the engines have a steam-reverse gear that looks for all the world like a Westinghouse air pump but these are not popular either with the men or the management.

THE SHOPS

are located at Neasden, N. W., a station on one of the branch lines and out of the heart of the city. The buildings are good and pretty well supplied with tools.

Mr. John J. Hanbury is the locomotive and carriage superintendent, and a very pleasant gentleman I found him. I noticed in the shops that the valve-yokes had a horn on the front of them to run in a bush in forward end of chest and act as a guide the same as often used in this country, but as the chest is cast on to the cylinder this style of yoke could not be gotten in and out if made solid, the horn is keyed into a taper hole in the front of the yoke, and as this can be uncoupled in the chest the yoke proper comes out easily.

Many of the engines have wrought-iron eccentric straps but inside of these there are cast-iron half circles with brass distance pieces between their ends and the lugs of the strap. These wearing pieces are recessed into the strap and have no other fastening.

Like all English roads they do extra nice wrought-iron and boiler work, the stacks are wrought-iron with the base flange welded and as smooth as glass. The domes are welded up, the lower flange turned out and the upper one turned in and thickened a third in the process.

The cars carry sixty and eighty people and weigh 31,000 pounds. The elevated cars weigh 30,000 pounds and seat forty-eight persons, while forty more can stand in them. Both roads pull about the same number of cars.

Most of the passenger stock has six wheels, each pair set in jaws solid on the


LOCOMOTIVE OF THE LONDON UNDERGROUND RAILROAD.

frame, some have eight wheels, using what they call a Bissell truck, the end pair of wheels having a radius bar something like our pony engine truck, with the back end fulcrumed over the center of the other axle. This pair of wheels carries a portion of the load, but I could not see how it did any guiding, and the rigid pair generally proved that they did most of this work by the condition of their flanges.

Wrought-iron wheels can be found under

| | MET. | MAN. |
|---|---|---|
| Train miles made in 6 months by passenger trains... | 1,030,132 | 4,268,548 02 |
| No. of passengers carried | 43,816,342 | 105,753,101 |
| Receipts from pass'ger fares. | $1,641,214 35 | $5,287,655.05 |
| Average fare per passenger. | 3.49 cents | 5 cents |
| Coal burned per mile (6 mos ending Dec., 1891)... | 35 91 lbs | 42 05 lbs |
| Cost of operating per train mile ...... | $0 26 18/100 | $0 64 |

These figures go to show the immense volume of business done on the elevated, and at the same time show the extra ex-

WRECK OF THE "CITY OF CHICAGO"—FIRST DAY.

all the old stock, but the new has the now very popular wood wheels. These have iron hubs and rims, and are a plate wheel made up of triangular pieces of four-inch hard wood with the grain running radially from the center of the wheel.

All car boxes have an oil cup above the brass with a wick feeder, and three oil pads in the cellar, a great deal of pains being taken to insure oiling with certainty and economy.

Wood brake-blocks are used and automatic vacuum-brakes. There are no heating arrangements on the cars of any kind.

Half of the space taken up by the enormous buffers is now saved by making cars with buffers on one end only and letting the buffer of one car rest directly against the frame of the next, but these trains have to be run solid and not mixed up with other stock.

All the trains and most of the stations are now lighted with Pintsch gas, and some of the stations are supplied from large holders permanently located on flat cars which are taken to the works to be re-charged, some fourteen of these cars are in service.

The permanent way is good, and the block signal system up to the high English standard. Bull's-head rails are used, but these are not reversible, as is almost usually supposed to be the case in this country; the lower part of the rail is smaller than the top. I was told that a turned rail was the "jiggliest" thing ever discovered in Europe and some years ago abandoned. The ties are farther apart than ours, and the cast chairs held down by spikes, screws or a combination of either with a wooden pin, the rail being held in the chair by a huge wooden wedge; rail joints are usually of the suspended order—between the ties—and the fish plates inclose the whole base of the rail.

I noticed several large stacks of hay near the shop, and found on inquiry that it had been gathered along the grade of the open country branches and sent into the shops for sale—an economy that American roads, with ten thousand times as much hay to burn, never think of.

When I was in London the directors of the Metropolitan had just made their semi-annual report to the Board of Trade; this was for the six months ending June 30, 1892, a copy of which was furnished me. The Manhattan made a report for the Interstate Commerce Commission covering the same period exactly, and a comparison will readily show how much more work is done by the elevated over the same length of road as the underground.

pense of "forcing" power. The elevated concentrate a great deal in a little engine weighing less than one-half what the underground machine does, give it about the same load, and, are therefore, obliged to burn fuel fast, which is always more or less wasteful. The underground engine has a comparatively big boiler, a large wheel and cylinder and is very economical of fuel, running as it does most of the time with natural draft.

Another item is that for six months per year the little boiler of the "L" engine is called upon to heat a five-car train, while the underground train is not heated.

Whatever the difference in cost of operating the two systems, the fact remains that for the convenience, cleanliness, comfort and health of its patrons, the elevated of New York is far ahead of the underground of London; the trains are more comfortable, the service much more frequent and the cost nominal—less for long rides and more for short ones. The difference in expense of operating is largely due to better wages paid here than there. Engineers there get from seven to eight shillings ($1.75 and $2) as against $3 to $3.50 on the elevated; this, however, is not all to the advantage of the men, as I took considerable pains to see how these men lived and how much it cost them, and I found a big difference between the purchasing power of a dollar in that country and this, rents and clothing being far cheaper—but more of this at another time.

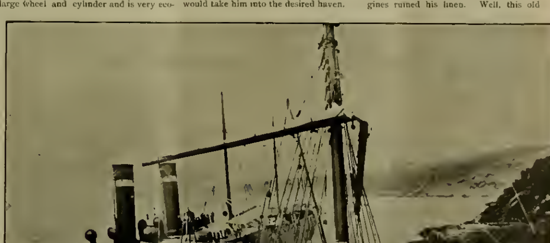
On another page will be found some interesting figures of the business of the elevated road, that could not be used as a comparison in this article. JOHN A. HILL.

## A Wreck—Mistaken Signals.

I came home from Britain on the *City of Berlin*, of the Inman Line, and had the satisfaction—I could hardly say pleasure—of seeing a first-class wreck at sea.

Sometime in July, the sister ship to ours, the *City of Chicago*, was wrecked on the Irish coast at the Old Head of Kinsale, an hour's sail from Queenstown harbor. We went close by her and I had a good view of the fallen queen.

The small picture shows the ship the morning after she struck. The night before was black with fog, and the captain of the *Chicago* was on the bridge, he saw a signal-light on the shore, and decided that it was a well-known light to the east of Queenstown harbor, which he was trying to make, and accordingly steered a course which to the best of his judgment would take him into the desired haven.



WRECK OF THE "CITY OF CHICAGO"—SIXTH DAY

The ship was driven into a sort of cave in the rocks almost up to her foremast, and there she stuck.

All the passengers were taken off safely, some climbing a rope ladder over the rocks and others going in open boats to a small village some miles down the coast.

The photograph taken the day after the wreck shows the boat in a calm, almost uninjured, apparently; but unlike a railroad wreck, which lays still after the first crash unless fire breaks out, a wreck at sea is never let alone. The tide lifts and lowers her, grinding her weight against her wounds, and tons of water in wave after wave beat her against the rocks.

The large picture shows the unfortunate boat as she appeared the sixth day after the wreck. The mountainous waves had actually broken her in two and thrown her stern around against the shore. In this position, with the waves washing her decks, I saw the *City of Chicago* on August 25th, as her sister ship bore myself and 1,200 other passengers away toward New York, the cholera scare, and—home. J. A. H.

## The English Spotter.

"Do you hevver 'ave watchers in America?" asked the old English engine-driver, as we stood up behind him on the footplate of his baldheaded, bell-less and cab-less mill, bowling along at fifty miles an hour.

"Watchers, did you say?"

"Aye, lad, tellers."

"Tellers, you mean in banks?"

"No, no, lad; blooming rascals who are set to watch you and report something, carrying a man on the engine, making black smoke, throwing fire, or leaving the dampers open."

"Oh, yes, we call 'em spotters."

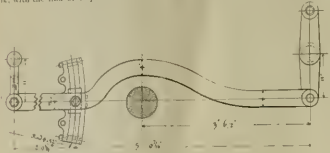
"Spotters, a good name for a rum set of brass rascals. We just had a rare good case. One of 'em, a noted old poacher, too, was sent out to a certain place on the road to report all engines that threw smoke—some fine haired gent had writ a letter to the paper saying as how the engines ruined his linen. Well, this old poachin' teller 'unted rabbits all day and then sent in—by guess—the number for several engines that were bad for smoke. 'E warnt a good guesser, and put down the numbers of two engines that were in the shop, and when they fined one of the men ten shillin's an' tried to get it out of his pay they found he'd been dead for six weeks. The liar is livin' with his wife's relations now."

## McConnell's Plan for Hanging Motion Bar for 10-Wheeler.

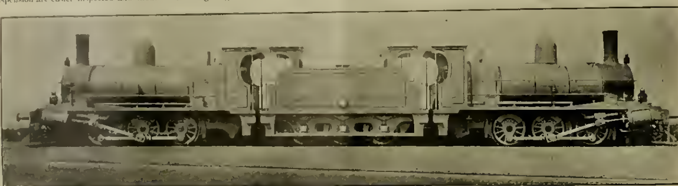
The accompanying sketch shows the plan adopted on the U. P. road for hanging the motion rod for 10-wheelers.

Instead of a short hanger in front of the link, with the link block pin in the end of the bar, they run the bar past the link and suspend it by a hanger that is just the length of the lower rocker arm.

This makes a much steadier motion, admits of larger bearings on the suspension pins and keeps the bar paralleled with the frame of the engine, while the points of suspension are easier inspected and oiled.



MOTION BAR, U. P. TEN-WHEELER.



TWIN ENGINES FOR INDIA.

## An Indian Monstrosity—Siamese Twins.

The engraving shown on this page was made from a photograph of a double-barreled affair recently turned out to order by Neilson & Co., of Glasgow, Scotland, for the Government of India.

These are monstrous engines, the gauge of track being 5 feet 6 inches and the cylinders being 19x26 inches.

Twin engines have often been made with the evident idea of having one crew handle both, but here are two freight engines tied up to one tender which is none too big for either of them for ordinary work. If they are pushing on an incline there would be economy in the single tender, but the man running the mill with her head down hill would have more or less grief in carrying water enough to cover the rafters and at the same time keep out of the dome.

## The Unwritten Laws of Travel on European Railways.

In all compartment cars there are, of course, two long seats across the car, each seat usually holds four in first-class compartments, five in second-class and six in third—all the same length.

At either end of both seats there are located small windows but these are not movable at all; there are two doors in each compartment, one at either end, and in these are sliding windows just like those in hacks, the sash slides down into the door and can be raised by a strap and stopped part way up by slipping one of several holes in the strap over a pin, or held entirely up by pushing the bottom out on to a stop.

It is one of the unwritten laws that the person who sits next to the window and facing the way the train runs has absolute control of the window—he sits in the draft. If so disposed he can shut or open the window without consulting the other passengers. Often the two persons at the ends of the seat will consult one another but seldom the other passengers. The one who is on the side from which the wind is blowing will ask the other to open his window wide while he closes his, and *vice versa*.

If one of those fellows who sweat ice water gets next to the window and persists in keeping it sealed a passenger on the interior may ask him to change seats with him so that the others may breathe without endangering his health. This is often done, but whether the man next to the window moves or not is optional with him.

Another law is that "luggage"—to say baggage is to brand yourself an American, over for the first time—will hold seats. A man going out to get a sandwich or to the closets will take down a young trunk with valise handles, a hat box and an umbrella and leave them on the seat as evidence that the claim is preempted. This plan is universal and pretty well respected.

One of the unwritten laws is for each and every person that gets into a pen to try any and every means to keep others out—stand in the door, strew the seats with bundles, assume partial intoxication or insanity—anything to get a compartment as nearly to one's self as possible, the easiest and surest plan being to tip the train conductor or a guard.

In all trains and in almost all cars there is a smoking compartment and one for ladies where smoking is not allowed, but in the others smoking is permitted by consent of the passengers—"one black ball rejects."

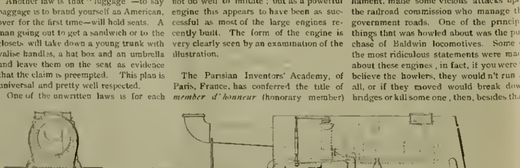
This rule is posted in the compartments of some roads while on others it is the unwritten law. The first experience of the writer on the subject occurred on a Scotch road. The only other being in the compartment was a rough-looking man who eyed me sharply for a few minutes after the train started—much to my uneasiness. At last he came over to me, put his hand in his hip pocket, and said:

"Kin I heve a dhraw at th' poipe?"

In most of the countries the people in a compartment will glare at intruders and try in every way to discourage them about entering the compartment, but on leaving will usually bid each one good-bye very pleasantly.

## French Double-ended Locomotive.

There is an impression in this country that the principal work toward developing extremely wonderful locomotives has been performed in the United States. When we trace the history of locomotive construction in engineering works, we find that America takes a little more credit in this department than what it is entitled to. The locomotive illustrated in the annexed engraving is a case in point. This is a French engine designed and built in 1874. It was used on heavy freight service and was reputed to be very efficient for that kind of work. There are many oddities about the design which our people would not do well to imitate; but as a powerful engine this appears to have been as successful as most of the large engines recently built. The form of the engine is very clearly seen by an examination of the illustration.





A DOUBLE-BARRELED FRENCHMAN.

The Parisian Inventors' Academy, of Paris, France, has conferred the title of *member d'honneur* (honorary member) with the award of the first-class diploma and the great gold medal upon John A Hill, one of the editors of this paper, for his invention of educational valve-models. As the great gilded medal has a string to it that the Academy will let go of only on the payment of $10, Hill will have to struggle along without it for some time to come. The long list of Americans who have put up $10 (names and addresses given in circular) indicate a right smart sprinkling of fools in these United States of America. This society makes a business of selling medals to alleged inventors who have more money than sense and ape after foreign honors (?)—with tinsel on them.

## Causes of Failure.

Few men come up to their highest measure of success. Some fail through timidity, or lack of nerve. They are unwilling to take the risks incident to life, and fail through fear in venturing on ordinary duties. They lack pluck. Others fail through imprudence, lack of discretion, care or sound judgment. They overestimate the future, and build air castles, and venture beyond their depth, and fail and fall. Others, again, fail through lack of application and perseverance. They begin with good resolves, but soon get tired of that, and want a change, thinking they can do much better at something else. Thus they fritter life away, and succeed at nothing. Others waste time and money, and fail for want of economy. Many fail through ruinous habits; tobacco, whisky and beer spoil them for business, drive their best customers from them, and scatter their prospects of success. Some fail for want of brains, education and fitness for their calling; they lack knowledge of human nature and the motives that actuate men. They have not qualified themselves for their work by practical education.—*E.*

Some time ago a labor leader, who had been elected to the New South Wales Parliament, made some vicious attacks upon the railroad commission who manage the government roads. One of the principal things that was howled about was the purchase of Baldwin locomotives. Some of the most ridiculous statements were made about these engines; in fact, if you were to believe the howlers, they would n't run at all, or if they moved would break down bridges or kill some one; then, besides that, there was a "job" somewhere. An investigation has recently been held and the howlers asked to prove their statements, with the result that they were unable to do so and Chief Commissioner Eddy and his colleagues have been entirely exonerated. The Baldwins are running all right enough.

The Eastern Railway of Canada have lately equipped all their rolling stock with the Westinghouse air-brake. They used the hand-brake before.

## A Prize Winning English Engine.

Engine 240 of the SouthEastern Railway, of England, captured the prize in the tests for speed made during the Paris Exposition.

The illustration here shown was made direct from a photograph taken this summer.

The 240 is a typical English eight-wheeler, she has 18x24 cylinders, 6½-foot drivers and 42-inch truck wheels, inside connected.

The affair that looks so much like an air pump on the side of the boiler is a steam reverse device.

The engine is a very fine piece of machine work, she is painted black all over, boiler and all, and all trimming, handles, etc., are polished iron, no brass finish is used.

At the Samuel Moore & Sons manufacturing establishment, at Elizabethport, N. J., we recently observed a very convenient method of transferring power to work by means of an electric motor and the Stow flexible shaft. A great deal of heavy work is done here that is too cumbersome to put to a machine, and they follow the practice of bringing Mohamet to the mountain, since they cannot bring the mountain to Mohamet. By means of this motor, which is light and convenient to carry around, and the flexible shaft, they do drilling, tapping and a great many other operations. One of the most noteworthy improvements in shop practice to be seen at present is the tendency to transmit power by means of flexible shafting. At the Moore Works, the officer in charge said that the drilling of one large cast-iron cylinder of the motor, which it was at work on, saved enough expense to pay for the cost of the motor and shafting.

## How to Tell When Steel is the Proper Heat for Flanging—A Rule.

It is now a pretty well understood fact in this country that steel plate, at a black-hot heat, is almost sure to fracture in flanging, even though it can be flanged cold without showing a flaw.

At the works of Sampson Fox, at Leeds, England, flanging is one of the principal branches of its business. More intricate and better flanging is not done in the world, and they have a simple, easily followed rule for insuring the proper heat.

A hard-wood hammer handle is placed on the sheet, and if it does not blaze instantly on contact, the sheet is heated until it will, if it sparks only, it is not hot enough. The shape of a sheet is never allowed to be changed until this heat is shown.

This is a simple test. Try it.

## Railroad Blacksmithing.

By W. G. Lottes.

I see that nearly all the mechanical branches of railroads are represented in your paper but the blacksmiths, and I think the cause for that is not for the want of argument, or the necessity of information on the subject, but for the want of time, that I have not done more writing in this line, and suppose there is a great many of my brothers in the profession in the same boat.

It must be remembered that there is a tremendous large field to be cultivated in this line, and the cause for not having more of it done is the ten hours' hard labor that is connected with the blacksmith's trade. The blacksmith's trade is not like most other trades; they have not got a minute to study during the ten hours that they stand in the shop.

The fire is ready for the blacksmith before the whistle blows in the morning, and as soon as it blows he puts in his iron and stands patiently over a hot coal fire, watching it every second, which is certainly a strain on a man; and when he has got the proper heat on it, or what he believes to be the proper heat, he puts it under the hammer or on the anvil, grasping the tongs in one hand and the hammer in the other, with a strain on every nerve and muscle in his body; this he is expected to do for ten long hours every day, and six days in the week.

It would be unreasonable to expect writing from this craft or a great deal of reading. Stop and think of it! During the hot summer months we stand over a blazing coal fire, where the thermometer registers from 100 to 130°. After we put in ten hours of this work we have little ambition, or none, to sit down to write or read a great deal about our own trade, which is certainly necessary in any trade in order to keep abreast of the times—more especially in ours.

In the first place we ought to know what the material is composed of that we have got to work up. In order to know this we must read the mechanical papers and writings, or else analyze the material.

When you undertake to convince the average railroad blacksmith of the necessity of this knowledge, the answer is "What benefit will I derive from it? It's liable to get me out of a job." This is true in some cases where you have a jealous-minded foreman, but they are not all that way. There are some, I will admit, that it would be bad policy for any man under them to know any more than they do. I think you will find more of that in railroad shops than others. We all know that railroad shops are run a good deal on the standing plan, more so in the mechanical department than any other. When I say mechanical department I mean the shops. If every man was paid according to the knowledge he possessed of his trade there would be a wonderful change in a large percentage of these shops, especially in the blacksmith trade.

There has been many a railroad accident caused by the ignorance and incompetency of blacksmiths—this may be a strong statement but it is susceptible of proof. How often do we read of some poor fellow meeting with almost an instant death by the giving way of a brake-rod or lever, or step of a ladder, or a draft-iron pulling out, or a switch-rod breaking? They are common occurrences, in fact so common that there is no attention paid to them, not even in the shop where they are made. How often when an accident occurs are they examined, or how many railroad officials have we got, if they do examine them, could give a fair decision? How often do we hear of a side-rod breaking in the weld or a rod-strap in the corner, or valve-stem, or rocker-arm, and it is called an accident and cannot be helped, and nine times out of ten you could blame the material or the man that did the forging.

In the first place the man that purchased the material ought to thoroughly understand both iron and steel, so that when one of these breaks he ought to know whether it was the fault of the material or not. And the blacksmith should know if he was furnished the proper material or not, so that he can work it accordingly, and protect himself in case they blame him.

We see a blacksmith welding two pieces of iron, at what we call a borax heat, and it looks as nice and smooth as any when finished, and may give satisfaction for certain classes of work; but the practice is a poor one, no matter how common or rough the work may be. But when it does give way, the most important part is then to know who is to blame, the blacksmith or the material.

If the material is not what it ought to have been, the blacksmith should be able to tell by looking at the grain of it, and inform his foreman or M. M. that it is not the proper material for the forging, and if he is not furnished the proper material then he ought not to be held responsible.

In fact, it is the blacksmith's duty, when he gets expensive iron or steel, to test it before he works it up. You cannot make a success of tool work unless you test every bar before working it up into tools, and also see that you have the proper grade for the tool you are going to make, as a grade of steel that was made for lathe and planer tools is unfit to use for a chisel or hammer, nor is that which was made for drills and taps fit to use for lathe or planer tools.

If you test every bar as you get it, you will soon discover that there are often poor bars among the best of it.

Very often you will find bars that have been overheated, while others have been spoiled under the hammer by using too heavy a blow for the size bar you are making, which has a tendency to put seams in your bar which cannot be detected until you start forging it or harden it, and then very often they cannot be seen with the naked eye—it is necessary to use a microscope to detect them, and sometimes we find in expensive tool steel some of the impurities of cheap ore, which can only be seen under a microscope, and I will say that you are as apt to find them in expensive English tool steel as in American steel that you pay the same price for you are paying for English steel.

The same rule will to a certain extent apply to iron, as a rule you will find blacksmiths favor a fine, close-grained iron, which is all right for certain classes of work, such as valve stems, rocker arms, guide yokes and links, which are largely made of steel now, and for side-rods and main-rods, but for frame and rod bolts, in fact, all engine bolts except stay-bolts, a loose-grained iron should be preferred, but it should be uniform all through, a pure and clear grain, and the heating should be done in a furnace or hollow fire, as the open fire has a tendency to burn and spoil the grain, especially if the forging is such that a great deal of hammering cannot be done on it while it is at a welding heat. In forging steel more pains should be taken in the first place to get the proper grade and see that it is what it was represented

Gold Medal Engine of the Paris Exposition.

as being not to do as a great many do, simply look for a square, hexagon or octagon bar and then, not knowing what per cent of carbon it contains, use the argument that square, hexagon or octagon steel is better than round because it is finished under the hammer, or perhaps the hexagon or octagon is not as liable to crack in hardening, and the cause for this is that it is generally a milder grade of steel, intended for chisels or similar tools, and will stand more abuse than the round steel, because the round is generally intended for taps, reamers, drills, etc., and contains a larger percentage of carbon, and is more liable to crack in hardening, especially if heated the same as hexagonal or octagonal, and that is one of the greatest difficulties to overcome in hardening, especially in expensive tools, such as large and irregular-shaped milling cutters, reamers, taps and dies.

But when some of our steel manufacturers will put what they call temper marks on every bar of steel they send out, for toolsmiths to be guided by, for instance, "No. 3, suitable for dies, large taps, reamers, punches, hammers, cold sets, track chisels, smith's tools, large shear blades, etc., welds easily and hardens at a cherry red."

"No. 3½, suitable for punches, shear blades, plane irons, large circular cutters, etc., welds easily and hardens at a cherry red."

"No. 4, suitable for cold chisels, small punches, taps, reamers, stamps, mining drills, etc.; weldable; harden at a cherry red."

Now, some of our steel makers ought to ask the different nurserymen to sell only such cherry trees as will bear a certain color of cherries, and that ought to be a very dark color. As it is now, the Minnesota toolsmith has the advantage of the California man, for it is principally choke cherries that are raised there.

Or else ask the California fruit raiser to stop shipping his cherries to Western States, or else send a sample of cherries with your steel, but I don't know how that would work in the month of January.

I would like to have somebody, in the near future, explain how to get at that cherry red. For this same steel company sends out the following instructions.

"We beg to call special attention of the user of steel to the importance of studying its different tempers, with relation to the various purposes for which it is required. Temper means percentage of carbon combined with the iron to produce steel, and has no relation to price.

"The quality of steel means the absence of phosphorus, sulphur, silicon and other impurities, and can only be secured by the selection of the purest ores, which are costly in proportion to their purity. For the convenience of our customers, every bar of our steel bears a label showing purpose for which that particular temper is suitable.

"This temper is signified by number on the label, and for additional security stamped on the bar in the center, so whenever a customer requires the same temper again he can have it by simply giving the number. By this means we put it in the power of every user of steel to select that temper which suits him best. The lowest number is the mildest steel, the percentage of carbon increasing as the numbers advance."

*(To be continued.)*

The Eugene V. Debs Publishing Co., of Terre Haute, Ind., publishers and sellers of books on railroad subjects, are already doing a thriving business. Several new works are in press, and the demand for standard works has taken a spurt, owing to the advertising put out by Mr. Debs.

## To Take Lime or Other Scales Out of an Injector.

When an injector becomes scaled up it often does more harm than good to attempt to remove the deposits with tools.

Scale can be removed very thoroughly by immersing the entire injector in a liquid compound of one part muriatic acid to eight parts of water.

Leave the instrument in the bath as long as it boils; when the scale is dissolved this boiling action will cease. In time the acid would injure the brass, but it will not hurt to leave an injector in over night; two hours, however, is usually long enough to do the work. Should the scale dissolve too slowly, a stronger solution, say one part acid to six of water may be used.

This receipt is worth remembering and may save lots of trouble where injectors, checks or other valves and cocks are partially filled with lime.

The acid solution must be kept in a stone, glass, or lead vessel.

## A Hard Tire.

On the C. B. & N. they had an engine that broke a pin on one side twice within a few weeks. The last time they found a twisted axle and other evidences of severe strains; this was somewhat of a mystery until they came to turn the tires, when it was found that one of them was so hard it could not be turned.

General Foreman Allan McDuff had the tire taken off, well heated and laid on the ground with a band of iron both inside and outside of it. Here it was carefully covered with ashes and left over night and put on the wheel-center next day without cooling. Subsequent wear proved that they had got what the men call "a good scald" on it; it was as soft as the others.

This instance may point out the trouble in other similar cases; this tire was so hard it had less adhesion than the others, and when it let go threw its proportion of the strain upon the other wheel, and its pin was not strong enough to stand it.

Many a slipping engine has been "caught" on one pipe of sand and the slipping side twisted its axles, or bent or broke its pins.

## Tiled Secrets of the Tank Shop.

In only one instance was the philosopher of the L. E. refused admission to a shop in Europe, and that was at the works of Byer, Peacock & Co., at Manchester.

None of the firm were at the works, and after three or four men had come into the waiting room and pumped him a little and then went outside and held a whispered consultation, they decided that they could not, singly or collectively, take the fearful responsibility of admitting a blooming foreigner into the sacred works.

The philosopher knew that the place was mighty little different from other works of their kind and was doing very little just then, and so went away just as happy as if he had been allowed to see the wheels go 'round and sleep with the shop secrets. When going away in the rain, and a tram car, the philosopher could not help thinking of Bobby Burns, the Scotch poet, and the Carron works. At Carron, Scotland, there is an iron works once famous for making a short, heavy, cast cannon, much used on shipboard up to half a century ago. Burns on visiting Carron was refused admittance to the works, and in humorous revenge wrote the following verses on the window of the inn:

> "We came na here to view your warks
> In hopes to be mair wise,
> But only, lest we gang to hell,
> It may be nae surprise.
> But when we tirled at your door
> Your porter dought na hear us;
> Sae may, shou'd we to hell's yetts come,
> Your billy Satan sair us."

## A Boy's Locomotive.

Many a boy with a mechanical turn of mind has started to build a locomotive, but very few have ever finished one that would work and that looked anything like an ordinary every-day locomotive.

An exception to this rule is shown in our illustration, the boy and his work.

Stephen L. Pagenhardt is now 19 years of age and works with his father, who is a gunsmith. Three years ago young Stephen started to build his little engine and has worked at it during his spare moments ever since, having been a little over 3 years in completing it.

The principal dimensions are as follows:

Gauge of track 7¼ inches.

Cylinders 2 x 2½ inches.

Steam port 1 1/8 x 1/8 inch.

Exhaust 1 1/4 x 3/16 inches.

Travel of valve 5/16 inches.

Throw of eccentric 5/16 inches.

Diameter of drivers 6¼ inches.

Total wheel base 26 inches.

Top of rail to top of stack 17½ inches.

Total length of engine and tender 64 inches.

Diameter of smallest boiler ring 5¼ inches.

Firebox 6½ inches long by 4¼ inches wide.

Twenty-three ½-inch tubes 1[illegible] inches long.

Tender holds 3 gallons of water.

Total weight of engine and tender, ready for road, 1[illegible] pounds.

Young Pagenhardt has 2[illegible] feet of track at his home in Westernport, Md., and over this line the little engine has carried four persons. Coal is used as fuel.

The builder expects to exhibit his engine at the World's Fair in Chicago next year.

"Little Maryland."

## Too Much Comfort.

Stepping upon an English passenger engine in the Charing Cross station, London, we took a survey of the footplate and its attachments, and, with a view to striking up an acquaintance with the grizzly old runner, we ventured to remark:

"That cab would hardly do us in America."

It was merely an iron sheet, straight up, with two hinged glasses set in, and called the "spectacle plate."

"They tell me it's a bit colder there than 'ere; they 'ave ye boxed up like,—aint that un'andy?"

"Oh, no, we are as used to it as you are to being out of doors. I dare say we *could* get used to your cab, but every man in America would strike if he couldn't sit down. Are there no seats at all?"

"Seat? Sit down! Why, man, I never 'eard of the like; don't you get drowsy?"

"No, it rests us."

"Seat? Sit down! Well, I just wish my chief could 'ear you talk.

"Why, do you see 'ow far it is from the deck h'over that wheel cover to the side of the engine? Well, no man can see h'over it, I step back into the gangway to see signals and often stand there for miles. Well, sir, I made a bit of a stool like, a board on two blocks, so I could see over and at the same time be out of the stoker's way. But one day the Chief comes up and spies it and says he to me, says he: 'Why the blooming 'ell don't you bring your bloody bed h'on the engine? Take that blasted girl-baby plaything off the foot-plate h'and stand h'up to your work like a man.'"

## A Strong Cylinder.

A curious accident happened last month to one of the Vauclain compound locomotives running the express trains on the Philadelphia & Reading, between New York and Philadelphia. Owing to the jerking caused by the suction of the pistons when steam was shut off, a relief-valve was put into the main valves. One of these relief-valves broke or worked out when the engine was running and dropped into the port holding the main valve in a position that covered the exhaust port. As the steam inside the cylinder could not get out something had to break. The steam was bottled up in the cylinder, and the advancing piston had either to squeeze the whole volume of steam into the clearance spaces or force relief by bursting the cylinder or breaking the piston connections. The weakest point proved to be the great main rod that looks as if it would easily stand ten times the strain that could be put upon it. The rod doubled up, however, and smashed things pretty badly, taking off guides and crosshead.

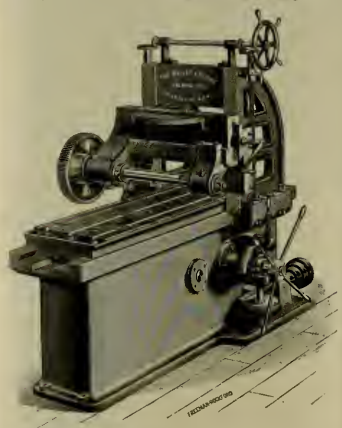
The accident gave very decided testimony in favor of the strength of the cylinders of these compound locomotives. In order to keep down the weight the amount of metal put in the cylinders has to be made as small as possible consistent with strength, but there still appears to be a good wide margin.

## The Ingersoll Milling Machine.

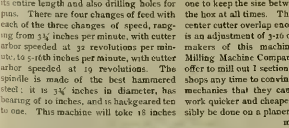
The engravings shown herewith will give any mechanic a pretty fair description of the machine, which the makers call a slab milling machine. It is built more on the planer principle than other millers, and is intended to do much work now done on planers. The makers' circular describes the tool as follows:

"The table is 20 inches wide; mills 5 feet long, is driven by a gear 24 inches in diameter, 3 pitch and 4-inch face, running into a cut rack. By this means we obtain a very steady movement of table. We have arranged for clamping or keying work to the table, by milling three T slots its entire length and also drilling holes for pins. There are four changes of feed with each of the three changes of speed, ranging from 3¼ inches per minute, with cutter arbor speeded at 32 revolutions per minute, to 5-16th inches per minute, with cutter arbor speeded at 19 revolutions. The spindle is made of the best hammered steel; it is 3¼ inches in diameter, has bearing of 10 inches, and is backgeared ten to one. This machine will take 18 inches under a cutter 4½ inches in diameter. We would call your special attention to the means we have provided for cross adjustment of cutter. This is of the greatest advantage, especially in key-setting, or milling work of any special form, such as rod-boxes, crossheads, shoes, etc., as the work can be set on the table at any place and the cover set over to suit the work. There is a dial on the elevating screw reading in thousands. With this machine and our patent cutter we can mill a surface 20 inches wide (either straight or angular face) at the rate of 2 inches per minute and do a finished job. On a large variety of work we have been able to do the work of three, and sometimes four, planers, with one of our millers. The weight is 10,000 pounds."

The third illustration represents the Ingersoll milling cutters, inserted steel teeth that can be changed and ground the same as a standard milling cutter. The particular one shown is intended for milling crank-pin boxes. The center cutter is made in two parts; each part is recessed to receive a screw washer. This enables one to keep the size between the flanges of the box at all times. The flat teeth in the center cutter overlap enough so that there is an adjustment of 3-16 of an inch. The makers of this machine, the Ingersoll Milling Machine Company, Reckford, Ill., offer to mill out I section side-rods in their shops any time to convince railroad master mechanics that they can do this class of work quicker and cheaper than it can possibly be done on a planer. They make a machine similar to the one shown 36 inches wide to mill 8 feet long, which is especially fitted for this class of work.



INGERSOLL 22 X 22 X 60-INCH MILLING MACHINE.



INGERSOLL CUTTER.

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Lots of engineers getting Jerome metallic packing for the first time are worried to tell how they would clamp the valve-stem in case it became necessary to disconnect one side. There are also a lot of men running it to-day that don't know that there are provisions for holding the stem on all the latest packings. On top of the valve-stem packing will be noticed a small bolt-head with a washer under it. this is a set-screw. In case you have to disconnect a side, take out this bolt and remove the washer, then you will find that the bolt will reach the stem and clamp it just where you want it.

## Brass Thrust Blocks in Eccentric Straps.

Of course, anybody that knows anything about eccentrics at all knows that the straps wear oblong—they do most of their work in the front and rear.

To provide for this wear, Mr. Leeds, of the L. & N., uses a brass inset in the strap, as shown in our engraving.

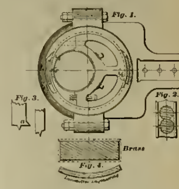
In a private letter (Mr. Leeds is modest about printer's ink) the designer of this strap says:

"This drawing shows our original method of placing these insets, in which we used to counterbore two places and then chip out between the two. In doing this we used to counterbore with the ordinary square ended lip drill and then recess or dovetail with the drill, as per attached sketch. Of course the first drill would leave a little point; taking advantage of this point, we made a flat drill with a round point which would enter the point made by the square tit, and this would crowd the lip *A* out sideways and recess under, making the counterbore dovetailed. Within the last year or two we have been putting these insets in in the form shown at *B*, casting the recesses into the strap. In fact, we cast almost all our straps now to the form, leaving but very little to cut out, an improvement on the original plan of casting them straight across and working out all this metal with a tool.

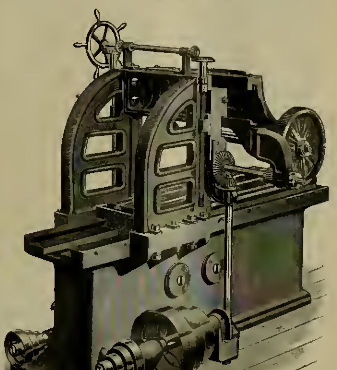
"In the old style we used to have to rough-bore our eccentrics within about 1-16 inch of the finish and then counterbore them, whilst now we put the brass in as the strip comes from the foundry, rough.

"Our practice in filling these cavities has always been to place a piece over the cavity inside the strap, which would form the brass to the circle of the strap but leave it about 1-16 inch higher than the cast iron, and heating the strap by laying it on top of the brass furnace to such an extent as we considered it could be done without putting any strain on the iron, we then poured the brass inset through holes in the cap before mentioned. This leaves the brass somewhat higher than the iron around it, we generally peaned it out until it filled the opening rigidly, and then bored the entire strap together.

"Be careful to warn anyone who is trying this experiment against putting round insets or buttons in without cutting the two holes into one, as should they turn around they of course would wedge between the strap and eccentric, whilst the two being cut into one it is practically impossible for them to turn, as even should they break between the two holes it would




scarcely be in such form as to allow of their revolving. I have used these insets for about eleven years now, and not only have I obtained the best of results from them, but every master mechanic on the road has indorsed them as being an excellent thing. I will say, however, that we use an extremely hard metal in both eccentrics and straps, our eccentrics being made of old wheels, pure and simple, which makes them about as hard as they can be turned. In fact, we had to round all the edges of our pattern to obviate the chilling of the square corners as they were originally made. Our straps are made of old wheels with 25 per cent. of No. 1 charcoal iron. With this material and the generous proportions given our eccentrics, viz., a 4-inch face for everything over an 18-inch cylinder and a 3½-inch face on everything 18 inches and under, we have had excellent results, our straps running for years before they take the tool marks out of the eccentric."



REAR VIEW, SHOWING ADJUSTMENT OF CROSS SLIDE.

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## Dear Cheapness.

During the discussion on steel for fire-boxes, which proved such an important part of the proceedings of the last Master Mechanics' Convention, several of the speakers asserted that the price of steel was of secondary consideration compared with the importance of getting material suitable for the severe service that fire-boxes are subject to. The speakers who took this ground were doubtless sincere in their expressed views, and they advocated a line of policy that would be very economical for railroads to follow, but it is sad to relate that they represented a hopelessly small minority. We cannot recall any line in which engineering material is used, where the best is so emphatically within the requirements as in the parts that constitute locomotives and cars; yet there is no line where one per cent. difference in price so frequently leads to the bad being preferred to the good. There are numerous exceptions to this rule, but, unfortunately, the practice of selecting inferior articles on the ground of cheapness is so common that it is the rule among railroad companies.

The matter of steel for boilers is a good illustration of the craze toward cheapness. When steel was first introduced certain companies engaged in making that material devoted all the resources of science, skill and experience, to producing an article which would meet the conflicting requirements. To do this they had to exercise extraordinary care in supervising every process the material went through, from the ore to the finished plate. High-class iron had to be used and the highest priced labor in the market had to be employed. But by meeting the necessary outlay a grade of steel was produced which demonstrated that steel was superior to all other materials for boilers and fire boxes. This steel was necessarily expensive, but railroad companies found it cheaper than copper or the class of iron that would stand the service and they paid the price willingly. The rarity of failure in service made the steel cheap when a high price was asked. This lasted for a few years till the railroad officers began to forget the troubles they had experienced from the use of unsuitable material, and then the cry arose that steel-making companies were paying dividends and that they must therefore of necessity be imposing upon their customers, the artless, helpless railroad companies. As the methods of manufacture were developed the makers of first-class steel found themselves able to reduce the price and fair reductions were made.

The success of any industry is certain to bring the tenth-class species of rivals, and this happened in the steel-plate business. About the time that the reliable steel-makers were beginning to give railroad companies the benefit of lower prices, parties who had engaged in the manufacture of cheap imitations of good steel began offering their miserable stuff to railroad companies at a still lower price than that asked by reputable makers. A great many railroad companies began buying the cheapest steel, and the men responsible for this short-sighted policy closed their eyes and ears to every consideration except the one question, "How much per pound do you ask for your steel?" They know nothing and care less about the comparative value of the steel offered for sale. Railroad officers howl against the public tendency to look closely into profits made in transporting passengers and freights, but many railroad officers are overwhelmed with hate, envy and indignation when they hear that a company manufacturing goods for railroad companies is making a living profit. We sincerely believe that there are railroad officers who will prefer to purchase an inferior article from a struggling company rather than a first-class article at the same price from a company that is prosperous.

With the demand for cheap steel and the tendency to purchase from the lowest bidder, inferior grades were furnished to suit the market. First-class manufacturers reduced prices as far as they could and probably lowered the quality of the article supplied. When the inferior steel got time to prove its quality, complaints began to be heard of the failure of firebox steel. Men seldom discriminate finely between what should be good and what ought logically to be bad, and those who have persisted in making a decent grade of steel have to share the odium of failure due to the inferior grades that are becoming the most common article.

By the purchase of inferior steel a railroad company secures a few dollars in first cost and loses thousands of dollars by waste of fuel due to leakage, by loss of the service of engines and by premature renewals.

In making a journey on a passenger train some time ago, we met with a long detention and learned that the engine of the passenger train had to go up the line and bring in the train of a freight engine that was disabled. The same day we stopped off to visit the shops of the road, and learned that the engine which caused the delay had burst a flue which put out the fire. They were having no end of trouble with flues. The officer controlling the purchases for the company was suffering from a fit of economy and was buying the cheapest flues in the market.

In looking around the same shop we stopped at a wheel lathe which was idle and was examining with some curiosity the light cut begun on a wheel which was in the lathe. Presently the lathesman came up with a newly ground tool and we inquired why he was taking such a light cut. "The tool will not stand even a light cut," he answered. "The worst steel I ever saw used," he added. Here was a first-class tool run at one-third its capacity because some one was saving a few cents a pound on tool steel. All the tools in the shop were more or less affected from the same cause, and it is safe to say that the man responsible for the purchase of inferior tool steel was paralyzing the shop of one-third its capacity.

In no department of railroad mechanism has the craze for cheapness been so expensive or so disastrous as in the purchase of cheap wheels and axles. For a long time there has been a conflict going on between wheel makers and railroad companies. Cast-iron wheels can be made that are reliable for ordinary service, but select iron must be employed in their manufacture and most of the men engaged in this business are anxious to supply wheels of good quality. But many railroad companies appear to think that cast-iron wheels should be got for the price of pig-iron and the maker that comes nearest to the pig-iron figure gets the business. The cost of wrecks and of human lives due to the use of inferior wheels receives no consideration. There has been more inhumanity practiced in the purchase of cheap wheels than in any department of industry we are acquainted with.

Scarcely less creditable than the practice of using the very cheapest cast-iron wheels that can be bought, is that of many roads in regard to axles. An inferior wheel, or an axle that would run without accident at low train speeds, is a constant element of danger at the high speeds now so common on most railroads. Increased precautions ought to be exerted to make every member of the running gear of cars thoroughly reliable, but safety is kept away in the background when first cost is considered. The prevailing policy seems to be, get good wheels and axles if you can, but buy the cheapest. If a railroad company cannot afford to buy selected scrap-iron or good steel axles, they ought to be forced out of business. Muck-bar iron is not equal to modern requirements, and the Bessemer steel axles that are becoming so common are a menace to the life of every man who has to ride on a freight train.

We have known of lots of Bessemer steel axles that broke like pipe-stems when subjected to the ordinary drop test, being rejected by a road that followed a rigid system of inspection. The same axles were quietly taken back and sold to roads that are strong in faith and take material supplies without bothering about tests. First-class iron axles and axles made of toughened steel can be bought for one-half cent a pound more than that paid for the poorest kind of Bessemer steel, yet there is scarcely any market for the reliable material, as the inferior kind is considered the more desirable because it is cheap. This is a matter which deserves the very strongest kind of publicity. The practice of putting into train service wheels and axles admittedly unreliable is a crime, and the parties responsible for the outrage ought to be treated as criminals when their recklessness leads to disaster.

## An Economical Substitute for Waste.

On a great many European roads no waste is used to keep locomotives or other machinery clean, but a cloth, woven loosely of waste material is employed, and this is cleaned by special apparatus several times before it is used up. There is a saving not only of the wiping material but of the oil.

The best example of this practice that the writer saw was at the Gateshead shops of the Northeastern Railway, just across the Tyne from Newcastle.

The wiping cloths are about eighteen inches square, woven very loosely, even coarser than gunny sacks. They are white, like new waste. These are used on engines and in shops where waste is used here, but there is no loss from small pieces catching here and there as waste does, and they are handier to carry, many of the men keep a clean one thrown around their necks, to be handy. I saw firemen on the road carrying them that way.

Soiled "wipes" from engine cleaning are used by the wipers until thoroughly saturated with oil, and are then deposited in iron boxes about the shops and roundhouses.

From these places they are gathered on an iron barrow and wheeled to the wash-house, which is quite a plant of itself.

Here the cloths are, thrown into a tank containing hot water and some loosening chemicals, probably potash. This tank is heated by steam pipes that serve to keep up a high temperature and a great deal of the grease is left here.

From the tank the wiping cloths go into centrifugal wringers such as are used in this country in steam laundries, they are called "washers" there, however, these machines, as most of our readers know, consist of a vertical shaft set in proper bearings and properly belted for high speed. On top of the shaft there is a globe shaped vessel with its sides perforated and an open top. Around this perforated dish there is another of sheet metal that catches the liquid thrown from the inner vessel and conducts it where wanted.

These machines run at a high rate of speed and the cloths are thrown in so as to make a ring several inches deep all around the outside of the revolving globe.

A hot-water pipe is led over each washer, and enough is introduced to make a current through the cloths, carrying grease and dirt with it. The water is allowed to run as long as it comes from the machine discolored.

When taken out of these machines the cloths are only damp; you can't twist a drop of moisture out of them. They are then hung over wooden poles set close together in an iron-ended frame running on a track, this frame is about 1 foot wide and 8 feet long by 4 feet high. It is then rolled into a brick oven or dry room.

There are a large number of these frames running into the dry kiln from either side the kiln is heated by steam pipes and is ventilated by a stack, each rack end forms a door as it slides up to its place in the kiln. The cloths are completely dried here and then packed up and returned to the shops for further use; they are sweet and clean, but they are no longer perfectly white—virginity once sullied can not be entirely purified.

From the dirty water tanks the oil is separated from the water by some simple processes, requiring little apparatus, goes through some steam-refining arrangement and finally runs off into vats.

This oil is of a rich yellow color, like butter, and is about as thick as will run through an open trough; it's pretty thick for oil and pretty thin for grease. It is odorless and clean, and is used for oiling cars.

By this arrangement several losses in using waste are avoided; each piece does eight to twelve times as much work as the same weight of waste, and besides, a large percentage of good engine oil (they use sperm there) is saved for use on the rolling stock.

When the cloths are worn out entirely, they are just as good to build fires with as is our waste with all its original strength, but greasy.

We do not know how much of the light mineral oils used in our country could be saved by such a process, but believe it would pay any company to use the cloths even if the oil was wasted.

We were told at Gateshead that the saving of oil or the saving of waste would either of them alone insure the use of the process. It's worth trying.

## Attacks on the Rules of Interchange of Cars.

A club of railroad superintendents held a meeting at Buffalo last month. The principal subject of discussion was "accelerating the movement of freight cars." A disposition was manifested to tear up the Master Car Builders' rules of interchange of cars and in fact to abolish every rule which directly or indirectly interferes with the free and untrammeled movement of cars.

The superintendents who attended that meeting doubtless were full of good intentions but they are the quality of good intentions that hell is said to be paved with. Good intentions that aim to destroy any system of government be it the government of people or of car movement without providing a superior substitute is merely a step towards chaos. The rules of interchange of cars formulated by the Master Car Builders' Association are the most perfect regulations that practical men impressed with the necessity for moving cars from one company to another expeditiously could devise. There are certain railroad men who have no patience whatever with any restraint that will delay a car for a single hour. Every delay is regarded as unnecessary detention. They cannot understand that there are necessary short delays which provide against prolonged detention. Thorough inspection and the effecting of the minor repairs found necessary will frequently enable a car to finish its journey safely. The neglect of that work will often result in a break down with tedious delay, or even to the wrecking of a train with great damage to property and perhaps loss of life.

The master car builders' rules of interchange of cars are framed to serve two essential principles. First, they provide for the movement of cars without accident, and second, they devise the means of holding the railroad companies that cause the damage to cars responsible for the expense of putting such cars in good order. The men who are striving to abolish or ignore the master car builders' rules are trying to substitute hap-hazard confusion for a salutory system. There are men still in railroad service old enough to remember a time when cars moving from one road to another were not subject to any rules. Such men are very pronounced in their opinions against the confusion that existed then. The rules of interchange were forced into existence by grim necessity and it is better to go very slow in a movement to have them abolished or rendered inoperative.

## Business of the Elevated Roads of New York for Six Months.

It may not be a well known fact, but fact it is, nevertheless, that the Manhattan "L" road carries more passengers than any other road in the world.

The following figures of the business done in the six months ending June 30th, are very interesting

Number of train miles made in six months, 4,288,548 02.

Number of passengers carried in six months, 105,753,101.

Number of engines in service in six months:

Daily average attached to trains, 199.

Daily average in relay, 35.

Daily average baggage trains, 1.

Daily average ash trains, 2.

In service in six months, 43,134

There were made 514,926 trips in six months.

Number of engine miles made in six months, 4,560,647.08.

Average miles per engine for six months, daily, 105.73.

Average miles for six months, 19,242.86.

Number of cars in service, weight and capacity.

Daily average in train service, 935.

In service in six months, 170,170.

Car trips in six months, 2,356,226.

Weight, 30,000 pounds.

Seating 48 persons and carrying on an average 75.

Receipts for passengers carried in six months, $5,287,655.05

Cost of coal per mile and amount used:

Cost per engine mile, .09.75 cents.

Pounds per mile run, 52.16.*

Total consumption in six months, 106,198

[*It must here be observed that this figure is found by dividing the total pounds of coal used by the train miles which is very unfair, as the immense number of hours that engines lay in waiting with fires up consumes a great deal of coal. The actual amount of coal consumed by engines pulling trains has been found to be 41 5 per train mile It will also be seen that 272,099.06 miles were made by engines not pulling trains, for which no allowance was made.]

Number of trains daily

Trains and crews in actual passenger service, 199.

Trains and crews in actual baggage service, 1.

Trains and crews in actual ash service, 2.

Trips or trains, daily, in passenger service, 2,792.

Cost of operating per train, per train mile, 64 cents.

Average speed on road, 15 miles per hour.

Average time of stops, 15 seconds.

In six months engines consumed 237,883,520 pounds of coal. The true measure of engine performance is to ascertain the amount of work performed. Now the road carried 105,753,101 passengers, and it is therefore seen that it required a consumption of 2.2 pounds of coal per passenger.

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The American system of laying men off is used in Great Britian only for grave offenses, and then with nothing of the severity practiced in the States. The usual plan on English roads is to fine men for minor offenses. There is usually a bulletin printed for each month and put up so that all can see the crimes and punishment thereof. We noticed one at Crewe where men were fined 2*s.* (50 cents) for being absent without leave; this is increased for second and third offenses. Firemen and engineers 2*s.* for neglecting fire, and 10*s.* ($2.50) for running by signals and station platforms. This is an offense always punished, even though the man is trying to stop and runs by; this cast-iron rule makes men more cautious in approaching stopping points. There were several suspensions for from two to ten days, fourteen being the longest ever imposed, if it's worse than that it's dismissal Discharge after long service is a misfortune there more than with us, as there are on most roads different benefits and on some a pension after long service, hospital fees and insurance, all of which is lost with the position, although the man may have been paying into them for a quarter of a century.

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Around the city of Berlin there is a circular elevated railroad. The elevation is graded except on streets, where handsome bridges are placed. The stations are very large and nice and the rolling stock fair Its engines are tank machines of about 70,000 pounds weight. In riding around, our German interpreter was wondering how on earth the New York Elevated road could load and unload its passengers with end doors only, so we kept time on them. There were forty-six compartments in the train we rode in and certainly room enough to get on and off, and there was no crowd, probably 100 changes at a station. The average stop—we timed twelve—was fifty-four seconds, and two were over a minute. Last year we counted the time lost in stops on the New York Elevated, Third Avenue line, and the average was only seven seconds, and the longest in thirty stops was for twenty-eight seconds, the average for all the lines is fifteen seconds

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The London & North-Western road have a rule that prohibits the employment of a man who has passed his fortieth birthday. If all roads did this and still persisted in the practice of discharging men "for discipline" it would put into the hands of a few men the power to take away from many a good mechanic and engineer the opportunity to use his experience and skill, and, leaving the gross injustice of the thing aside, the average man is at his very best at 40 years of age; he is skilled, experienced and steady This same road have another inhuman rule and this is the discharge of a man who has been on the sick list for six months. Many a poor devil suffering from a long run of fever, a broken limb or something of that character, has had a notice served on him in the hospital or the workhouse that his name has been stricken from the roll. Refined cruelty, that.

Many of the French locomotives are covered from end to end with sheet brass, stack, dome, boiler and all. As a rule these are not cleaned, and look like a fire engine that has been at a three-days' fire The "spectacle plate" is even smaller than that on the English locomotive, and, on the Northern Railway, many of the throttle levers come down from the dome *ahead* of this plate and the engineer has to reach ahead of what cab he has to use it. Almost all of them have the eccentrics on the main pin and the link motion outside; their looks were fairly well described by a Yankee boy who said, "they looked to him like an American locomotive that had turned over about three times and sorter turned herself outside in."

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Go where you will in the old country and the fact will be strongly impressed upon you that it is an old man's country In every place of responsibility you will find an old man—mighty few are there pulling passenger trains who are not yet gray headed, and foremen of engine sheds and master mechanics are, almost without exception, men who have seen their fiftieth birthday. I talked with men who had been running extras for more than ten years—hadn't got old enough for a regular run Firemen are in luck to get to running after ten or twelve years of firing—many of ours are kicking at three.

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In Germany they heat their passenger cars with steam, and, in each compartment, is located a little lever that can be placed in any of three positions—warm, medium or cold. There is also a handle that when moved will apply the air-brake, the Carpenter now being used. The movement of this lever breaks a small string with a lead seal upon it, so that it can be told in what compartment the brake was meddled with. It is a fine of 40 marks ($10) for needlessly applying it.

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The erroneous impression prevails in America that the English "bull-head" rail is alike, top and bottom, and that when one side is worn the rail is turned This was so of the first of this class of rail, but the practice was long since abandoned Speaking of the old practice of turning rails, a locomotive superintendent said it had caused more loose teeth than all other disturbances combined, including earthquake.

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Steel or other metals ties are used to a considerable extent on some of the English roads, and, while they may be safer than wood, they certainly produce more noise, it being easy to tell when you pass from one to the other.

## NEW BOOKS.

MAXIMS AND INSTRUCTIONS FOR THE BOILER ROOM, 330 pages, 6 x 9 inches. By N. Hawkins. Price $2 50. Theo. Andel & Co., 91 Liberty street. New York, publishers.

This is quite a large book, containing a great deal of information about boilers and their care. There appears to be very little original work in the volume, but the editor has gathered his facts and figures from every available source. That the average boiler-room attendant, engineer or fireman would be better off with this work, for reference, goes without saying, and a study of it will do all of them good. There is very little in it about firing locomotive boilers, but for those in the stationary service it will be a valuable aid.

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A table book for civil and mechanical engineers has been compiled for Van Nostrand's Science Series, by Geo. W. Plympton. The tables are remarkably exhaustive and will be a great convenience to engineers, for tables relating to all sorts of subjects are here collected in one handy book. It costs 50 cents.

## PERSONAL.

Mr E. Greenwood, of West Farmington, Me, has been appointed master mechanic of the Sandy River Railroad, with headquarters at Phillips, Me.

Mr. John Medway, who has been master mechanic of the Fitchburg Railroad at Mechanicsville, N Y., for a long time, has been promoted to the position of superintendent of motive power of the same road in place of Mr. O. Stewart, resigned.

Mr. Edward Dauson, late roundhouse foreman for the Chicago & Northwestern Railroad Company at Council Bluffs, Iowa, was appointed assistant master mechanic of the Freemont, Elkhorn & Missouri Valley, appointment to take effect September 1st.

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Mr L S. Randolph, for some years engineer of tests of the Baltimore & Ohio Railroad, has been appointed electrical engineer of the Baltimore Electric Refining Company. Mr Randolph was previously on the Cumberland & Pennsylvania Railroad at Mt. Savage, Md., and has a very high standing for ability as a mechanical engineer.

Mr Sam W. Simonds has been appointed engine despatcher of the Fitchburg Railroad with headquarters at Boston Mr. Simonds has been employed on the B. & M. Railroad for the past sixteen years as fireman, engineman and assistant engine despatcher, in each of which positions he has shown himself capable, intelligent and trustworthy. His many friends will wish him continued success in the larger field now opening for him.

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Angus Sinclair and wife started for California on the 16th of last month for a little recreation, but Angus has a Kodak and a note book, and if he comes home without something interesting for the readers of his paper it will be the first time. The junior philosopher is in charge just now, but has agreed to keep over all articles on, and models of, automatic link and pin couplers and other "revolutionizing" inventions until the return of the executioner.

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Mr. T A Fraser, superintendent of the Wells French Car Works, has been away on a European trip with President Meysenburg The trip was understood to be undertaken for business and pleasure, the business part being the looking up of machinery and methods that might be employed to advantage in the car works. Mr. Fraser would have continued for a long time a railroad master mechanic before he would have been invited to take a European trip at the expense of his employers.

Mr. Albert Griggs, for a number of years superintendent of motive power on the Providence & Worcester Railroad and more recently occupying same position on the New York & New England Railroad, has entered the employ of Page, Newell & Co., Boston, Mass, and will care for the interests of the "Brunswick" wheels. Albert Griggs was raised in the motive-power department of New England railroads, his father having been one of the first general master mechanics in America and the inventor of the brick arch.

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In the resignation of Mr. O. Stewart from the position of superintendent of motive power of the Fitchburg Railroad, another veteran master mechanic steps out of railroad life. Mr. Stewart, who is treasurer of the Railway Master Mechanics' Association, has been a leading figure in that organization for years and has a host of warm friends who will regret to hear that he is leaving their ranks It is understood that Mr Stewart has managed his private affairs so judiciously that he is quite independent of railroad business.

## Work of a Railroad Poet.

The writer recently stood in a little museum in the base of Robert Burns monument at Edinburgh, and read a letter written by the poet, a few days before his death, begging a friend for the loan of ten pounds. Since his death thousands of dollars have been expended in almost every city of the Christian world in monuments to his memory, and his publishers have made a fortune at every edition of his work. This seems to be the fate of poets generally. Our old friend, Cy Warman, once an engineer on the Rio Grande Road, has written enough good poetry to establish his reputation as a writer of verse, and, when he is dead, will be counted a poet worth reading. He does not go deeply into Greek mythology for comparisons and examples, but—let him explain in the first verse of "I Would Know My Native Land."

"There are those who praise the poet who can soar in starry spheres,
And can mold his mystic phrases from the wrecks of other years;
I would have my inspiration fresh from Nature's open hand;
I would sing a simple sonnet that a child can understand."

Cy Warman's Memorial Day poem, "Our Heroes," should endear him to every railroad man; the first verse reads:

"Now that we've scattered the flowers of May
Over the graves of the blue and the gray—
Over the graves where the women weep,
Over the mounds where the heroes sleep—
Now let us turn to the graves of those
Who have lived and died in their overclothes."

Warman has just issued a little volume entitled "Mountain Melodies," full of little gems that glow with the sunset, sparkle like the mountain dew and murmur like the snow-fed streams—Nature's poetry. Another volume of the same size is in press, called "Rhymes of the Rail." No one will be disappointed in sending fifty cents apiece for them to the author, Denver, Colorado.

Cy's preface to "Mountain Melodies" is typical of the man: "The author offers no apology to the public for the publication of these rhymes. They were inspired largely by Nature and Nature's God. If you have a kick coming, kick higher."

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George Richardson, the inventor of the "pop" safety-valve and the balanced slide-valve, died at his home in Bridgeport, Conn., on September 1st, at the age of sixty-four years. Mr. Richardson was an engineer on the old Troy & Boston road, now a part of the Fitchburg, when he experimented with the pop-valve, and finally perfected and patented it in 1866. George Richardson was a good mechanic, an original investigator and one of the best-hearted and noblest friends a man could have.

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The Fall's Hollow Staybolt Company claim that the tensile strength, elongation and elastic limit of their hollow staybolt is much greater than a solid bolt of the same diameter. Half a dozen other makers claim the same thing; why not have a public test by disinterested parties.

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The Chicago & Western Indiana Belt Railroad have placed order with the Cook Works for five six-wheel engines.

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Mr. W. T. Hamer has been appointed road foreman of engines of the Atlanta and Brunswick divisions of the East Tennessee, Virginia & Georgia Railway. His duties are to instruct engineers and firemen regarding the proper working and firing of their engines, with a view to obtaining the best and most economical results. To see that engines are properly equipped with tools, signals, etc., and that they are kept in perfect order. To correct any irregularities or errors in connection with the working of the engines that may come to his notice. To consult with the master mechanic or roundhouse foreman regarding the condition and requirements of engines. To report to the division superintendents violations of rules or neglect of duty, and as to qualifications of engineers and firemen, and matters of like character. To report to the superintendent of motive power upon mechanical matters, and to conform to such instructions as may from time to time be received from him.

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The Brotherhood of Locomotive Firemen held their Biennial Convention at Cincinnati on September 12th; this would have been their nineteenth annual convention under the ordinary yearly convention scheme. The report of Grand Secretary and Treasurer Debs shows that the order is in a promising condition. The total membership is 25,967, a gain of 7,310 in two years. Two thousand four hundred and one men have been expelled in that time, and 3,218 have withdrawn. Mr. Debs took his office in 1880, with the order bankrupt; he received from his predecessor in office $143.15; in the twelve years of his stewardship he has received $3,214,607.55, and paid out the same, less $51,583.64 turned over to his successor. The order has a protective fund of $64,901.55 for use in an emergency; this fund the grand secretary recommends be returned to the lodges contributing it, as he says, "Money cannot win strikes."

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In a letter received from Mr. H. J. Small, superintendent of motive power, Southern Pacific Railway, we learn particulars of the long service performed by S. C. Clark, one of the locomotive engineers in the service of the company. He commenced to run in 1868 and since that time has made 1,000,051 miles. During that period he has drawn $28,800 for his services. He has had two accidents during his term of service; first about nine years ago, when he had a collision with another train, damaging the pilots of both engines, and two years ago when he ran off a switch, for which he was not responsible. He is now fifty-seven years of age and well and hearty, and expects to make a great many more miles and does not look forward to going out of service for at least ten years.

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Mr. Clement E. Stretton, the eminent English railroad authority, gives the following incident as the origin of the steam-whistle: "One of the first events in the history of the "Samson," built by Stephenson in 1833, was that it ran into a horse and cart crossing the line at the "Stag and Castle" Inn, Thornton, the cart being loaded with butter and eggs for the Leicester market. The engine-driver had but the usual "horn," and could not attract attention. Mr. Bagster, the manager, suggested the use of a steam-trumpet or whistle; and by Mr. George Stephenson's instructions such an appliance was at once constructed by a local musical instrument maker, and it worked satisfactorily."

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Walking along the streets of Manchester, England, one day this summer, the junior philosopher of the L. E. espied in the window of a tool store across the street, this large sign: "The best thread gauge in the world." The junior philosopher went right over to view the wonder. Under the sign hung "the best thread gauge," it was made by L. B. Starrett, Athol, Mass. Some of the original and handy kinks for mechanics manufactured by Mr. Starrett had prominent places among the fine English, French and German tools displayed in the window. The dealer informed us that while some of the other makes were, perhaps, finer in finish or heavier, the Yankee tools were the "cutest," most ingenious and original.

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Among the many friendly notices which we have lately received from the railroad officers regarding LOCOMOTIVE ENGINEERING, we are glad to notice some kind words from Mr. A. M. Smith, assistant-superintendent of the Duluth & Iron Range Railroad, who writes: "While I am not in the motive power department, your paper has been very interesting and I hope instructive also, to me, particularly the air-brake department, as we have air-brakes on all of our cars. I do not know that I could suggest any improvements, further than that you continue in your present course; it is certainly onward and upward."

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The Pield Feed-Water Purifier Company within the last month has equipped the new plants of the Armour Packing Company and the National Linseed Oil Company, at Kansas City, also the new Electric Light & Power Company plant, at Rockford, Ill., and added to its list of railroads the Chicago & Alton. The Wisconsin Central, since the beginning of the year, have equipped twelve locomotives, which fact substantiates its value by continued use. It is also making several equipments on marine boilers and which, from the success of two large steamers already equipped within the past few months, bid fair to be of great value to this class of large boilers.

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We understand that Westinghouse, Church, Kerr & Co., have secured exclusive control of the sale of the Hodges & Havenstrite system of refrigeration and ice-making. Refrigerating and ice-making has become such an important business of late that Westinghouse, Church, Kerr & Co. have been negotiating for some time to enter the business. They already have a large number of orders, particularly in the direction of manufactured artificial ice, and they are pushing the work vigorously as they are liable to do with anything which they control.

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To be in touch with these progressive times, one ought to have an opportunity to see the wonderful advancements made in wood-working machinery, and the Egan Company, of Cincinnati, Ohio, U. S. A., are in a position to present it. This concern has just issued a handsome catalogue of nearly 300 pages, which displays the largest line of the very latest and most improved mechanism for the saving of time and labor and can be had now by duly accredited shop foremen and master car builders, on application. The Egan people are building a special line of tools adapted for car building and car repair work.

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In May last Charles H. Strain, an engineer on the Pittsburgh, McKeesport & Youghiogheny Railroad, forgot his running orders and had a collision with another train, resulting in a bad wreck and the killing of a fireman. Strain was prosecuted for manslaughter and was convicted of misdemeanor. The judge, in passing sentence, said that it was the first offence of the kind in his district, and he would inflict light punishment as a warning. He sentenced Strain to pay a fine of $100 and go to jail for forty-eight hours.

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The Servis tie plate is deservedly gaining in favor daily. This little device has virtually widened the rail base, prevented side slipping of rails and prevented the cutting of ties by abrasion of the rail, an important item, as the separation of the fibers of the wood under the rail admitted of loose spikes. With plates all the movement is between the plate and the rail. The idea that they would cause a shearing strain on the spike has been proven without foundation.

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B. M. Jones & Co., of Boston, have done a wise thing in placing on the market annealed blanks, suitable for milling cutters, taps and dies, rose bits, countersink and twist drills, etc. The price of this annealed brand is 75 cents per pound, but this cuts no figure at all when the *comparative* cost of making and using common steel tools is considered. Those who now consider "Mushet" as indispensable for lathe and planer tools will appreciate the new move.

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A correspondent writes us that Jared Turrell, a veteran engineer on the New York Central road, has retired from the footboard at the age of 82 years. Of late years he has been running in one of the company's yards. The day he retired he had been running an engine on the New York Central 40 years. Superintendent Burrows would not accept his resignation, but gave him a vacation during life on half pay, which Mr. Turrell accepted.

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The first order of fifteen 19 x 26-inch cylinder mogul engines, for the Duluth, Messaba & Northern road, has been given to the Pittsburgh Locomotive Works.

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The twenty-first meeting of the American Society of Superintendents will be at the Hotel Brunswick, New York, on October 10th, at 10:30 A. M.


## A Defense of Crucible Steel for Boiler Purposes.

*Editors:*

In LOCOMOTIVE ENGINEERING for September appeared, under the heading "Crucible Steel for Boiler Plates," an article which, in its tone and statements, argued in favor of open-hearth steel instead of crucible for use in locomotive boilers and fireboxes. As intimated in the circular recently sent out by Mr. James W. Brown, chairman of Howe, Brown & Co., Limited, this firm has facilities for the manufacture of open-hearth plate steel as well as crucible. Their testimony on this subject, therefore, deserves to be considered on a higher plane than as a mere bid for a revival of the use of crucible steel. I lean, in this discussion, on Mr. Brown's practical experience of over thirty years, believing that his acquaintance with the manufacture and use of all grades of open-hearth and crucible steel places his views beyond successful contradiction by any man in the business, most certainly by any maker whose range of vision is limited to the open-hearth process only.

The report of the committee submitted at the Master Mechanics' Convention in 1888 is so far at variance with the present feeling in railroad circles, and with ideas held by some of the most conservative master mechanics, that it can hardly be claimed to represent the sentiment of 1892; and we believe that the longer the railroads postpone their return to crucible steel, the stronger will be their final opinion that this report of 1888 was decidedly unfair to the crucible process. To have this again brought forward in your columns will not change the views of any who can recall the time when crucible firebox steel was so successfully used, but it may carry impressions to others, not familiar with this subject, which would have a tendency to prolong the use of material demonstrated by past experience as unsatisfactory for fireboxes.

Howe, Brown & Co., Limited, in their position, will, of course, meet with the opposition of all open-hearth mills having no crucible furnaces, and they will probably be at the temporary disadvantage of asking for a higher first-cost for their crucible product, but the growing demand for steel that will stand the contraction and expansion of firebox use and give long service will eventually, they believe, put crucible steel again into general use.

The assertion in the report referred to, that crucible steel "is a failure when large masses of homogeneous character are required" can be answered by a denial as positive and emphatic as the charge set forth. The crucible process will produce not only a purer and stronger steel, but also a more uniform and homogeneous body, and the size of the ingot or plate is only controlled by the size of the steam hammer and other machinery necessary for turning it out. Any of your readers who may have attended the Exposition at Philadelphia in 1876, will no doubt remember the large ingot, broken in two, which was there on exhibition by the Krupp Steel Works. This ingot, if I am not mistaken, weighed in the neighborhood of 60 tons, and was perfect and sound in every respect. It is not too much to expect that this same concern will have at the World's Fair in Chicago, another specimen of crucible steel larger than the one sent to Philadelphia, and in keeping with the advancement and improvements in handling crucible steel since that time. Locomotive tires, some weighing from 2,000 lbs. to 3,000 lbs., and Krupp guns of many tons weight, are made of crucible steel. It is true that at the present time, Howe, Brown & Co., Limited, cannot make crucible plates as large as open hearth plates, but this is through no fault of the crucible process. They can with ease make plates large enough for locomotive fireboxes, and if their friends will not ask for boiler sheets weighing more than 1,200 lbs. or 1,300 lbs., they can equip a locomotive complete with crucible steel. There are still mechanical men who question the wisdom of using extremely large plates for boilers, therefore there seems to be no reason why sheets as heavy as 1,200 lbs. should not be large enough for locomotive boiler use. This question, however, does not concern the material for the boiler as much as it does the firebox, where the severe usage has proved to be more than open hearth and basic steels can stand. Crucible firebox steel was used at least 15 years before open hearth steel was introduced and no complaint was made of its failing to answer the purpose. It has been in use nearly thirty years without anybody being able to say that it was not entirely satisfactory, whereas open hearth steel has only been in use about 14 years, and, if we understand the matter correctly, is now condemned by some of the best judges on the largest roads, some of them going so far as to talk of returning to copper and imported iron, the use of which crucible steel superseded, and to which no one thought of returning while crucible plate was used. The facts, therefore, seem clearly to justify the claim that crucible steel successfully displaced what was previously used, while open hearth and basic steels have not successfully displaced the crucible. The only known points in favor of open-hearth firebox and boiler steel are the ease with which it may be worked and the lower price at which it is sold.

The word "homogeneous," as regards steel, has been used very largely in connection with soft boiler-plate, but in reality all steel must be homogeneous in the ingot to be of any account. Crucible steel, as before remarked, is made in very large sheets, and for purposes necessitating a much finer steel of more homogeneous character than is required for a boiler sheet. The crucible process is in every sense a refining process for all metals, and has been so for many hundred years

Your article says further, "it seems certain that the tendency to break down prices has brought into the market steel of inferior quality." That is true. Anything easy to make is fought for by many mills, and the number is rapidly increasing. The great aim has been to produce large plates, soft steel and low prices, and from reports of new mills soon to be erected in this line, it may be expected that this competition and the accompanying results will not be lessened. On the other hand, crucible steel has not deteriorated in quality by reason of excessive and reckless competition, and owing to the great care required in its manufacture and the comparatively small output for firebox purposes, the temptations for investment will not draw men into a specialty of this kind unless they are masters of the crucible process in all its details.

EDWIN S. JACKMAN.

*Chicago, Ill.*

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## Some Facts About "Improved" Valve-Gear.

*Editors:*

There is an editorial in the *Railroad Gazette* of September 9th, on "Improvements in Compound Locomotive Valve-Gears," which appears to the writer misleading, to say the least; it is one of the many cases where the circulation of *mis*-information appears to predominate, as its whole tenor is to prove that where saving is conceded in a compound locomotive, it is either the boiler or valve-gear that has been improved which produces it.

I shall not discuss the matter of saving effected by larger boilers at present. But will try to look into the saving by "improving valve-gear."

The *Railroad Gazette's* great effort appears to be to show how much the "Old Stephenson link" motion has been improved with the introduction of the compound locomotive; we will not follow the many figures given in the *Gazette* about lead, lap, etc., of old engines, but I just want to mention something about the Rhode Island Locomotive Works engine, with the "improved valve-gear" mentioned in the *Gazette*. It was on engine No. 40, built for the New York, Providence & Boston Railroad, and was designed to run 62½ miles with eight cars in 62½ minutes. This engine had 7-inch travel of valve, with long lap and large ports, steam ports 2 inches wide and the same length as diameter of cylinder. It was months before this engine could be made to do its work properly after going into service, and after many changes were made on it and to no satisfactory purpose. The valve-seats were finally planed off and false ones put on with smaller ports, and the travel of valve was reduced and the engine then did its work and has been doing it ever since. So much for the improved valve-gear on that engine.

Now, a word about the Reading "fliers," with the 7-inch travel, that run the Royal Blue Line on the Bound Brook road, which astonished the public until the *great secret* leaked out about cutting ¼-inch clearance out of valve (this great secret has been practiced for more than thirty years on many roads.) There is an engine now running on this same Royal Blue Line making the *best record* of any engine on the road, and it has run from Wayne Junction to Jersey City, 85 miles, in 81 minutes, which has not been equaled by any of the celebrated "fliers." This engine, No. 615, Lehigh Valley Railroad, has no "improved valve-gear," but is equipped with just the *old-fashioned Stephenson link*, with 4½-inch travel of valve, ⅞-inch lap outside, with $\frac{1}{64}$ inside. The offset of link-saddle is no secret on this engine, for it has none—it is in center of link-block. No. 615 has 2 inches less diameter of cylinder than the Reading "fliers" and is doing the same work Will the *Railroad Gazette* show where the "improvement" comes in on this link?

How about the long travel and large ports on the compounds that make the saving? The *Gazette* has no more to prove in this than in the long travel theory.

The Webb compound on the Pennsylvania Railroad, New York division, is doing more work with less fuel than any other compound locomotive in America of same weight, and it has only 3½ inches travel of valve with ports only 10 inches long and steam-pipes of much less size than any single expansion engine on the road.

Should any question the above statement they will find no trouble to have them verified by visiting the places where these engines are in service.

If the railroad papers would publish *facts* in place of so much *theory* it would prevent so many from treading the same path that has been worn out by others without making any improvement. It is a well known fact that it is impossible to make an improvement without a change—but it is also well known that many, many changes are made which are not improvements.

COMPOUND.

*Providence, R. I.*

P. S. I will say that the valve-gear of the No. 615 is exactly the same as has been in use for nearly forty years and originated by the *best* locomotive builder the world has ever seen—Wm. Mason.

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## Double Plate Steel Wheels.

*Editors:*

There appears in the September issue an article, with an illustration, in reference to the manufacture of cast-steel car wheels. Certain statements therein are, to say the least, misleading, and as I do not think it is your purpose to misrepresent matters, I will state certain facts bearing upon the subject in question.

First, as to the claim that "all the patterns had been single plate" in design. The truth of the mattter is that not one single-plate wheel was made, for railroad service, prior to the present management taking charge. With the exception of a few spoke wheels and a special double plate design, all were of the double plate design commonly used by all chilled-wheel makers.

Certain parties attempted to make cast-steel wheels in Boston, as far back as 1887. Such as were put in service broke—not a mere check, but a bad break. They had expended much time and money in these efforts. In 1889, I took charge of the works, being the same as mentioned in your paper. In about two months time I commenced making wheels by methods which I originated, and for which several patents were granted me in 1890 The *first eight castings* made were shipped at once, and put in service within a few weeks, in the year 1889. The same eight castings, constituting a set of wheels, have been in service up to the present time without having been turned off, and the mileage made is very high.

Early in 1890, I designed and made wheels in which the front and back plates extended from the hub to the rim. The wheel illustrated in the article referred to is of precisely the same form, except as to the curve or depression in the front plate. I made the front plate straight, or in the form of a disk, for good reasons.

Upward of 300 of these wheels were cast and most of them put in service before I gave up the work, after carrying it on for two and a half years. You need not go far from your office to find some of these wheels which were in service nearly two years before the present management of the works commenced.

*Hartford, Ct.* W. G. RICHARDS.

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## Taking Care of Driver-Brakes.

*Editors.*

There seems to be little said in the columns of our railroad papers concerning the driver-brake. Possibly this is because it is only within a few years that the railroads have come to realize the importance of that part of the brake equipment. A few years ago there were very few engines that boasted the luxury (?) of a driver-brake. Now, however, an engine without one is an exception, at least on all first-class roads. The writer's experience has been that *most* of these brakes are not by any means what they should be, and a little agitation of the subject may be productive of beneficial results. To begin with, many of the arrangements are incorrect as to the leverage, proportion, and location of parts. This is the result of a number of causes. On some roads the design was made by a man who did

not understand the business. On others one design was applied without material modification to a number of different styles of engines, no allowance being made for variations in weight or slight differences in distance between centers.

The toggle-cam is not only a very powerful lever, but it is very sensitive to slight changes in position or curve, a small fraction of an inch one way or another sometimes varying the braking power by several thousand pounds. It is quite an elaborate operation to lay one out properly, and no one should attempt it unless thoroughly familiar with all the best practice in that line of work.

In some cases the design is not followed closely enough in setting up the work, a little carelessness in one or two dimensions throwing the whole out some distance, or the cam faces are not finished to template and many of the castings are out of line. Sometimes the threaded hole is not bored in perfect line. All such things as these preclude the possibility of securing accurate results, and hence the necessity of most careful work in all respects.

In many cases the cylinders and levers are all right, but a mistake is made in arranging the air supply, it being either too great, or, as is most frequently the case, too small. Connection is made from the tender brake triple-valve and thus the pressure in the auxiliary reservoir under the tender is allowed to reduce to too low a point, because it has to supply three cylinders. With this arrangement a very slight leakage in any of the connections around the cylinders will render the brake practically valueless. A separate reservoir and triple valve should in all cases be provided exclusively for the driver-brake, and the capacity of the reservoir should be sufficiently great to allow 70 lbs. to equalize on a full application, with an average travel of piston, at about 50 lbs. or a trifle over.

No other part of the air-brake system is so liable to become inoperative from leakage as the driver-brake. The reasons for this are numerous. The jar of the engine loosening the joints in the pipe, especially where a sufficient number of clamps have not been provided to hold it rightly in position. The amount of piping between the triple and the cylinder being much greater than on cars, and having more bends and turns, makes more joints to work loose and consequently greater liability to leakage. Then the location of the cylinder in close proximity to the firebox dries out the packing leather, causing leakage past the piston-head; this difficulty being especially troublesome where the wrong kind of oil, or an insufficient quantity is used. Leaks around a driver-brake generally receive less prompt attention than in other places, because of the difficulty of locating them or getting at the point when located.

To locate a leak around a driver-brake, the best way to begin is by making it into a straight air brake, which can be done by turning the triple valve handle either straight up or straight down, and if on account of some obstruction it is impossible to do either, then it must be done by removing the handle and with a wrench turning the plug so as to let the air directly from the train-pipe into the cylinder, the direction of the ports through the valve or plug being shown by the usual grooves cut on the end of the plug.

In the meantime the handle of the engineer's valve must be left in the release position so as to allow the main drum pressure to have free access to the train-pipe. It is almost worse than a waste of time to try to find a leak around a driver-brake by an ordinary or automatic application of the brakes, as the pressure even when fully equalized is not over 50 lbs., and if the leak is of any size all the pressure in the pipes and cylinder will escape before the trouble has been found.

Many and frequent are the complaints about the driver-brake, and all because the right method is not pursued in remedying the difficulty.

*First*, locate the seat of the trouble and cause of the disease, and *then* administer the proper remedy. This is a universal rule.

When the brake does not hold properly, many men take a wrench and proceed to tighten all the pipe-joints indiscriminately, when the only cause of difficulty may be dry packing-leather in the cylinder. There would be just about as much reason in the action of a doctor who, not knowing what ailed his patient, gave him half a dozen opposite remedies in succession, in the hope that some one might reach the seat of the disorder.

So far mention has only been made of brakes which did not hold well. Cases are also sometimes encountered in which the brake holds too well. The premonitory symptom of this is a very disagreeable grinding of the engine-brake just before the train comes to a stop. This trouble is almost invariably caused by too great a piston travel, allowing the cam levers to come too close to a horizontal position, thus greatly increasing the power of the toggle.

Setting the shoes closer to the wheels is of course the proper remedy, and one which seldom or never fails to accomplish the desired result.

PAUL SYNNESTVEDT.

*Chicago, Ill.*

## Laying Out Back Cylinder Head.

*Editors:*

I have just read Mr. Hitchcock's ideas in regard to laying out a back cylinder head of a locomotive. I do not wish to criticise Mr. Hitchcock's writings, but wish to offer an improvement. In the first place, we are given to understand the head of the engine is in a roundhouse 200 or more miles from a shop. He then says you are to get a piece of wrapping paper, black lead the end of the cylinder and get the helper to hold the paper while you are getting the impression. Then cut out the paper, lay on the head and mark holes, taking care to have the risers in head correspond with port-hole in cylinder. You then drill holes for bolting on.

Now, some roundhouses have no means of drilling, except by hand. Perhaps he did not make allowance for that. After drilling you grind head to cylinder, then bolt on temporarily and proceed to lay out holes for guide blocks, by leveling engine, using long straight-edge across frames, and then setting level and small straight-edge to long one, striking a line across head according to his instructions, laying holes out for blocks so bottom of block will be 1/16 higher than bottom of crosshead. Now this is not right, as the crosshead might have thin gibs on bottom, or the block might be planed off some time in the past and be out of center. Then, according to his instruction, the holes in head would be too high or low, as the case might be. Then when new gibs or blocks are put in and on it will be discovered that the holes are not in the right position. After block-holes are laid out the head is again taken off and taken somewhere to be drilled, brought back and again put on. He does not give an idea of how to get the thickness of head, as this is very important. And in regard to the paper template or pattern, I do not like that, for I do not think that is a mechanical way of getting at it. Another thing, that far from home, what if a person could not get any wrapping paper, what then would he do? I will endeavor to show how all could be done at the shop before sending head to roundhouse, if thickness was sent, and that can be easily done by measuring from end of guide in position to joint of cylinder head on cylinder, and also sending which side of engine head is intended for.

C. F. GREGORY.

*Detroit, Mich.*

The C. R. I. & P. R. R. placed order this month, with the Brooks Works for three six-wheel switchers.

## Draining Train Line in Yard Tests.

*Editors:*

I notice that for some time there has been a great deal of discussion as to the practicability of draining the train line in making yard tests. As I have had some experience in that line, and find that it cannot be practiced without a loss of time and a great deal of annoyance, I will try and tell why I think this rule should not become general, especially in freight service.

I would like to say right here, that on this road (A. T. & S. F.) there is a loss of time in testing the air, occasioned by the engineer not starting his pump until ready to attach to train. In charging a train of twenty-five to thirty-five quick-action brakes under such circumstances, and then to deliberately waste all the air in the train line, is certainly a waste of time, because there will not be pressure enough in the main reservoir sufficient to release all the brakes, thereby causing a vast amount of annoyance to the inspector and a great deal of unnecessary work for the pump. I don't think that the order "to drain the train line" could be followed with any degree of satisfaction; for this reason, viz.: The brass check-valve (Plate D 31, No. 15) in the lower case of the new quick-action valve is seated on an iron seat, which is constantly exposed to moisture and in consequence becomes so corroded that the check-valve will not seat, though the valve may have been in service but a short time.

Now if the train-line be drained the air pressure from the train-line (that has been assisting the emergency spring to hold the emergency valve up to its seat) will pass through the defective check-valve seat and pass out with the train-line pressure. By this action of the brake the auxiliary reservoir pressure that has passed to the brake-cylinder and on top of the emergency valve, will overcome the resistance of the emergency valve spring, and pushing the emergency valve from its seat, will allow the brake cylinder pressure to pass down on top of check-valve, thence through the defective seat and follow the train-line pressure to the atmosphere. In other words, it will allow the brakes to speedily leak off. I venture to say that, if 25 to 35 quick-action brakes be taken from actual service and be tested by draining the train-line, that fully 25 per cent. will have leaked entirely off before the inspector had gone the length of the train.

I would like to hear from others on this question, as it is advocated by a number of the best-posted air-brake inspectors in this part of the country.

CHAS. S. SHALLENBERGER.

*Fort Madison, Ia.*

## Lubricator Difficulties.

*Editors:*

I will endeavor to answer the lubricator puzzle that you were kind enough to publish in your March issue of '92.

I have seen but one attempt to answer it as yet. Mr. C. B Conger asked if the condenser-pipe was full length.

The lubricator was in good working order with the exception of a deficient gasket at bottom of sight feed-glass.

Mr. Conger says that when the condenser-pipe breaks off, that the oil will go into the condensing chamber and from there through steam-pipe into boiler, but I think Mr. Conger is mistaken. If he will tell how oil can go against the steam pressure of the boiler, which is greater than that of the cylinders, then I will say that he is right. Mr. Conger answered the puzzle when he said keep a good gasket in bottom of sight-feed glass. The oil in my lubricator went from the oil tank through the cavity around feed-valve and up outside of glass and under glass and up through glass into tallow pipe.

By taking feed-valve out and putting in a small gasket at bottom of glass it stopped the flow of oil around glass and lubricator went to work all right.

In July number there is a lubricator experience from New South Wales. I will try to answer it. When Mr. Hays drained the lubricator the condenser valve was not shut off tight, or there was a leak in valve, and the water went out of the condenser, leaving a vacuum in condenser globe, and a small amount of oil went into the globe. When he attempted to start his lubricator there was no water in condenser and lubricator would not work; but as soon as the globe was condensed full of water his lubricator went to work all right.

D. B. HUTCHINS.

*Creston, Ia.*

## The Wheel that Slid Flat.

*Editors:*

Referring to Mr. Stewart's letter in September LOCOMOTIVE ENGINEERING in which he gives a novel and original solution to this phenomenon, I should like to say that after examining several styles of car and tank trucks and their brake rigging, I fail to see the combination of circumstances that would permit the wheel to climb the brake-shoe. Look at it as I will, his philosophy bears a close resemblance to lifting one's self by the appendages of footwear.

Suppose one hanger is shorter or longer, won't the brake-beam and shoe go up or down with it?

Would not the observation of such phenomenon give rise to the question of safety of running trucks, the wheels of which disregarded the action of gravitation when the brake was applied?

There are many other questions that naturally suggest themselves, none of which could be answered in a satisfactory manner without a sketch, showing the truck and whatsoever else is necessary for a thorough understanding of the question. If the Editors will permit I will respectfully ask Mr. Stewart to contribute such sketch. It would also be well to state the position he was in when he saw the wheel come up. I say this, thinking, if on his engine, that possibly he was deceived by seeing the *truck frame go down* instead of the wheel *coming up*.

A. FARMER.

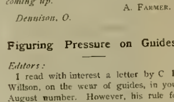
*Dennison, O.*

## Figuring Pressure on Guides.

*Editors:*

I read with interest a letter by C. F. Willson, on the wear of guides, in your August number. However, his rule for finding the pressure on the guide is not correct. An easy and correct way for him to do so would be thus:

On the center line of engine lay off $A\ B$ to scale equal to the pressure on the piston. Draw $B\ C$ at right angles to it




and draw $A\ C$ parallel to the main rod. $B\ C$, to the same scale as $A\ B$, will then represent the pressure on the guide.

This is not necessarily intended for publication, but is directed to you because I have not Mr. Willson's address, and, as he seems to take an interest in the matter, I think it is worth while to set him right.

GEORGE F. D. TRASK.

*Philadelphia, Pa.*

## Relating to Brakes.

*Editors:*

The brake failing to apply on forward section of parted train is explained thus: when the train parted the hose at rear end of box car doubled back, under pressure, and the hose-coupler caught behind hand-brake staff, the hose elbowing and flattening at so sharp an angle as to prevent the

escape of air. The bell-cord caught under the running board of the car roof and was held tight, breaking to the rear of it.

BRAKE LEVERAGE AND CHANGE OF FULCRUM.

It is a pleasure to attempt answering C. B. Conger's questions, as they are always original, but I think he practically answered one of his questions in the August number before he asked it. Regarding Union Line brake-gear, the bracket-pin is a fulcrum to second brake-lever when hand-brake is slack and the braking power is supposed to be distributed equally to each truck, but as Mr. Conger says, the bracket-pin fulcrums the lever at a point between the connection to hand-brake and the source of power; therefore in applying hand-brake and drawing brake-lever away from bracket-pin, a new fulcrum is formed at hand-brake connection, which, being at the extreme end of lever, and further from the source of power, greater leverage is obtained and the brake at that end of the car gets a greater leverage and greater power than the brake at the other end.

But, there will be another result Setting the hand-brake on car roof takes up the entire slack of brake-gear, giving a minimum piston travel and consequently maximum piston pressure, which increases the braking power of every shoe on the car.

LEAKAGE GROOVES.

Brake-cylinders on a vehicle whose train-pipe is always in direct connection with the source of air supply do not need leakage grooves because the pump is continually generating power necessary to hold the triples in release position, and while in that position any leakage of air to the brake-cylinder will pass away through the regular exhaust ports and triples cannot fall while train-line pressure is maintained. In case it becomes necessary to stop the pump, the release cocks on engine and tender auxiliaries may be opened and there will be no pressure to leak to brake-cylinders.

Neither do tender brake-cylinders require leakage grooves, but as they are the standard 8-inch car brake-cylinders they have the groove for the sake of uniformity.

STOPPAGE OF PUMP GOVERNOR.

Before taking up Mr Relyea's latest air-brake puzzle, one might desire that he should complete his explanation of the difficulty he mentions in the July number, by stating exactly the defects of that pump governor. His answer is indefinite enough to create doubt as to the safety of using the Westinghouse pump governor

EDUCATIONAL AIM OF THESE LETTERS

It is so easy to get up an air-brake puzzle, and the field so unlimited, that one might be tempted to work on the credulity of ambitious correspondents, but it should be remembered that LOCOMOTIVE ENGINEERING is read by a great many experts who are inclined to be critical, and as the paper is intended to have an educational effect, one should be accurate in explaining as well as propounding problems.

*Terre Haute, Ind.* WILL W WOOD

## Brakes Applying in Release.

*Editors:*

In reply to Paul Synnestvedt's question in the July number, regarding brakes applying when brake-valve was placed in release position, my idea is the air pump had stopped and there was a leak in main drum or connections, which caused a reduction of air-pressure in drum less than that of train-pipe; a slight leak in train-pipe caused brakes to creep on. When handle of brake-valve was pushed back to release position air flowed back into main drum, causing additional reduction in train-pipe, causing brakes to go on harder. The engineer finding pump had stopped started it, and after he had accumulated enough air in main drum to overcome reduction of main-pipe brakes released.

*Huntington, Ind.* FRED. S. COLNON.

*Editors:*

Would say of those brakes setting in full release, that air pump had stopped, train line pressure had gradually leaked away and brakes crept on quietly. Main reservoir pressure had also leaked away to keep up the drag on train line, till A. R. pressure had almost equalized with the latter. When handle was thrown to release position a greater volume of air striking the bottom of brake-valve piston, raised it from seat, setting brakes harder. The air also acting on pump governor started pump and released brakes.

*Kingston, Jamaica.* A. S. S.

## Wants Some Break-down Pointers.

*Editors:*

I should like to ask three questions in LOCOMOTIVE ENGINEERING to get the replies of its experienced readers on each. Different men have different ways and I hope you will give all a chance to answer.

1st. I am seeking information and will ask you how I would fix engine if I was on fast stock train and broke right go-a-head eccentric strap, how could I get to end of division with full train that engine could not handle on one side?

2d. If back tire on 6-wheel connected engine broke off and middle wheels had no flanges, how would I block engine so as to get in and back up and go-a-head safely?

3d. Suppose engineer started out and for some cause took down right main rod, threw liners, brasses, straps, all on ground so could not tell anything about where they belonged; master mechanic sent me up to put engine together. Where would I place engine and how could I put up rod and have it right.? K. T.

*Dennison, Tex.*

## Automatic Block Signal Advantages.

*Editors:*

Noticing in the August and September numbers of your valuable journal, editorial notes on the adverse criticisms which have been made upon block signal systems by reason of the failure of one system, (namely, at the Harrisburg accident), I am led to inquire whether you consider it necessary that block systems should depend at all upon human agency for their operation. In the case in point it appears that the accident was occasioned by the failure of the operator in the tower to show the danger signal. There are block signal systems, as for instance, the Union Switch and Signal Co.'s system and the Hall system, in which human agency is not employed, directly, at least, and in which, when a block is occupied, and in case of neglect to attend to the apparatus, or in case of accident to it, the "danger" signal is automatically shown. At all other times "safety" or "caution" signals are shown by electro-magnetic services Are not such systems preferable to those in which human agency is directly employed? Enginemen on the Jersey Central road, on which, as you are aware, one of the automatic systems referred to is employed, tell me they have in it the utmost confidence.

*New York* WM. MAYER, JR

[If we understand the case rightly, the trouble at Harrisburg was because of the want of a check from one tower to another; in other words, the signals were not interlocking, and it was therefore possible to give a wrong signal. Any system that prevents such blunders is an improvement.]

## Wages--The Equalizing Piece-Work System.

*Editors:*

There seems to be a great deal of injustice and inconsistency connected with the much agitated wage question. Let us confine ourselves to machine shops. A large employer may have what he pleases to call a standard or limit to wages paid. Railroad companies have the same system; 25 cents an hour may be called the standard or limit. Men come and represent themselves to be machinists; they are employed and paid 25 cents an hour; they can do a fair job on lathe or planer, but can do nothing at the vise, or they can do an ordinary job at the vise (if you give them time enough) and do nothing on a machine. Yet these men are pitted against the man who can do a first-class job on lathe, planer or vise, yet he is brought down to the same level with the botch, on the wage question, and ability goes for nothing. This condition of things is not right, and is a gross injustice to the first-class man in all branches of mechanics. It costs no more to pay Smith 30 cents an hour and Jones 20 cents than it does to pay each 25 cents; while the abilities of Smith make him worth $1 per day more than Jones, they each get $2.50 because that is the standard. Here is Smith at work in a job shop; a man comes in and complains that his engine will not run the saw, and is using too much fuel for the work done, who is sent out, Smith or Jones? Smith of course, his employers want to build up a reputation, and what does he find? Perhaps the valve or packing is blowing so bad that steam is on both sides of the piston at the same time. Or again, the new valve the shop across the street put in has too much inside lap and the engine is choking herself He applies the proper remedies and the engine makes things whirl. Result the Enterprise Machine Company gets lots of praise and Smith gets 25 cents an hour, the same pay Jones gets, who don't know a valve when he sees it. If any intricate job comes in, in the line of steam-pump, steam-gauge, or injectors, Smith gets the work because he is the only man in the shop who can take anything that comes along, but do his employers appreciate his abilities enough to pay him $3 per day?

These are not fancy sketches but facts coming under the writer's observation and in places where the general foreman and his bosses were stuck on the jobs. Jones belongs to a class of men who are looking for a job, but not for work; or a place to put in the time and draw the pay It is not an uncommon thing for machinist runners while working in the shop to get engineers' shop pay, which is less than regular machinists' pay; this man may be doing first-class work in the shop, yet because he is an engineer he must be paid engineers' shop pay only. The writer has had some bitter experience in that line, and the practice is wrong in every detail.

Note the practice in some railroad shops. The company are always kicking about reducing the operating expenses, and take these things as an excuse to keep down wages. Now, why not look into these things and see where there is money expended that had better go into wages.

An engine comes into the back shop for general repairs; one of the Jones crowd will get a copper injector-pipe and piece of emery-cloth and use up ten hours doing two hours' work; another fellow gets the steam-pipes on the floor and takes a lease on them grinding in the ball joints Two or three men will take the boiler-head attachments and monkey two or three days on them; another of the crowd will get the throttle and grind the life out of it, and if it never leaked before it will now. Yet these louts will get the same pay that the men do who line up guides and shoes and wedges, simply because they are hired as machinists. Why not have one good man at $3 per day, and let two of the Jones gang go.

Main and side rods come in covered with filth and rust; they are polished up in first-class style; the engine goes out on a freight run or in the yard, and the finished surface never sees daylight again. What good does it do? Why not paint them and put some of the emery-paper money into wages.

Now comes the labor agitator and says this extra finish makes work for more men. This same agitator, when he sees a man running two machines and is making money by so doing, says you are keeping another man out of a job. We feel like saying about this *other man* what a certain railroad magnate once said about the public. Some of the leading railroads are adopting the piece-work system in repair work, which is a move in the right direction, as it very soon draws the line of ability between Smith and Jones, and will do what trades unions fail to do, it will give the expert workman a chance to earn wages he is entitled to and put Jones on half pay. A WORKER.

*Baltimore, Md.*

## Relyea's Whistle-Signal Puzzle.

*Editors.*

Mr. Relyea's September nut can be cracked this way The main-reservoir pressure wasted away through a leak in the rubber diaphragm of reducing-valve, but the area of leakage was no greater than the feed space around the stem of whistle-valve, and the air leaking away gradually from both sides of the whistle-valve diaphragm, the valve remained closed and the whistle could not blow

When the hostler put the engine in the roundhouse, he made the stop by throwing the brake full on and exhausted all of the air from the train-pipe, and instead of releasing the brake he only pushed the handle back to lap and left it so. The brake-valve being on lap, all ports are blanked, and with a nicely-seated rotary-valve and tight connections, the small valve-reservoir will retain its air and register a high train-line pressure by the black pointer of the gauge when, perhaps, there is not an ounce of air in the train-pipe

When Brer Relyea made his appearance, the train-pipe was empty, although the black hand stood at 50 pounds. The red hand showed but 10 pounds in main reservoir, and when the pressure is so low there is direct communication between signal line and main reservoir through the reducing-valve. He pushed the brake-valve handle to the full release position and the reduction of main-reservoir pressure in filling the brake-pipe reduced signal line pressure and caused the whistle to blow, and it continued whistling intermittently until the auxiliary reservoirs were charged and pressures equalized, which, in this case, was hastened by starting the air-pump. WILL W. WOOD.

*Terre Haute, Ind.*

*Editors:*

In answer to the air-brake puzzle in August number by W F. Relyea, would say, that as pump had seen enough service to be reported as worn out, that gum had accumulated in countersink of bottom head into which the nut and bottom end of air piston-rod play, which would prevent the piston from pulling trip-rod down far enough to perform its work, and thus supply steam to send the piston up.

BRANDON LEONARD.

*Editors.*

In answer to Mr W. F. Relyea's air-pump puzzle would say, that the boss on lower side of steam cylinder-head was jammed against collar on upper main steam-valve cylinder so that when main steam-valve came to pull upper stroke it became wedged owing to the bush being squeezed out of shape This would prevent pump working and I presume this is what the hammer and chisel was used on.

*Winnipeg, Man.* W. S

## An Old Thing Made New.

*Editors:*

"Connelly's Axle Lubricator" in the September number of the LOCOMOTIVE ENGINEERING, is an old device.

Early in the 50's, Ned Andrews, a foreman in the Philadelphia & Reading Railroad shops at Palo Alto, under J E. Wootten, got up the same device, and it was put in use on a passenger engine running on the Tuscarora branch and gave no extraordinary results.

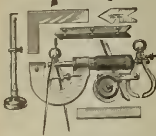
Andrews had a tin tube fitted with a valve in the one end that opened when forced against the bottom of the hole in axle and allowed the oil to escape. Otherwise it was the same as Connelly's.

E J RAUCH.

*Man El. R R, New York.*

STARRETT'S

# FINE TOOLS



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L. S. STARRETT. Athol, Mass., U. S. A.

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**Made in all Sizes to Cut from 1-4 In. to 6 In.**

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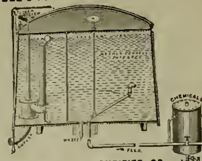

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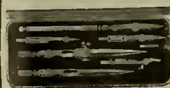
## FINE DRAWING INSTRUMENTS.



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*CATALOGUE ON APPLICATION.*

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# TUBULAR JOURNAL BEARINGS.

TO run trains with Brasses requires (by actual test) one-third more coal than with TUBULAR ROLLING BEARINGS. Ninety per cent. of lubricating oil saved and every bearing guaranteed for 200,000 miles. Coal and oil savings alone more than cover the extra cost in 50,000 miles. No delays from "hot boxes." Trains save from $250 to $300 per car per year, within the term of guarantee.

**MENEELY BEARING COMPANY, WEST TROY, N. Y.**

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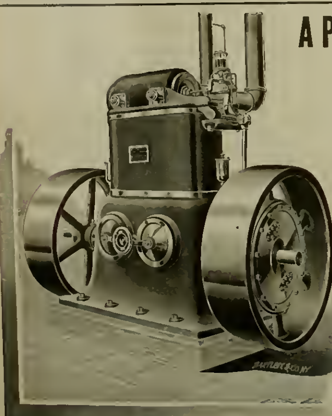

# A PLAIN STATEMENT OF FACT.

THE Compound Engine, when non-condensing, so far from possessing an economy superior to the simple engine, has been decisively proven, "much to the disgust of the stockholder," to show normal economy only at or about its rated power, and to fall off in economy faster than a simple engine as the load falls off; moreover, very much faster under the extreme light loads that are common at times in many industries. This point is at last reluctantly admitted by the more candid builders of such engines, most of whom now advise against compounding for variable loads. The reason is in their inability to divide the load and range of temperature proportionately and automatically between the cylinders at all points of cut-off. Hence, the low-pressure cylinder expands its steam below atmosphere under a moderately early cut-off, thus converting itself into an Air Pump, and becoming a load upon the high-pressure cylinder instead of a co-laborer with it. This point was distinctly foreseen by the designers of the Westinghouse Compound Engine, and an entirely new principle was worked out, making expansion below atmosphere impossible under any load, however light. For the first time in the history of Steam Engineering, either Simple or Compound, is built an engine which maintains essentially uniform economy, irrespective of load, and hence for the first time the Compound Non-condensing Engine has been made practicable. The results, demonstrated by test, show that where an ordinary Compound will range from 25 lbs. to 70 lbs. water per H. P. per hour from full to quarter load, the Westinghouse Compound, between the same limits, will range from 23 lbs. to 29 lbs. We have not deceived ourselves in this matter, and propose that the facts shall be understood. To those interested in the nicer points involved we will be pleased to send a reprint of the Paper read by Mr. F. M. Rites on this subject at the late meeting of the American Society of Mechanical Engineers at San Francisco.

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## Emergency and Service Application of Brakes.

By George Holmes.

Since your July issue I have found one of the old-style hose couplings with the valve still in it. These were in use before the stop-cocks were put in train-pipes, and if there was such a thing in that coupling on rear of first section of the train that broke in two, as described on page 241, it would have been surprising if it had acted otherwise.

While I can understand how a pump-governor could shut off till a brake leaked on, I fail to see how a train could be handled at all when the governor was in such condition that air would leak through it fast enough to set brakes, and should think there would be so much variation in pressure that it would be noticed and repaired before the engine was sent out.

I am very much pleased with Brother Synnestvedt for his protesting against placing restrictions on engineers, or in giving them a set of rules that would tend to make them automatons in their duties, but I foresee a long discussion on the handling of brake-valves and the action of air-brakes, and hope that all who are posted in any way on these matters will assist in their ventilation, and in order to make good my July statement will describe the situation here.

The road is composed of track under perhaps a greater variety of conditions than are usually met with. There are whole divisions almost level and very straight, and others that are nothing but mountains. Some of the trains are main-line trains, and are handled by many different men; others run on not more than one or two divisions. These engineers know every car, and all are handled very nicely, although the men on this road never had a printed set of rules, neither have instruction-books been issued to them, and the road foremen do not try to chain them down on these matters. It is understood here that a man who is intelligent enough to handle an engine will not injure it willfully, and that such a man, if he knows what he is handling when he has hold of a brake-valve, will be of far more benefit than one who is merely an effect with no cause whatever. We, therefore, instruct engineers as follows, knowing that he has some experience in using power. We tell him about what power is conveyed to the wheels to brake with, and what will slide or lock them. He is then given to understand that the triple valve is the most important factor, and that it is a mediator between the auxiliary reservoir and the brake cylinder, by this showing how the air is passed through the valve and having him time the reservoir while recharging, and watch a gauge on the brake cylinder until he is satisfied he knows the approximate effect of every application. He is also given to understand that the brake-valve, although separated from the triple valve, is nothing but a highly-adjusted throttle and reverse bar, which, kept in order and handled properly, will give him control of the machine or valve that manipulates his reserved volume of air in auxiliary reservoirs. Another arrangement is made with him to the effect that if he finds he has been misinformed or misinstructed, and cannot use air as advised when it is in good order, he is to let me know, and if I cannot make the matter agree with what I told him he is to call me down. I am also to see that his air is kept in as good order as it is when he is instructed.

We have also one way of keeping up brakes on mountain service where but one or two men handle the same train and another on main line where all have it. On main line the piston travel is about 7 inches and many coaches have six-wheel trucks with brakes on four wheels or only 60 per cent. breaking power, and the cars are generally loaded so that figured at 90 per cent. light weight they would stop as quick or quicker in emergency stop than in service stop, although one of our main line runners will stop any passenger train with ordinary air in as short a distance with service stop as emergency, and he will not use it at all unless his service stop fails to act.

Now on the Clinch Valley Division the service is very severe on brakes. It is a mountain road full of curves and nearly new, with all that that implies. Three good men handle the passenger trains there and their travel is set just to clear the leakage grooves, as so much air as is used on long piston-travel cannot be spared. The trains are light and the traffic does not add much to the weight, so they probably have over 100 per cent. braking power. The men do not use much over 12 lbs. of air to make their stops with and the speed is fast for such a road. In the early spring one of the engineers hit a cab and according to instructions usually given in such cases, used the emergency stop to make sure, while he knew he could stop short of the cab on service stop. This brought up a new question, as all these men relied on my instructions, and to test them they in turn stopped at this switch, both on service and emergency stops, and proved to their satisfaction that they could stop shorter by the use of service stop than by emergency. Of course when I came around they were ready for me and we had a love-feast, but by repeating instructions and making clear the action of the brakes I showed that this action was natural and in perfect accord with the best practice.

Now, while these engineers have such brakes and make such stops, it is because they know they have more power than the cars are figured for, and they use it accordingly. Now, the question, is have they a right to use the emergency stop when they know they could stop short of danger with the other? And here I believe should be made a plea for an automatic slack adjuster that will keep all brakes equal, as in this lies often the cause of unsteady trains. If triple-valves would graduate as they were designed this should bring us much nearer that haven so much dreamed of by air men.

Another statement that puzzles me is that after an emergency application the leaking of the triple-valves can be prevented by putting the brake-valve handle on lap. In order to get these valves to leak the train-pipe pressure must be reduced below that in the brake cylinder, and in order to stop the leaks the pressure must rise above it again. As putting the brake-valve handle on lap would not add to the train-pipe pressure, I think they would still leak, and where trains follow each other closely it would not be so easy to start with air exhausted from train-pipe, and in such cases getting away is almost as important as stopping, while, if a quick-action application were made instead of an emergency, there would be some forty or more pounds of air left in the train-pipe, which would be of great benefit, and have a pound or so higher pressure. There may perhaps be a claim made that emergency and quick-action stops are the same; but for my part I think there is a wide difference, and would like to hear what others know of it. And now as I believe this discussion is fairly started, and that I have been heard rather more of late than necessary, I will stand aside for a while and give others a chance, that the ones who have been through the mill may add their experience and assist to clear away the difficulties which unexplained have lent a shadow of mystery to the working of air-brakes, and while it lasts will continue to be a useless source of expense and danger.

*Roanoke, Va.*

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The Order of Railway Trainmen and the Order of Railway Conductors made a joint request last month on the management of the Chicago, Burlington & Quincy for an adjustment of wages. An amicable agreement was come to between the men and the company.

## Grand Trunk Locomotives.

Of late years the tendency of railroad mechanical officers has been to work down their locomotives to standards, making as many parts as possible interchangeable and making the fewest possible number of engines meet all the requirements of train service. We do not think that any large railroad on this continent has succeeded so well in this line of improvement as the Grand Trunk Railway of Canada. This company have got down their locomotives to fine standards. The leading characteristics of the five styles of engines are

First, a tank double-ended switcher, with cylinders 17 x 22 inches, two pairs of coupled driving wheels 62 inches in diameter, a four-wheel truck in front and a pony truck behind carrying a coal-box that has a capacity of 3½ tons of coal. The total weight of this engine in working order is 126,000 pounds.

Second, an eight-wheel passenger engine with the same cylinder and wheel dimensions as the last and many of the parts of the same size The leading difference is that this engine has a tender and no trailing pony truck The tender has a capacity of 2,500 imperial gallons and 20,000 pounds of coal. The total weight of the engine in working order is 86,300 pounds.

The third class is a six-wheel switcher with cylinders 18 x 22 inches. There is a saddle tank which carries 1,860 imperial gallons of water, and a back tender carried on the main frame which has room for two tons of coal. There is no separate tender. The weight of this engine in working order is 114,632 pounds. All the weight is necessarily carried on the driving wheels, for there are no others.

Class four is an eight-wheel engine suitable for heavy passenger or fast freight service. The cylinders are 18 x 24 inches and the driving wheels 68 inches in diameter. The total weight of the engine in working order is 98,084 pounds, 58,016 pounds resting on the driving wheels. The tender carries 2,500 imperial gallons of water and ten tons of coal.

Class five is the latest designed, and is a mogul engine adapted for either passenger or freight service. The cylinders are 18 x 26 inches and the driving wheels 62 inches in diameter. This engine may be said to embrace all the latest improvements in locomotive design. The weight on the driving wheels is 28,448, 27,216 and 24,752 pounds, respectively. The total weight of the engine is 96,376 pounds. The traction force at the rail per square inch of piston is 135.87 pounds. The grate area is 17.66 square feet, and the total heating surface is 1,231.5 square feet.

All the engines have straight boilers with a big dome in the middle, and the firebox is bound to the shell by radial stays. As compared with the best American practice all these Grand Trunk locomotives are deficient in heating surface, but the engines are said to work very satisfactorily. As the tendency toward greater heating surface has become very pronounced of late, it may be that the mechanical department recognize the shortcomings of their designs, but prefer maintaining uniformity in preference to improving the proportions to meet modern requirements.

## A Genuine All-Round Workman.

The Canadian Eastern Railway is a road 126 miles long, of standard gauge, has 8 locomotives, 8 passenger cars, 4 snow plows and 94 miscellaneous cars. It has a president and general manager, a superintendent and general freight agent, an auditor and car accountant, a treasurer, mechanical superintendent and trackmaster. In short, a full force of executive and operative officers. This is nothing unusual and would not entitle the company to special notice. But after the officials named, there comes a man whose name does not appear in the published list of the company's men of honor, nevertheless he makes the road worthy of notice This individual is rated as a carpenter, but there is no other such carpenter on this continent.

On getting to the shops in the morning, this carpenter starts work by wheeling into the blacksmith shop a supply of coal to last the day. Then he goes out to the yard and inspects all the cars and makes whatever repairs are necessary Then he returns to the shop and repairs the desks, locks and furniture belonging to the offices and stations. This being finished he paints and varnishes any of the rolling stock or furniture requiring any attentions in that line. His next duty is putting glass into headlights, cabs or passenger cars that may have been broken. By this time the electric bath is ready and he proceeds to electro-plate headlight reflectors, lamps or any other things that need that operation. This work accomplished, he turns to his tin shop department and solders up any cans, lamps, pails, ventilators or anything else in this line that calls for attention. He puts in an hour here, occasionally making new oil cans, lamp fountains, etc. When there is nothing else waiting to be done, this carpenter enjoys a turn at his own trade making cabs, tool boxes and hand cars. When a locomotive needs lagging he puts it on and does any repairs needed to the jacket.

A department of the road where he is the sole foreman and workman is the care of buildings and bridges. If a station house wants to be repaired or a new freight shed built, the carpenter is called upon to do the work, and he responds promptly. If a bridge begins to get shaky and needs new timbers or a general overhauling, the carpenter goes out and performs the work. The management appreciates the value of this man of many duties to the extent of paying him $50 a month.

## Hand Brakes on Engines.

It would make an American fireman's heart ache to see how faithfully all hands stick to the hand brakes on engine and tender in Europe. The runner rarely "plugs" his engine around the yard—even the switchers wait for the fireman, the screw brake and the wooden block to do the stopping.

The brake staff is generally incased in a 4 or 5 inch tube and the handle is not unlike a street-car brake except that it is straight. It is generally polished all over and carefully scoured daily, and oiled to prevent rust when the engine is left in the shed or yard

Beside this, the device is almost universally placed in the way, taking up much valuable room.

In some classes of engines there is a screw brake on both sides of the engine, there being no beams across from one to the other, in this case it is not uncommon to see both enginemen screwing away at them. On some of the older tenders there are also two.

Power brakes on train and engine do not seem to diminish the prestige of the hand "squinch" in Europe as it has in Yankeedom.

## Same as the Footpad.

"The first lesson in the art of money-getting," says Andrew Carnegie, "is the knowledge that it isn't the man who does the work who makes the money, but the man who gets the other men to do it."—*English Magazine*

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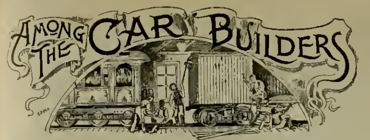
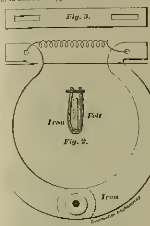
Mr. George Vernon, the oldest locomotive engineer on the Pennsylvania Railroad, died at Bordentown, N. J., last month.




## A German Dust Guard.

On the government railroads of Germany they use what seems to be a very sensible and efficient dust guard on their coaches. This is made of ⅛-inch iron cut out of the




flat in pieces like half of Fig. 1; two of these are riveted together, forming a hinge, they are covered with thick soft felt sewed so that the two edges come on the inside. See Fig. 2. This is opened and clasped around the axle, and a yoke piece of flat iron, like Fig. 3, hooked over the top ends This is also covered in the center with felt.

Into the holes in the horns a light coil spring is hooked that tends to keep the felt always pressed against the axle.

These guards run on an average 72,000 miles, and then only need recovering with felt to make them as good as new.

## Tough Cast-Iron Wheels.

The Mt. Vernon Car Manufacturing Company, of Mt. Vernon, Ill., have succeeded in selecting a mixture of iron that makes car wheels of extraordinary toughness. This company has been building cars for the Louisville & Nashville Railroad, and the inspector of the latter company subjected fifty wheels to the Master Car Builders' standard drop test of 140 pounds weight, falling 12 feet. By this test a wheel is required to stand five blows before a piece breaks out. The Mt. Vernon wheels went far above the requirements. It took an average of 37.18 blows to break the wheels, and five of the fifty tested did not break under the ordinary drop, although as many as ninety-five blows were given. This is the best record we have heard of cast-iron wheels making under the drop of 140 pounds falling 12 feet.

## James T. Leighton.

For years one of the most popular men attending the Master Car Builders' conventions has been Mr. James T. Leighton, who had been a member of the association for twenty years. When he joined he was a member of the New Haven Car Works. His numerous friends will learn with sorrow that Mr. Leighton died suddenly at Portland, Me., during the last of August. For some time he has been connected with the Consolidated Car-Heating Co. At a meeting of this company the following resolutions were adopted.

The officers and employés of the Consolidated Car-Heating Co. learn with sorrow of the death of their associate, Mr. James T. Leighton, of New Haven, and at this their first meeting since that sad event desire to put upon record an expression of appreciation of the admirable qualities which endeared Mr. Leighton to so large a circle of friends. Though in the last few years failing health made him able to take up only part of that full measure of service which formerly brought him in active contact with railroad men throughout the country, yet whatever work fell to him was always done cheerfully, and wherever he went he was always accorded a generous welcome.

His life was that of a Christian gentleman, continually thoughtful for others. His loss will truly be felt in many places outside his own family. We deeply sympathize with those of his own household, and trust that these few words may in slight degree convey to them the affectionate regard in which James T. Leighton was held by those who knew him best in business life during the few years just past.

## New Horizontal Tenoning Machine for Car Builders.

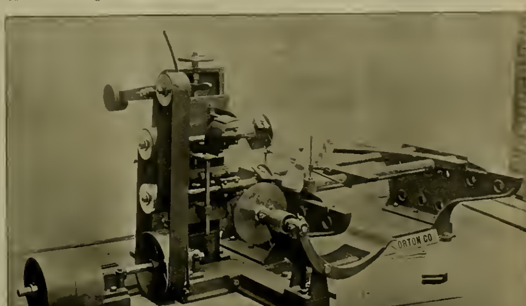
The handsome engraving on this page is itself a good description of a new tenoning machine recently designed by the Berry & Orton Co., of Philadelphia.

It is a horizontal tenoning machine that cuts both sides of the stick down at once, and has a saw that is thrown back, cutting off the "heel" in brace tenons, all at one operation.

The mode of driving the two cutter beads is plainly shown, together with the mode of adjustment for size of tenon.

The table, with its provision for holding work at any desired angle to the cutters, is also plainly shown. With such a tool it is possible to duplicate any piece used in a car frame, and insure uniformity and interchangeability.

One of these tools can be seen in operation in the works of the Haskell & Baker Car Co., at Michigan City, Ind.




New Horizontal Tenoning Machine.

## Master Car Builders' Committees of Investigation for Next Year.

Secretary John W. Cloud reports that the following committees have been appointed to investigate the subjects stated and report at the next meeting of the convention.

*1. Drawbars and Brake-Beams*—To consider the suggestions of the Committee on Standards, as to standard height of drawbars, and as to standard form of brake-beam, and report with recommendations and drawings in detail.—E. D. Nelson, John Bean, J. R. Rankin, C. A. Schroyer.

*2. Axles, Journal Boxes, Lids and Wedges*—To consider the suggestions of the Committee on Standards, and to recommend in detail, with drawings, how these standards should be modified and published.—R. H. Soule, W. H. Day, W. H. Lewis.

*3. Truck Pedestals and Safety Chains*—To consider the suggestions of the Committee on Standards, and to recommend in detail, with drawings, how these standards should be modified and published.—T. A. Bissell, Wm. McWood, A. E. Mitchell.

*4. Protection to Trainmen and Lettering Fast Freight Line Cars*—To consider the suggestions of the Committee on Standards, and to recommend in detail, with drawings, how these standards should be modified and published.—E. P. Lord, Robert Walker, Thomas Sutherland.

*5. Tests of M. C. B. Couplers*—To arrange for and conduct the tests, as proposed by the Committee of 1892 and approved by the Convention, and to consider and report upon all other questions connected with M. C. B. coupler which they might consider advisable, with the exception of the attachment at the rear end of the coupler and the form of the coupler at that point. To confer with the Committee on Attachment of M.C.B. Couplers to Cars.—J. M. Wallis, J. S. Lentz, R. D. Wade, J. H. McConnell, E. Chamberlain, T. G. Duncan.

*6. Attachment of M. C. B Couplers to Cars*—To recommend a form, in detail, of M.C.B. coupler at rear, and so as to take yoke, tail bolt and continuous drawbar attachments; also, to consider and report upon the best form of draft attachment to cars. To confer with Committee on Tests of M. C. B. Couplers.—E. D. Bronner, W. H. Harrison, A. M. Waitt, Wm. Garstang, A. Dolbeer, Jno. H. Davis.

*7. Metal for Brake-Shoes*—To investigate the relative friction and wear of different metals and different shoes in general use on chilled treads and on steel tires.—Wm. Forsyth, Benjamin Welsh, F. D. Adams.

*8. Cast-Iron Wheels*—To investigate and report whether there is any substantial difference in wheels made by different methods, such as by solid chills or contracting chills, or by any other difference in process of manufacture.—G. W. West, W. H. Thomas, Jno. Player.

*9. Steel-Tired Wheels*—To investigate further and report with all data available as to relative values in service.—R. E. Marshall, J. O. Pattee, C. H. Cory.

*10. Air-Brake Tests*—To further investigate and report in detail what tests are desirable to insure best available service.—G. W. Rhodes, E. B. Wall, Geo Gibbs, A. S. Vogt, E. A. Williams.

*11. Freight Car Truck Frames*—To include in its report the relative advantages of fixed bolsters and swing bolsters.—J. C. Barber, W. S. Morris, S. A. Crone.

*12. Steel Center Sills*—To consider and report whether the use of steel for center sills in freight cars would be desirable.—D. L. Barnes, J. N. Barr, J. D. McIlwain.

*13. Steam Heating and Ventilation of Passenger Cars*—To review the report of last year's committee on this subject, which was acted on provisionally, and to recommend any changes that may be deemed proper; also, to further pursue the subject of steam heating in general, informing the association as to what improvement, if any, is being made over the methods now in use.—L. B. Paxson, J. J Hennessy, Jos. Townsend, John Hodge, David White.

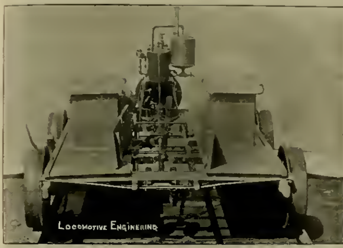
At the Allison Car Works, [illegible]phia, they have introduced th[illegible] tricity for transferring material a[illegible] yard. They have an overhead trolley system and a motor car that traverses [illegible] principal tracks. The system is found [illegible] be much superior to switching en[illegible] is likely to be extended to [illegible] the yard work.

A company known as the Whirlpool Water Purifier Company has been incorporated under the laws of Missouri to purchase the patents and put upon the market the water-purifying apparatus designed and used by Mr. Arthur Pennell, of Kansas City, Mo. Mr. Pennell has several purifying plants at work along the U. P. road where the water is simply awful. The capital stock of the company is only $50,000—a modest sum.

## Locomotive Hand Car.

The annexed engraving illustrates a very neat application of power to hand-cars. One of these cars has been built for the use of a railroad manager, and others have been ordered, so that gas-driven hand-cars may be soon seen on every railroad trying to keep up with the times.

The power used to propel this locomotive is simply made by pumping a very small quantity of gasoline into the cylinder each second stroke of the piston. It is ignited by a small spark from an electric-battery after vaporizing in cylinder; it carries 1½ gallons of gasoline, a sufficient amount to run the locomotive 100 miles. Its total weight is but 550 pounds; can readily be taken off the track by one man on a crossing, and two men can handle it in any locality with ease. Its maximum speed is 12 miles per hour; only requires 20 minutes instruction to manipulate to perfection (or can be handled by printed instructions as well).




Locomotive Hand Car.

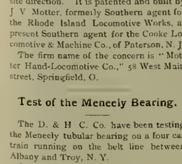
This locomotive is intended for the use of presidents, superintendents, roadmasters, bridge builders, linemen and for all classes of emergencies, by way of inspection. It obviates the necessity of breaking into gangs at work on line for hand-car power; it can be reversed and run in opposite direction. It is patented and built by J. V. Motter, formerly Southern agent for the Rhode Island Locomotive Works, at present Southern agent for the Cooke Locomotive & Machine Co., of Paterson, N. J.

The firm name of the concern is "Motter Hand-Locomotive Co.," 58 West Main street, Springfield, O.

## Test of the Meneely Bearing.

The D. & H. C. Co. have been testing the Meneely tubular bearing on a four car train running on the belt line between Albany and Troy, N. Y.

One train was fitted with ordinary brass



bearings, the other with the tubular, each train weighing 102 tons and both were drawn by the same engine. Eighteen round trips were made with each, a distance of 270 miles.

The coal consumption for this service was 14,800 pounds with the plain bearings and 11,100 with the tubular.

Dynamometer tests showed that a force of 3,276 pounds was required to start the train with plain bearings, while that with the tubular only required a force of 252 pounds.

A gravity test was made by letting the trains run down a slight grade on to a level. The train with plain bearings only rolled 100 feet beyond the incline, while the tubular bearings carried their train 534 feet.

## Cause of Failures in Tempering Steel.

I suppose that all toolsmiths who know anything about steel will agree with you that the lowest heat at which steel will harden is the best, but how is the toolsmith to get this heat? Some smiths have nothing to heat in but a green coal fire; others use coke on the forge; some throw on a little charcoal; others use the hollow fire with coke, and a great many use charcoal in a hollow fire.

In furnaces there is the same diversity; the ordinary green coal or coke furnace, sometimes used with charcoal, the spring furnace used with charcoal, the gas furnace, the lead bath and the piece of gas pipe used either in a furnace or in a green coal or coke fire. The sensible employer supplies his toolsmith with a charcoal furnace which he can regulate to the proper degree for any grade of steel that he may be treating. Where hardening solutions are used that one should be preferred which will harden steel at the lowest heat.

In hardening, the smith must get the same heat each time, a most difficult thing to do where he has nothing better to heat in than the ordinary furnace or forge fire.

Say he gets a tap to harden in the morning before sunrise; he heats it to a very low and even heat; the tap is put to use and gives the best of satisfaction. A month after he gets another made from the same bar, but this time he hardens it later in the day when the sun is shining or, it may be, when a fresh fall of snow is on the ground. He heats to what he believes to be the same heat that he had on the one he hardened before.

The tap is put to use but does not give satisfaction at all, and yet it is the same steel, used by the same man and for the same purpose. Nobody knows what is wrong. The smith goes on and hardens a half dozen more off the same bar, and gets three good taps and three poor ones. The machinist or boilermaker complains and the smith replies that it is in the steel. The taps are laid aside until the steel salesman comes around, when they are examined and in nine cases out of ten nobody has the least idea what is wrong. The steel is blamed and other brands are tried which turn out pretty much the same. Now, the price of one tap would put an end to the whole trouble if used to provide shades for the windows near the forge with which to regulate the light.

If the smith cannot induce his foreman to furnish shades let him get heavy, dark wrapping paper and tack it over the windows, for it is better to nail them up altogether than to let the sun or bright light strike the forge, anvil or water tank. If objection is made to nailing up the windows, let the smith take a piece of old pipe, or an old barrel or keg and hold the cutter or reamer in that before quenching and the benefit to be derived from shades will be fully proved. Shades are also a great help in preventing steel from cracking. I have black shades on my windows which can be raised or lowered to suit the work I am doing, and I use a brine bath of thirty-five to forty degrees temperature and have found both a success. Many steelworkers are afraid to use a solution of this kind for fear of cracking intricate shapes, but if the proper steel has been selected there is no danger. I have softened and hardened some very difficult shapes of milling cutters of Crescent steel thirteen times and there was not a crack of any kind in them. They were used in cutting tool steel and they held as good an edge after the thirteenth time as they did at first. I did not draw the temper a particle. I gave them a low, even heat and dropped them in the solution upon a screen, which was set in the tub at a distance of twenty-four inches from the top and six inches from the bottom where the brine could cool them equally and where they were left until as cold as the bath.

The greatest folly that has ever been practiced among steel workers is to take a cutter out of the water and put it over a keen fire, but I will reserve what I have to say on this subject for another letter.—*W. G. Lottes, Madison, Wis., in "Sparks from the Crescent Anvil."*

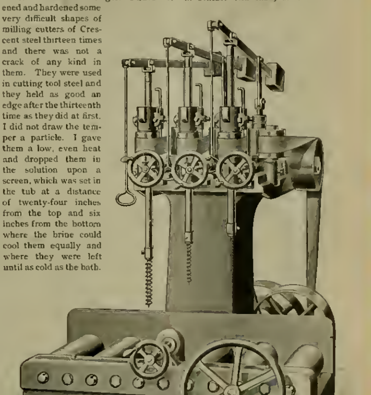
After long tests to prove its efficiency, the Reading road has adopted the Smith Triple Expansion Exhaust Pipe. This pipe does away with the necessity for a draft pipe and allows engines to run with an exhaust nozzle opening nearly equal to the area of the exhaust port.

## Improved Three-Spindle Vertical Timber Borer, With Power Driven Rolls.

The accompanying cut represents the latest improved vertical boring machine for car and bridge work.

The column is cast hollow with ample floor space, and has the roller frame bolted to the front of the same, thereby making a very heavy and reliable machine, capable of standing up to the heaviest work on the largest timbers.

The slides which carry the spindles have a movement of 15 inches, each independent of the other, operated by hand wheel and screw, and working in planed ways with gibs to compensate for wear without changing the tension of the belt. The spindles are made of best cast-steel, and have a vertical movement of 18 inches. Each spindle is driven at a different speed, to suit the auger, and is provided with a stop to gauge the depth of the boring. All spindles pass through a sleeve pulley, consequently do not come in contact with the journal boxes. The




Three-Spindle Vertical Timber Borer.

spindles are also provided with self-oiling boxes at the top. The roller frame is very heavy and of large surface, and is made to carry six large feed rolls, all driven by friction and operated both ways, being controlled by the foot. If it is desired the rolls can be thrown out of gear when the foot is released from the treadle, by means of the large hand wheel. All the movements in this machine are actuated by one single belt. Timbers 15 x 16 can be bored clear through at one operation.

For further information address the builders, the Egan Company, 204–224 West Front Street, Cincinnati, Ohio, U. S. A.

## The Making of a High Grade Wrought-Iron Wheel.

The day when anything but a high-grade wheel can be safely put under passenger stock or used for locomotive trucks ought to be gone We hope it is.

Of the many good wheels on the market the double-plate wheel, long made by Colonel Boies, of Scranton, Pa., has had a reputation worth being proud of; but Mr. Boies determined to simplify it, and made a solid plate wheel, similar in shape to the old one, having corrugations.

Experimenting further, Colonel Boies, at last, settled upon a single-plate wheel to be specially forged, the tire put on so as to compress the wheel and fastened by two retaining rings. All of this he has done and yet has a complete steel-tired wheel having but two pieces

A quarter of a million dollars has been expended in an elaborate plant for the manufacture of this wheel and the company are now ready for business.

Our large engraving shows the immense steam hammer used for welding up and shaping the wheel centers, and the great crane that serves it.

Steam Hammer in Boies' Steel Wheel Works, Scranton, Pa

As can be seen, this crane is a hydraulic affair handled from the platform as shown. On the arm of this crane there is a "crab," a car running on wheels on the crane-arm. Below the frame of this crab there is a long projecting pair of claws that can be opened and closed horizontally. These claws are shown extending well up toward the anvil, they are pivoted on the frame of the crab in front and are opened and closed by a cylinder at the rear,—used just as the hand is with a pair of shears.

A man located on the crab can reach its claws into a furnace, seize upon a piece of metal of the proper weight, that is at a welding heat, withdraw it from the furnace and carry it to the hammer, placing it on the die. Here this immense hammer forces it into the shape shown by the car wheel centers standing against the hammer; all excess metal being forced out of the rim in a thin fin.

From the hammer the wheel blank is turned off on the outside and the tire put on; this is done by shrinking it on. The small engraving shows the form of the forged plate and very plainly illustrates the intregal tire lock, the last of Colonel Boies' inventions. There is a ring similar in form to the Mansel left on the inside edge of the wheel center and a proper groove cut for it in the tire; this ring is shown under the flange. The other ring is on the tire and has a lip extending under a recess turned in the edge of the wheel center. When the tire is on, the inside edge of this lip is forced up into this recess by a rolling process, which amounts to "spinning," as it expands the lip and makes it fill the cavity. This makes a fastening that the makers are willing to guarantee will prevent the separation of the tire from the center, even though a piece be broken entirely out. The beauty of the thing is in its simplicity, no bolts or rivets being used.

Fig. 1.

Fig. 2.

Fig. 3.

Fig. 1 shows the front of a finished center.

Fig. 2 the back of the same wheel.

Fig 3 shows the complete wheel, tire and all.

These wheel centers can be re-tired at any railroad shop, it only being necessary to cut off the retaining ring on the tire and then take the tire off.

As there is no wear on these centers there seems to be no reason why an investment in them would not be as permanent as in real estate Certainly, if they are not broken they can be re-tired repeatedly, until the oldest hand has forgotten when they were bought.

These wheels are much lighter than cast wheels and possess several times the strength.

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The Chicago & Alton recently put in service six ten-wheel engines from the Schenectady Works They have cylinders 19x24 inches, 70-inch driving wheels, carry 170 pounds of steam and weigh 160,000 pounds These are the first ten-wheelers the Alton have used and the heaviest engines they have. Before they were received some little apprehension was felt lest they should give trouble through journals heating in passenger service. On the contrary, however, the engines are running smoothly and no trouble is being experienced whatever. The journal bearings of these engines are fitted with Ajax metal.

## Train Running for the Confederacy.

By Carter S. Anderson

GOOSE-NECK COUPLINGS FOR WAR HISTORY COACHES.

Closing my last letter, we were rolling along that dark and rainy night about Frederickshall, with our ten trains of about twenty cars each, all loaded inside and outside with Jackson's soldiers going—none of us knew where—except that our orders were to go to Beaver Dam, which is forty miles from Richmond, and about twenty-five miles from where it might have been supposed some of General McClellan's men would be scouting. We got orders, just as soon as we pulled up to Beaver Dam, to unload and pull down east a mile or so, to allow the eight rear trains to come up to the station. This threw us down in the woods a mile and a half.

Just as soon as our next neighbor—the following train—came up to us, Engineer Whalley got his engine cooled and came on back to our caboose—a wet and muddy freight car. We were down side by side on the floor, and fast asleep sooner than I can write it down. Mortal was never happier than I was on being relieved of such responsibility. The sun was climbing up out of the tree-tops when we awoke. Being chilled from getting wet and the night air, we crawled up on top of the cars to dry and get warm, wondering what would be our next move. Whalley, my engineer, had no coat along, having thrown his in the firebox at Gordonville to get his engine hot. He had drank right freely of new brandy the past day and being thoroughly drenched with the rain he got chilled so that he trembled awfully. He said he believed he would go up to the station and try to get a dram from some of the officers, and hear what news he could. In half an hour or so he came on back. I took him to be a Confederate officer, but soon discovered that Whalley had on a Confederate brigadier's coat. "Promoted!" he bawled out as he pulled up. He had gotten a good big drink, and the officer happening to remember the circumstance of his being without a coat kindly gave him a really good Confederate officer's gray dress coat. He had it buttoned closely around his other wet and greasy clothes which made him a ridiculous sight.

"What news, John?"

"Plenty of it," he replied. "The men have orders to cook three days' rations, and prepare to march."

"Did you learn anything as to the direction they are going?"

"Not positively," he answered; "but I begin to think that they are going to get into this scrimmage about Richmond, because, when the officer gave me the coat, he remarked that where he was going it would be plenty hot without a coat."

Whalley had scarcely finished telling us this when we heard and soon saw the army moving along the County road, right along side the railroad, where the trains were standing. Conjectures fled, and the solution of the question as to where Jackson was going was solved. He was certainly on the Richmond road. The cavalry in front, artillery next, then the infantry, and some cavalry in the rear. Quietly, that is, no music, no shooting nor boisterous commands, but gleefully and cheerfully marched forward the whole of Jackson's command. Our soldiers loved to go and fight. It was camp that sickened and killed our boys. They longed to fight it out, and go home. They cursed each delay, and worshiped a dashing, daring leader. On, on they passed,

Some to Fame;
Many wounded on the field to lie.
A few to *Shame*,
But most and best of them to *Die!*

The goodbyes given them as they passed along, were mostly said forever.

In a few hours there remained not a sign of any army about Beaver Dam General Jackson left a respectful request for us not to sound the whistles until we got as far as Louisa Court House on our return. Being thus set free from military rule, we held a council and decided upon getting back to our superintendent at Charlottesville. We had not been to bed nor eaten a regular, decent meal for nearly a fortnight. At that time, here in Virginia, a soldier was everything, and a man who was not in the army stood a poor show indeed, so long as there were any soldiers to be attended to. We were near the point of starvation. The engineers decided to examine their engines before starting on the return trip, as the engines would all have to go to Gordonsville before they could be turned around. Tink, tink, tink, under or somewhere on every engine, could be heard the hammers and chisels. The engines had not been near a shop for a month or more, and it is a mystery now how those engineers did the work required to be done, and managed to keep their engines together.

It was arranged that returning the order of trains should be, "The last shall be first, and the first shall be last." This placed in front Conductor D. Pat Woodward and Engineer Westley Huntley, who ran the mountain climber, "C. R. Mason," a Roger engine, built to take four passenger coaches down and up a grade 360 feet to the mile, and was used between Millboro tunnel and Mason's tunnel, where the Lick Run fill now is. Her tender was on top of her, or rather on each side and on top. She had no truck, but was built on four small drivers, and when working waddled about and switched herself from side to side We had her at that time in service on the main line, as engines were so scarce. The tender on top was not sufficient to hold water enough to go from tank to tank, and Master Mechanic C. E. Wildman had attached to her a captured B. & O. tender. She was the laughing stock of the party. It was discovered by Engineer Huntley that the "Mason's" drivers were loose—a serious matter. Huntley hunted up Conductor Lex. Netherland, who usually carried along in his caboose from four to six tons of scrap, which he would pick up and say, "It will come in." Mr. Netherland had a barrel of charcoal and an old 20-gallon iron pot which was in those days used to hang on the rack and boil clothes in. He would build a coal fire in the pot, jab a piece of iron into it, and using a track rail for his anvil, would do a pretty good blacksmith job. Conductor Netherland soon had his shop in full blast for tightening the drivers on the "Mason" With the assistance of some of the older engineers, Huntley soon got her on her feet again and took the lead.

We found an office open at Frederickshall and reported to Col. H. D Whitcomb, at Charlottesville, who ordered us to come to Gordonsville and report. We had nothing to meet and no cause to hurry, so we jogged along, occasionally seeing the rear of the preceding train Passed Louisa, Trevilian, and struck out for Gordonsville. Our train had reached Forest Hill church, about one and a half miles from Melton, when we were flagged down.

"What's the matter ahead?"

Nobody could tell from the fact that everybody except the fireman on each train had gone ahead to find out just what caused the halt. Walking on ahead, we found the colored brakeman on the front train, which was standing with the engine at the tank at Melton, a water station four miles east of Gordonsville.

"What's the matter Tillman? Those drivers loose again?"

Tillman answered

"No, sir. Mars Pat and Mr. Huntley up dar at Harkless' shanty getting something to eat. Mr. Huntley done swore dat de "Mason' shall stand dar till the owls bull dar ness in her biler fore he'll tech her till he get something to eat."

We joined in "Amen!" Harkless was one of two men who pumped water at Melton, and Melton being a place out of the way, no army had ever camped there, and we very often stopped there and got Harkless to cook us something to eat. Harkless, who was a slave, had thereby accumulated a pretty good supply of ham, eggs, coffee, etc, and was patronized that day to his full capacity. Harkless had not sufficient table service to accommodate more than a crew or two at once, and the boys would eat and fall back. Never was royal banquet enjoyed as was that strong, hot coffee, ham and eggs, and hot ash-cakes, which Harkless baked on the large slate rocks of which the hearth was constructed.

We were about through eating, and getting ready oiling up, etc, to go ahead, when an old citizen came walking along down the track from Gordonsville, and as he came up to us, asked some of the men if they had heard the news.

"What news?"

"Why, the Yankees are expected in Gordonsville before night. They say they are now at Orange Court House, on their way to Gordonsville."

What on earth to do we did not know Engineer Ragland said he did not believe it, and would run his engine up there, or at any rate in sight, and see, but it was thought best not to run any engine nearer for fear they would find out about so many trains being there. Well, Ragland said that he would walk up there and see, and off he went, assuring us that he would be back soon if he did not get shot.

We waited and watched, until finding that the day was nearly gone, we walked on up to meet Ragland or somebody else. We found him about a mile from Melton, sitting on the end of a tie, as tight as a tick. We approached him, and earnestly begged him to tell us all about how it was at Gordonsville, but he imagined that he had told us, and would only reply that

"If you all know so much more than I do, it is no use for me to tell you. You can go up to Gordonsville and see for yourself, if you don't believe what I say"

We gave him up, and were about arranging to send another squad this time to find out the state of affairs at Gordonsville, when we saw some one coming rapidly walking down the track from toward Gordonsville, and soon recognized Mr. C. E Wildman, master mechanic

"What on earth is the matter with you all, boys? Col. Whitcomb is on his head, afraid you are all captured or wrecked. Where are your trains?"

We informed him, and also of the rumors we had heard. He told us that there was a rumor that Gen. Pope had crossed the Potomac and was operating toward the direction of Gordonsville, but there was no immediate danger, and that we should go on at once to Gordonsville and get orders to go right on to Charlottesville, which we did, and reached that place some time in the night.

Next morning we all went in a body and reported to our superintendent, Col. Whitcomb, who thanked and congratulated us, remarking, "that it was remarkable that not the slightest accident had occurred nor injury to any soldier, and that we could all rest that day, and that next morning he wanted the engineers to take their engines to Shadwell, where Mr. Wildman had erected a temporary shop, and give them an overhauling, to be in readiness for the next campaign." So we decided to order breakfast at the Exchange Hotel for the whole party, about thirty men. Conductors Finks and Nat Shepherd were appointed a committee to go up and arrange with the proprietor for a big breakfast, or whatever you might call it—it was early in the forenoon. By the time they got breakfast ready the most of the boys had drank their neighbor's health pretty freely, and a merry crowd it was, as we gathered around the perfectly white and clean table with the hot smoking scratchbacks, coffee and steak.

War is very demoralizing, and it did seem to me that the men forgot everything else on earth but just making the most of that jolly hour. One grind on the steak was enough to satisfy the most carniverous that she was tough Then began comparisons; anecdotes the most amusing and ridiculous, not to say any more. Captain D. Pat Woodward always was very touchy about any remark being made which would cast any reflection on what he was eating. He was out of the ring pretty soon and others followed. Finally, Conductor Nat Shepherd, who stammered miserably, raised the question "What sort of meat is this, boys?" Answers came quickly from all around the table Bull beef, calf, dog, mule, goat, wild boar. Nobody had any idea it was mutton. Shepherd bet it was mutton.

"Done," said Whalley, "here's ten dollars it is not."

Proof was called for by all. Shepherd held up a good chunk of the old ram on his fork, and, exhibiting to us a good bunch of wool, pulled in the money, remarking that he never saw that kind of hair grow on a calf.

Breakfast being over and paid for, we pulled for the rooms—the box cars.

"Let's go a-fishing,' met with no favorable response. I determined to go, and buying a small quantity of tackle, was soon on the banks of the muddy River Anna along where she seeks the shadows of Monticello to get herself in good shape before making her terminal flow into the James River.

I had scarcely a nibble; I studied the art of fishing, tried all sorts of bait, disliking so to go back empty-handed. I had gotten down opposite Jefferson's old Shadwell mills, hoping to find a hole where the fish would bite. I saw just ahead of me, under a bending willow, two little negro boys. As I came up to and made friends with them, I saw they were fishing, and they soon showed me how to do it Snatching out a good-sized "cat," the larger of the boys pulled out of the bushes to hang this one on a bunch of fish which weighed at least ten pounds. The idea struck me at once to buy them out They were soon made happy as to the trade, and giving them my hook and line, I struck out for Charlottesville "big as life."

I exposed my luck to the best of my ability, being determined that every railroad man should know of my success, even to our unsuspecting superintendent The fish were served for supper and my point was gained All hands were bent on going early and spending the next day on the River Anna Great preparations were made bread, frying-pans, a two-gallon jug of brandy, and abundant tackle

"Are you not going?" I was asked the next morning

"No," I replied, "yesterday was fishing enough to satisfy me for the season, go on, boys, and success attend your efforts."

They had planned a great fish-fry at old Shadwell Mills

I cannot describe the scene which appeared as those boys came along through the switches of Charlottesville yard, late in the afternoon, returning from their grand fishing excursion. Colonel Whitcomb had been let into the secret, and was so diverted from his usual dignity that the boys suspected me, and finally found it out. No power on earth could have kept us from laughing, but curses fell thicker and faster on me than ever before or after They threatened me all sorts of punishment.

Whilst we were thus trifling precious time away, great military movements were being brought into action around Richmond. Next day, through all Piedmont district—in fact, taking Richmond as the center, for about one hundred miles around—could be heard the thunder, low muttering, and now and then great blasts of artillery, under the command of Generals McClellan, Lee and Jackson.

The historian has the floor as to that Seven-Days' Fight, and I must continue my railroad narrative.

Flying rumors from Richmond were all

favorable to our side, and Colonel Whitcomb energetically set to work organizing a large carpenter force to rebuild the burnt bridges between Richmond, Fredericksburg and Potomac Junction and Richmond, resuming passenger service to Richmond, via the Richmond, Fredericksburg & Potomac from Junction, and transferring passengers and baggage over South Anna bridge to the trains which came up to the burned bridge from Richmond.

The travel increased daily on our road. That from the Southern roads to Richmond became enormous. The reports going out (exaggerated, of course) as to General McClellan's defeat, brought crowds to the city—refugees returning, parents to attend their wounded sons, and many sad ones seeking among the slain to recognize a lost brother or son—many times digging up from a two-foot grave their bodies to be carried home, to City Cemetery, or decently buried on the battle-field.

Being then baggage-master, my trip brought me to Richmond the night of the battle of Malvern Hill. After supper I strolled out into Capitol Square. It had been reported all the afternoon that General McClellan had been surrounded, and his whole army prisoners, but the way those war dogs barked on Malvern Hill convinced us all that it was not true.

Capitol Square was literally packed. I remember there were a large number of beautiful and nicely dressed ladies, many of them strangers in the city, and for three or four hours, it seems to me now, we remained there listening to the thundering, bursting and terrific cannonading on Malvern Hill that hot, clear and starry night. Next morning it was known that General McClellan had gotten under cover of his gunboats and was comparatively safe.

There was now no doubt as to General Pope moving in the direction of Gordonsville, and just as soon as General Lee could spare him he arranged to let General Jackson go to Gordonsville to meet General Pope, and President Edmond Fontaine and Superintendent Whitcomb were urged by the government to hurry the bridge so that the army could go directly back to Gordonsville in time to save, if possible, that very important military station. Then commenced a *hustle* indeed on the part of our railroad officers to connect the two ends of our road, get our machinery together, our engines to the shops, and to satisfy the great military pressure bearing on us for immediate transportation for Jackson's army to meet General Pope, who was pressing toward Gordonsville.

George F. Thomasson, the veteran bridge builder of Virginia and West Virginia, was at that time our master road carpenter and had full charge of rebuilding the bridges and trestling which General McClellan had destroyed between R., F. & P. Junction and Richmond. Acting under Superintendent Whitcomb's orders, he had organized a strong force of carpenters with work train, Conductor Horace Gooch, and a big force of laborers, a good engine and twenty flats to haul the timber, which was being prepared by a part of the carpenter force, whilst Mr. Thomasson and his best men were at the burned bridges removing the debris and preparing to rebuild. After the seven-days' fight a great pressure was brought to bear on Thomasson. Colonel Fontaine, who was as much concerned about the immediate transportation of troops as he was about his road, he being a strong Confederate, took matters into his own hands. He instructed Mr Thomasson to cut timber wherever he found it most convenient and suitable, that the patriotism of the people would allow this on account of the urgent necessities of the government for transportation.

George immediately threw a good force into the beautiful pine timber, about two miles east of South Anna, belonging to Mr William F. Wickham. Returning to the bridge he met Mr. Wickham walking down the track towards Hanover Court House, probably to get the news.

After speaking to Mr. Thomasson in his usual very polite manner, he halted to pass a few words in conversation with regard to the situation of things military and resuming business on the road. His quick ear soon caught the sound of the axes as whack, whack, whack, they very well imitated cavalry pistols.

"Gracious God! Mr. Thomasson, what do I hear," he remarked, as he straightened himself up, placing his hands on his sides, as he always did under excitement. "Is it not cavalry firing?"

"No, sir," answered Mr. Thomasson; "it is my men cutting pine piles to trestle South Anna bridge."

"In the name of God, Mr. Thomasson, by whose authority did you dare enter my premises?"

Mr. Thomasson told Mr Wickham that Col. Fontaine ordered him to do it, repeating to Mr. Wickham what Col. Fontaine had said about the patriotism of the people, etc.

Mr. Wickham snatched the word patriotism out of Mr. Thomasson's mouth with "Patriotism, hell!" and Mr. Thomasson says he never heard cursing put into such grammatical sentences nor such beautiful words as Mr. Wickham laid on him. Mr. Wickham used as fine English as any gentleman in Virginia at that time, and under strong provocation could cuss. Extremes politically met in Mr. W. F. Wickham, who was every inch an Old-Line Whig, and Col. Edmond Fontaine, who was a Democrat, a "red hot rebel."

How these two gentlemen made it with regard to the timber cutting I don't know, but Thomasson got the trees and built the bridges. Col. Fontaine went to another extreme in his eagerness to get his road open. He ordered Road Master William Richardson to bring at once every section-hand east of Gordonsville and let the foremen walk and watch their track.

Negroes soon got so thick around South Anna bridge that Mr. Thomasson ordered Reuben Woolfolk, a great negro preacher, to take them all, except such reliable men as he had selected from among the crowd, and go down on North Anna River banks, all in sight, and preach to them. Or they could fish, as they preferred. Mr. Richardson himself coming down next morning with another great crowd of them, Thomasson ran up some distance to meet him, and pointing over toward the crowd under the trees by the North Anna, he told Mr Richardson to hurry back to the Junction and send these men back; that those over there had made insurrection and were on their way to the Yankees.

No sooner said than done. The next morning Mr. Richardson came down and concluded that he believed it all happened for the best. The raw section-hands knew nothing about bridge building, and the carpenters were afraid to allow them on the bridge to any extent. Mr. Thomasson had the bridges and trestling all up, and Mr. Richardson had the track replaced where it was torn up in a remarkably short time, considering the extent of damage. The track in some places was actually turned over.

Just think of it. Those Northern soldiers would go on a moderate embankment, generally on a curve, and *raise up* the track until it would turn over completely, bottom-side up, and some parts of it setting up like a fence. They knew we were scarce of rails, and would pile up cross-ties, then lay the rails across the pile, set fire to it, and when the rails got red hot, seize them at both ends, with rail tongs, and twist them around the trees, leaving them looking like great snakes.

When the order came to haul Jackson's army to Gordonsville to meet General Pope about August 1, 1862, our road was open and we did not let anybody walk back, but gave them all a ride, and having gotten our rolling stock together, once more we had the pleasure of giving our soldiers rather better accommodations than we could when we brought them down.

## They Say They Will—Will They?

The daily papers of the 14th of September contained the following telegraphic dispatch "The wind blew a hurricane on the Penobscot Mountain last night. A heavy Jersey Central Railroad freight train was coming down the mountain. The violence of the wind drove the train ahead. The engineer could not control it. He whistled down brakes, but the brakemen thought the train was running away, and jumped from their posts. The engineer followed suit. The fireman, John Connors, climbed over the tender, and, mounting the box cars, put on the brakes. He brought the train to a stand-still after running six miles. The railroad company will reward Connors."

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Secretary Cloud of the Master Car Builders' Association has sent out a circular announcing the results of letter ballot. At the last meeting of the Master Car Builders' Association the proposal was made to change the wheel guarantee, making it a little more favorable to wheel makers. This proposal has been rejected. It was also proposed to adopt the form of coupler gauges recommended by the executive committee of the association. This recommendation has been adopted.

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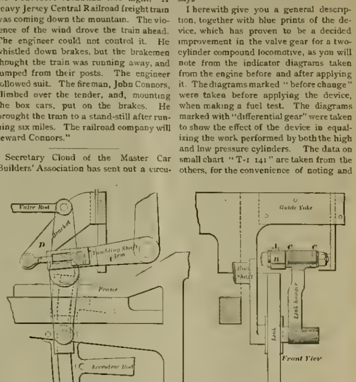
J. G. Butterfield having tendered his resignation as master machinist of the Sioux City, Iowa, shops of the C., M. & St. Paul, taking effect September 1st, Thomas Roope has been appointed to fill the vacancy. Mr. Roope has been an engineer on the Pacific Shore line for some years.

## Equalizer for Compound Cylinders.

The device shown in the annexed engraving was invented by Mr. T. W. Heintzelman, master mechanic of the Southern Pacific, at Sacramento. Mr. Heintzelman, writing about the invention, says:

I herewith give you a general description, together with blue prints of the device, which has proven to be a decided improvement in the valve gear for a two-cylinder compound locomotive, as you will note from the indicator diagrams taken from the engine before and after applying it. The diagrams marked "before change" were taken before applying the device, when making a fuel test. The diagrams marked with "differential gear" were taken to show the effect of the device in equalizing the work performed by both the high and low pressure cylinders. The data on small chart "T-1 141" are taken from the others, for the convenience of noting and comparing the difference in the figures between the two above-mentioned charts.



Elevation

Locomotive Engineering

You will note the device consists of an attachment to the ordinary link-valve gear and is so arranged to give a differential cut-off in the cylinders, thereby producing equal work for both sides of the two-cylinder compound at all points of cut-off, as we all have noted that with the ordinary link-valve gear, with both sides of the engine having equal cut-off in a two-cylinder compound, the work performed is very unequal at any point of cut-off after leaving full stroke, and the shorter the cut-off the more unequal the work, the effect of which is very detrimental to the efficient working of the engine and also using steam very uneconomically. Description of device as shown in engraving: The reverse shaft-arm *A*, is provided with slot of required length, into this slot the sliding block *B* is fitted, to this block is attached the top end of link hanger, also one end of radial-arm *C*, the other end of radial-arm *C* being attached to pin or bolt securely held to bracket *D*, which is bolted to guide yoke or any other convenient place.

Referring to the movement of radial-arm *C*, when the valve-gear is at full stroke either in forward or backing motion, the pin connection at top of link hanger is in same relative position that it

COMPARISON OF INDICATOR DIAGRAMS TAKEN WITH ORIGINAL VALVE GEAR, AND DIAGRAMS TAKEN AFTER ENGINE WAS EQUIPPED WITH DIFFERENTIAL VALVE GEAR.

*Data of Diagrams taken with original Valve Gear*

| | | | | |
|---|---|---|---|---|
| No of notch in quadrant | 1 | 2 | 7 | 8 |
| Cut off at | 21" | 22½" | 17⅛" | 15½" |
| Per cent of work done in H P cylinder | 40 87 | 41 94 | 42 87 | 22 1 |
| Pounds steam used per H P, per hour | 23 6 | 21 2 | 20 6 | 21 9 |

*Data of Diagrams taken with Differential Valve Gear.*

| | | | | | | |
|---|---|---|---|---|---|---|
| No of notch in quadrant | 1 | 2 | 3 | 6 | 7 | 8 |
| Cut off at (H P cylinder) | 23⅝ | 22¼" | 20⅝" | 15" | 12½" | 9⅞" |
| Cut off at (L P cylinder) | 23⅝ | 22⅞" | 21⅞" | 18½" | 17" | 13" |
| Difference between points of cut off | 0 | ⅝" | 1¼" | 3½" | 4½" | 3⅛" |
| Per cent of work done in H P cylinder | 41 15 | 43 18 | 41.64 | 46 38 | 45 04 | 49 08 |
| Pounds steam used per H P per hour | 23 20 | 21 03 | 20 60 | 18 28 | 19 13 | 19 01 |

Two Central car repairers, named John Klein and O. Dege, were instantly killed while at work in the "Cripple Yards" at East Buffalo, on September 21. They were under a car when a switch engine ran into it, and the two men were crushed. Three others escaped with slight injuries.

Watson & Stillman have found it necessary to run their hydraulic machinery works at 204-210 East Forty-third street, this city, both night and day to keep pace with their orders. The prospect for future business is very promising.

would be with a fixed link hanger pin in end of reverse shaft-arm, thus making the point of cut-off equal at full stroke for the forward and back motions, and as the link is lifted toward its center to produce a shorter cut-off, the sliding block *B* is moved to the radial arm *C*, inward toward the center of reverse shaft, the effect of which is to lift the link on the high-pressure side in advance of the link on the low-pressure side, increasing the ratio of difference in cut-off as the link approaches its center, the ratio of difference in the cut-off can be increased or decreased as is found necessary, by changing angle of reverse arm or the length of the radial arm *C*.

The expense of applying the device is very nominal as compared with the results obtained.

The device is fully covered by Letters Patent No. 471,253, and the writer will be pleased to give further particulars to any one interested in the invention.

The diagrams shown were taken from No. 367, a consolidation compound engine built at Schenectady for the Southern Pacific Company. The leading dimensions of the engine are

Diameter of high-pressure cylinder, 20 inches.

Diameter of low-pressure cylinder, 29 inches.

Stroke of piston, 26 inches.

Diameter of drivers, 51 inches.

Number of drivers, 8.

Weight on drivers, 109,750 pounds.

Weight of engine, loaded, 139,000 pounds.

Weight of tender, loaded, 71,800 pounds.

Heating surface, 1,884 square feet.

Grate surface, 30.80 square feet.

Outside lap of valve, high-pressure, ⅞ of an inch.

Outside lap of valve, low-pressure, ⅞ of an inches.

Inside lap of valve, high-pressure, ⅜ negative.

Inside lap of valve, low-pressure, ⅜ negative.

Lead of valves at full stroke, $\frac{1}{16}$ of an inch.

Size of steam ports, high-pressure cylinder, 1½×18 inches.

Size of steam ports, low-pressure cylinder, 1½×20 inches.

Size of exhaust ports, high-pressure cylinder, 3½×18 inches.

Size of exhaust ports, low-pressure cylinder, 3½×20 inches.

Area of exhaust nozzle (4⅝-inch), 19.6 square inches.

Table A gives particulars of the diagrams taken before the differential gear was applied.

During the round trip from Sacramento to Truckee, 239 miles, 5.9 pounds of water was evaporated to the pound of coal.

Table B gives particulars of the diagrams taken after the differential gear was applied.

TABLE A.—BEFORE THE APPLICATION OF NEW GEAR.

| | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Number of card | 1 | 1a | 2 | 2a | 3 | 3a | 6 | 6a | 7 | 7a | 8 | 8a |
| Cut off at | 23" | 23" | 22¼" | 20¼" | 20¼" | 20¼" | 19¼" | 19¼" | 17⅛" | 17⅛" | 15⅛" | 15¼" |
| Revolutions per minute | 60 | 60 | 90 | 90 | 90 | 90 | 130 | 130 | 156 | 156 | 210 | 219 |
| Piston speed, feet per minute | 260 | 260 | 390 | 390 | 390 | 390 | 520 | 520 | 676 | 676 | 910 | 910 |
| Velocity of train, miles per hour | 9.1 | 9.1 | 18.6 | 18.6 | 18.6 | 18.6 | 18.2 | 18.2 | 23.6 | 23.6 | 31.8 | 31.8 |
| Position of throttle | Full. | .. | Full. | ... | Full. | | Full. | | | Working | Throttle | |
| Boiler pressure | 155 | ...... | 160 | | 155 | | 158 | | 160 | ...... | 160 | ..... |
| M. E. P. in cylinder, both ends | 80.7 | 56.36 | 78.5 | 51.00 | 69.33 | 50.51 | 65.99 | 40.60 | 37.785 | 46.14 | 14.68 | 24.05 |
| I. H. power | 197.1 | 272.98 | 285.95 | 305.91 | 258.90 | 391.42 | 322.35 | 513.46 | 230.91 | 490.46 | 125.5 | 435.17 |
| Total I. H. power of engine | 470.06 | | 687.86 | | 645.41 | | 835.81 | | 720.37 | | 560.67 | |
| Pounds dry steam used per H. P. per hour | 23.632 | | 24.237 | | 20.972 | | 19.916 | | 20.631 | | 24.975 | |
| Total tractive power of engine (pounds) | 20,114 | | 18,726 | | 17,785 | | 17,215 | | 11,567 | | 6,505 | |
| M. E. P. on crosshead, 1 rev. (pounds) | 25,017 | 36,956 | 24,196 | 33,500 | 21,492 | 33,120 | 20,157 | 32,585 | 11,718 | 23,884 | 4,551 | 15,770 |
| Total M. E. P. on both crossheads, 1 rev. | 61,973 | | 57,696 | | 54,612 | | 53,042 | | 35,607 | | 20,321 | |
| Per cent. of work done in H. P. cylinder | 40.37 | | 41.94 | | 39.31 | | 38.57 | | 32.87 | | 22.4 | |

TABLE B.—AFTER THE APPLICATION OF NEW GEAR.

| | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| No. of card | 1 | 1a | 2 | 2a | 3 | 3a | 6 | 6a | 7 | 7a | 8 | 8a |
| Cut off at | 23⅝" | 23¾ | 22⅛" | 27⅝" | 21⅛" | 21⅞" | 15" | 18¼" | 12¼" | 17" | 9¾" | 15" |
| Revolutions per minute | 72 | ..... | 120 | . | 72 | . | 156 | | 150 | ..... | 150 | .. |
| Piston speed, feet (per minute) | 312 | ...... | 520 | | 312 | | 676 | | 650 | ... | 650 | |
| Velocity of train (miles per hour) | 10.92 | ....... | 18.21 | | 10.92 | | 23.67 | | 22.76 | .. | 22.76 | |
| Position of throttle | Full. | .. | Full. | | Full | | Full | | Full | | Full | .... |
| Boiler pressure | 150 | ..... | 150 | | 140 | | 155 | | 150 | ... | 140 | |
| M. E. P. in cylinder (both ends) | 85 | 57.464 | 72.593 | 45.16 | 75.8 | 60.22 | 55.393 | 41.308 | 43.605 | 25.148 | 33.187 | 16.276 |
| I. H. power | 349.127 | 356.246 | 351.608 | 466.613 | 222.163 | 311.338 | 351.706 | 408.242 | 266.34 | 324.764 | 202.642 | 210.206 |
| Total I. H. power of engine | 605.373 | | 821.221 | | 533.501 | | 760.008 | | 591.098 | | 412.848 | |
| Pounds dry steam used per H. P. per hour | 23.26 | | 24.08 | | 20.60 | | 18.28 | | 19.13 | | 19.04 | |
| Total tractive power of engine (pounds) | 20,780 | | 16,914 | | 18,318 | | 12,011 | | 9,738 | | 6,862 | |
| M. E. pressure on crossheads (pounds) | 26,350 | 37,680 | 22,504 | 29,612 | 23,498 | 32,930 | 17,172 | 10,929 | 13,517 | 16,488 | 10,288 | 10,672 |
| Total M. E. pressure on both crossheads | 64,030 | | 52,116 | | 56,428 | | 28,101 | | 30,005 | | 20,960 | |
| Per cent. of work done on H. P. cylinder | 41.15 | | 43.18 | | 41.64 | | 46.24 | | 45.04 | | 49.08 | |

One of the most crooked railways in the world is a little narrow-gauge running to Caracas, the capital of Venezuela. The distance in a direct line between the terminals is only 6 miles; but it takes 23 miles of track to get there.

---

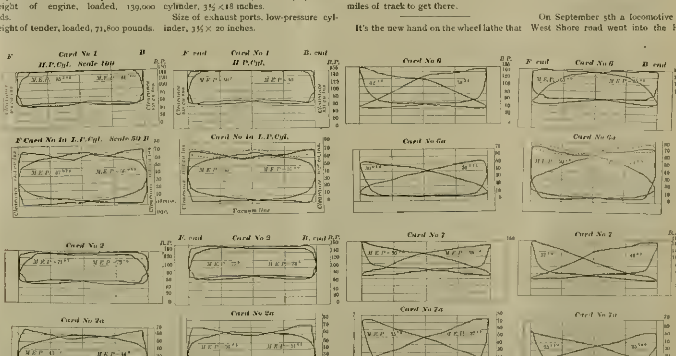
It's the new hand on the wheel lathe that turns up the rear pair of tires first and discovers, when he gets to the main pair, that they are worn more, and he hasn't taken off enough of the other pair, and must give them another cut. The old hand turns the main pair first. He never finds another pair of wheels on the same engine that are worn more.

The railway officers of India have devoted great attention to investigating the best material for axles. They have tried all kinds of steel and the best brands of iron. In a report recently made public the management of the Great Northern of India express the belief that steel axles for locomotives give better results than those made from the best Yorkshire iron.

---

On September 5th a locomotive on the West Shore road went into the Hudson River, killing the engineer and fireman. It is said the accident was caused by the slipping of a truck wheel upon the axle.

Now is the season of hustling for the car heater men. There is enough to do to keep them all busy if only they were put at it by the roads.



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### By J. G. A. MEYER, Esq.

(Associate Editor of *American Machinist*).

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| Chapter | III. | Valve Gear—Construction of Link. |
| Chapter | IV. | Construction of Pistons—Crossheads—Slides—Stuffing-boxes |
| Chapter | V. | Frames—Axle-boxes. |
| Chapter | VI. | Driving-axles—Driving-Wheels—Counterbalance. |
| Chapter | VII. | Main Rods—Side Rods—Crank-Pins. |
| Chapter | VIII. | Throttle-pipes—Throttle-valve gear—Safety-valves—Whistle—Pump—Checks. |
| Chapter | IX. | Spring Gear. |
| Chapter | X. | Boilers—Grate Surface—Heating Surface—Riveted Joint—Extension Front. |
| Chapter | XI. | Ash-pans—Smoke-stack—Exhaust-pipes. |
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**Northern Pacific has 117.**
**Phil. & Reading, 70.**
**Minneapolis, St. Paul & Sault Ste. Marie, 43.**
**Canadian Pacific, 48.**
**Great Northern, 15.**

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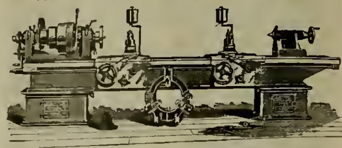

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## Building Railroads Without Capital.

We have had information repeatedly of railroads being built with remarkably little capital; but some personal reminiscence of Uriah Lott, recently published in the *Railway Review*, gets a little ahead of anything we had previously heard in this line. Our contemporary says

"He started out from Corpus Christi with $5 borrowed money and moved to San Antonio on a two-wheeled Mexican cart. He had been down on the Mexican National, driving a team, and finally he got a sub-contract while that road was building. After he got to San Antonio he set to work to get up a charter for the Aransas Pass Road, the project of which he conceived. He succeeded in getting interested with him the number and means necessary to procure a charter from the State, and without money they went to work and half-way graded about a mile of the road.

"Then Mr. Lott went to Palestine and he secured from Col. Eddy, receiver of the International & Great Northern Railway, enough scrap-iron to lay a mile of the track. After this was done he went back and bought with notes an old engine which I ran on the Texas & Pacific fifteen years ago and which had been laid up for scrap-iron six years before Mr. Lott bought it. He steamed into San Antonio with that old engine and two old cars, which he placed on his mile of track. The cars were painted with lamp black 'S. A. & A. P.' He managed to get some second-hand stuff which a street car company had bought from a narrow gauge road and with that he got down three more miles of track. He then made a trip to Pittsburgh and there he managed to make a trade with a steel mill for enough stuff to lay ten miles of track. When it was shipped into San Antonio he didn't have the money to pay the freight on it, but he got it out and placed it and then he bonded that section of the road for enough to carry it on forty miles, and that section was bonded, and so on until he had completed 600 or 700 miles of the road. He labored under difficulties which, in the hands of other men with less nerve, would have crushed the life out of the enterprise many times.

"I heard him say once that he undertook to ride from Chicago to San Antonio, without anything to eat. He was 'flat broke,' as railroad men say. He has got more grit than any man I ever knew and he did something that no other man has ever attempted—built 600 miles of railroad with hardly a dollar to begin with."

## Standard Sizes of Taps.

Mr. James Meehan, superintendent of motive power, C., N. O. & T. P. Railway (Queen & Crescent), has an admirable system of classifying standard taps and reamers for the purpose of uniformity and insuring to a certainty that all taps and reamers purchased from time to time shall be absolutely to standard. A blue print giving all the standards is lodged with the department originating a requisition and all along the line to the purchasing agent, and also with the manufacturer. It is obvious that all taps will be standard when all are ordered by this standard drawing. The drawing is headed:

Standard sizes of Hand and Machine Taps. *This sheet to be used in ordering Taps.*

Then follows drawings and specifications of dimensions as per sketch, which is taken at random from the nine drawings grouped on the sheet. At the end attention is called to the following directions:

Suggestions in ordering taps. Please state the following essential points:

The exact diameter—Threads per inch.

The shape of thread—If regular hand or machine taps are not wanted, give length over all and length of thread.

*For what they are intended:*

Hand Taps—Taper—plug or bottoming, new or old style.

Machine Nut Taps—Long or short thread.

Boiler Taps—Straight or taper.

Hob Taps—For solid or open dies, Sellers' or short shank.

Pipe Taps—Taper and straight, for hand or machine use.

Machine Screw Taps.

Taper Taps.

Pulley Taps—Give length over all.

Staybolt Taps—Give length over all of reamer and of thread.

Bit Brace Taps.

---

We have received from the Star Brass Manufacturing Company, Boston, a new illustrated catalogue of the goods they make, which embrace pressure and vacuum gauges, safety-valves and all sorts of attachments for steam boilers.

## Making Pipe Fittings.

The advantages gained by sub-division of labor and manufacturing by specially developed methods and appliances have given American workshops the power of producing finished articles better and cheaper than anything found elsewhere. We have never seen a better illustration of this tendency than what we found during a recent visit to the Stanley Flagg Co.'s works in Philadelphia. This firm started out on the manufacture of pipe fittings, such as unions, couplings and elbows, and they have built up a great industry in this contracted line. Railroad men are interested in the work done in this establishment principally from the fact that all the joints and elbows used in air-brake apparatus are made here. The air-brake fittings are made of steel and are so well made that the air-brake companies could not afford to make their own pipe fittings.

What strikes a visitor most forcibly in going through these shops is the quantity of special tools employed. The aim appears to be to have tools that will automatically perform all the operations to be done on the fittings. They have tools that face, bore and tap work, by successive automatic movements. One of the most ingenious tools I have ever seen has lately been introduced. It faces a joint and trues up the back of the flange at the same time. Extraordinary care is taken to make the fittings exactly alike so that interchangeability is absolute. The threads are all run over twice and then tried on a test gauge. To prevent the gauges from departing from the correct size, they are all tested once a week, and the least perceptible wear leads to their being changed. When joints are put up they are all carefully tested under pressure of air. No coupling or joint goes out of the works without going through this ordeal.

There is a soft-lined union made here that ought to be better known to railroad men than it is. A bushing of babbitt metal is squeezed into the mouth of the union and trued up to make a fitting joint with a similar bush on the other part of the union. The joint needs no grinding, and those who have used it say that it is always tight.

A. S.

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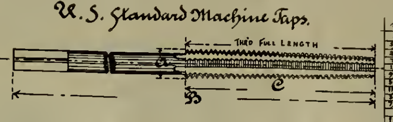
Correspondents must give us their true names, not necessarily for publication.




| A | B | C |
|---|---|---|
| 1/4" | 5" | 2" |
| 5/16 | 5½ | 2¼ |
| 3/8 | 7 | 2½ |
| 7/16 | 7½ | 2¾ |
| 1/2 | 8 | 3¼ |
| 9/16 | 8 | 3¼ |
| 5/8 | 9½ | 3½ |
| 11/16 | 9½ | 3½ |
| 3/4 | 10¼ | 4¼ |
| 7/8 | 11 | 4½ |
| 1" | 12 | 5 |
| 1⅛ | 13 | 5½ |
| 1¼ | 14 | 6 |
| 1⅜ | 15 | 7 |
| 1½ | 15 | 7 |
| 1⅝ | 16 | 7¼ |
| 1¾ | 17 | 7½ |
| 1⅞ | 18 | 7¾ |
| 2 | 19 | 8 |

## Performance of the Old Colony Compound.

The compound locomotive built by the Old Colony Railroad, which was illustrated in our July issue, is running regularly on the Fall River express trains, pulling from nine to twelve passenger cars. We are informed by Mr. Lauder, superintendent of motive power, that, up to a certain speed, the compound handles the trains rather better than the simple engines of similar capacity, but that she is not so efficient when the piston speed exceeds 1,000 feet per minute. The engine is doing so well, however, that her performance has decided the company to build another compound locomotive, with a view of thoroughly testing this type of engine. The new compound will be of the 8-wheel type, the same as the engine now in service, but the driving-wheels will be larger.

The engine is run against remarkably good simple engines, which makes the performance all the more creditable. Our readers will be interested in studying the comparative performance of the simple and compound engines shown in the above table.

### STATEMENT OF RESULT

*Of Tests of Simple Locomotives Nos. 148 and 229, and Compound Locomotive No. 232, on Fall River Line Steamboat Train between Boston and Fall River, on round trips (100 miles). Coal quantities include coal used for banking fire in Fall River over night.*

| No. of Locomotive | 148 | | | 229 | | | 232, Compound | | | 148 * | 232 * |
|---|---|---|---|---|---|---|---|---|---|---|---|
| Year | 1890. | | | 1890 | | | 1892 | | | 1890 | 1892. |
| Date | Sept. 30–Oct 1. | Oct 1-2. | Oct. 2-3 | Oct 5-6. | Oct. 6-7. | Oct. 11-12. | May 31–June 1 | June 1-2 | June 2-3 | Nov. 17 | May 22. |
| Number of cars South | 11 | 11 | 11 | 12 | 11 | 10 | 12 | 11 | 11 | 12 | 12 |
| " " North | 9 | 9 | 10 | 9 | 9 | 9 | 11 | 10 | 10 | 12 | 12 |
| | S N | S. N. | S N | S. N | S N. | S N. | S N. | S N | S N | S N | S N. |
| Weight of train in tons (2,000 lbs.), including engine tender, passenger and freight | 477—399 | 477—399 | 479—433 | 479—433 | 477—390 | 443—397 | 542—460 | 491—450 | 498—436 | 457—457 | 476—476 |
| Weight of train in tons (2,000 lbs.), excluding engine and tender | 398—318 | 398—318 | 398—352 | 398—352 | 398—318 | 362—316 | 450—367 | 398—379 | 396—344 | 376—376 | 391—391 |
| Equivalent number of cars of 33 tons each | 12 0—9 64 | 12 0—9 64 | 12 1—10.6 | 12.1—10 6 | 12 0—9 64 | 11 0—9 6 | 13 6—12 1 | 12 0—10 9 | 12 0—10 4 | 11 39—11 39 | 11 65—11 65 |
| Time during which power was developed—minutes | 70¾—61¼ | 78½—74¼ | 74¾—71½ | 63—69¼ | 71½—67½ | 68—69 | 69¾—68 | 67¾—60½ | 72¾—72 | 61½—62 | 57½—61 |
| Aggregate intermediate stops—minutes | 0¼—0 | 6—0 | 0—0 | 0—0 | 0—0 | 0—0 | 0—0 | 0—2 | 23¼—3½ | 0—1 | 0—0 |
| Schedule time in motion | 80—80 | ... | ... | ... | ... | ... | 85—85 | ... | ... | ... | ... |
| Actual " " | 80—80 | 89—84 | 94—85 | 86—80 | 85—78 | 83—79 | 82½—84¼ | 84—82½ | 96½—89¾ | 65½—61½ | 68¾—69¼ |
| Time made up—minutes | 1¼—0 | 0—0 | 0—0 | 0—0 | 0—3 | 0—1 | 2½—¾ | 1—2½ | 0—0 | 0—0 | 0—0 |
| Average speed—miles per hour | 34 9—37.5 | 33 7—35.7 | 31.0—33 3 | 34 9—37 5 | 35 3—38 5 | 30 1—37 9 | 36 8—35 6 | 35 7—40 3 | 33 1—33 4 | 40 4—40 5 | 40 1—38 1 |
| Maximum boiler pressure, by gauge | 162 | 150 | 160 | 160 | 160 | 160 | 185 | 191 | 191 | 180—178 | 185—188 |
| Minimum " " | 128 | 121 | 124 | 130 | 120 | 130 | 131 | 165 | 161 | 120—128 | 165—150 |
| Average " " | 150 | 150 | 150 | 153 | 158 | 150 | 177 | 182 | 185 | 160 1 | 177 0 |
| Actual weight of coal used | 6,753 | 6 256 | 6,407 | 6,897 | 6,712 | 6,676 | 5,390 | 4,880 | 4,685 | 7 455 | 5 217 |
| Number of miles run per ton (2,000 lbs.) of coal | 29 6 | 31 9 | 31 2 | 29 0 | 29 8 | 29.9 | 37 1 | 40 9 | 42 7 | 26 8 | 38 8 |
| Number of pounds of coal used per mile | 67 5 | 62 5 | 64 0 | 68 9 | 67.1 | 66 7 | 58 9 | 48 8 | 46 8 | 84 7 | 59 2 |
| " " " " car mile | 6 24 | 5.78 | 5 64 | 6.07 | 6.21 | 6 50 | 4.21 | 4 26 | 4 18 | 7 14 | 5 08 |
| Number of pounds of coal used per ton of train, per 100 miles | 18 9 | 17.5 | 17.1 | 16 4 | 16 8 | 16 7 | 12.7 | 12 0 | 12.6 | 22 52 | 15 42 |
| Number of pounds of coal used per ton of train, per 100 miles, including the locomotive and tender | 15 4 | 14 3 | 14 1 | 15.1 | 16 0 | 16 9 | 10 4 | 10 4 | 10.1 | 18 5 | 12 4 |
| Average number of pounds of coal, per ton of train, per 100 miles | ...... | 17 83 | ..... | ...... | 16.97 | . | ........ | 12.7 | | | |
| Saving of No. 232 of pounds of coal, per ton of train, per 100 miles | ...... | 28 7% | ..... | ......... | 33.1% | ...... | ... | .. | | 31 5% | |
| Average saving of No. 232 over both engines | | 30 9% | . | ......... | .... | ...... | ... | . | .. | | ......... |

* Two special test trips, twelve cars each day, between Boston and Providence.

NOTE. Minimum steam pressure readings were taken when approaching terminal stations and were intentionally low.

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At 12.26, on the morning of September 20, a car load of powder in transit over the New York & New England road exploded while the train was in motion, between New Hartford and Winston, Connecticut. Two brakemen were severely injured and twelve cars were wrecked.


## A Lesson in Physics.

Talking of liars who invent their tales or what they suppose to be truth, reminds me of an old plug-puller on our road," said General Foreman McDuff, of the C. B. & N., as he changed his seat to get away from the dazzle of Jim Brady's scarf-pin and the smell of Charley Barnard's cigarette.

'Puffy' and the stove committee were deep in an argument about the weight of a new engine that had just come off the scales.

"'I'm a tellin' ye,' says he, 'I'm a tellin' ye that the 'hole thing depends on what the engineer is a doin' when the engine is weighed. Why, here is that old nineteen, don't claim to weigh more'en seventeen ton, and didn't she break down the big bridge over the Cedar? Well, I should say so!'

"'Now, boys, I don't know much, and believe nothin' I hear told, but when I *see a thing with my two eyes*, why, then I know it. Now, one time when I was on the St. Paul, me and the master mechanic got into a jawin' match about the weight on the front trucks of my engine—the hubs was forever gettin' hot. I contendin' that she got hot when the engine was workin' hard and cooled off when running down hill, and the master mechanic sayin' it was 'cause she was too heavy on her truck.

"'Well, the long and the short of it was he said we'd weigh her, and I said he couldn't tell nothin' by that, but he kinder sneered at me.

"'I run her out onto the scales, and she weighed 96,000 to a T. Now,' says he, 'jest back her drivers off and I'll weigh her trucks.

"'I backed her off, put the brake on the tank, stood the reverse lever in the center and pulled her wide open. Jest *slammed the hull boiler pressure right onto ther valves*, and say!—they cudden't find weights enough around them scales to weigh her!'"

Here the president of the club rose gravely, cleared his throat, and said "I trust our visitor will be the bearer of a letter to this gifted young amateur—the secretary will please inclose a free, full membership. We recognize an artist when we see or hear of one, and I trust a little cultivation of this now uncouth engineer, will develop him into a liar worthy to be at the head of this association—who'se got a match?"

## A Plugged Up Vacuum.

"Talk about havin' a 'pull' in politics," said the Old Timer, "a politics pull aint nothin' to a pull with the chief engineer on a road just bein' built.

"Out at the F—— Oh! you needn't yell *chestnuts*. Out at the—er—well, when we was a buildin' into Salt Lake, we had an old plug-puller as had a pull with the chief engineer—they both took the same brand of gin-fiz.

"Well, old Uncle Dan he had his say when new engineers come over to the end—they was under the chief engineer—and it so happened that he got most of 'em their jobs, and a dandy lot of galoots they was, too.

"Uncle Dan recommended a Dutchman once that use to fire for him before the flood; he'd been running an old pelter up around some Pennsylvania coal mine for ten years or better.

"Dutchy Fritz was a good feller enough, but he wan't just up to modern improvements and he'd never seen an injector in his life.

"He went over the unaccepted tail of the line with Uncle Dan to learn the road and then was given a 'hog' to double head to the front with a train of steel.

"It was cold weather, and as the engines stood out, the hostlers had the heaters on and Fritz couldn't get his Monitor to sling a drop of juice—the overflow-valve was screwed down.

"Hank Johns—biggest devil that ever lived for the fun of the thing—go without his dinner to get a sell on you—was behind Fritz and got onto his trouble at sight.

"When the water was flutterin' around the middle spicket, Fritz, he put on the wind-jam, stopped, and come back.

"'Mister Shons, you know off dose inchectors already?' he asked.

"'Oh, sorter so-so. I kin make 'em go, ginnerally,' says Hank, gettin' down and going over ahead.

"He got up in the cab and Fritz followed close to see how he operated. Hank looked wise at the squirt, put his ear down to it and said

"'Get me a cupple of broom straws, stranger.' Fritz stepped back into the gangway to make a raise of the straws and Hank lifted the overflow-valve slyly. He gravely measured the straws on his finger, broke 'em off and slipping them up the overflow wiggled 'em back and forward a few times and then primed and started the injector.

"'How you do dot, Mister Shons?' asked Fritz.

"'Didn't nobody put you onto this bad water?'

"'Yes, 'Tan dold me to look oud if he tond foam.'

"'Yes, but it stops up the vacuum, just like nicotine does a pipe stem. You take a broom straw just the right length and clean out that vacuum before you try to start that squirt and you won't have no trouble, but if I was you I'd go to Alick when you get back to the Junction and kick for a new vacuum, it's a shame to send out an old worn-out vacuum like that.'

"Fritz used the straws regular the whole trip and when he got to the base of supplies demanded a new *waccum*.

"Hank Johns got the hiccoughs from laffin' and liked to choked hisself to death."

## A Dangerous Man.

Once upon a time, away out in the wild and woolly West, there was a town where the colored folks did congregate and have dances and camp-meetings and Sunday-school picnics.

The management of the smoked Sunday-school decided to hold the annual picnic at the Grand Cañon of the Arkansas one year, and to that end chartered a train to be pulled by a dare-devil plug-puller by the name of Walker—John Walker—and he isn't dead yet, either.

The road from this town to the wonderful cañon was, at that time, as crooked as the little stream it followed and about as rough as a corduroy road. The track was narrow gauge—and the train no wider.

While the dusky crowd were packing themselves into the coaches on the fateful picnic day, and balancing the precious baskets of cold hen and watermelon pie out of harm's way, an old, gray-headed sage known as "Uncle" went up to take a look at the neat little engine trimmed up in red, white and blue, with an evergreen shield over her boiler front with the symbols "A. M. E. C. S." thereon, and John Walker, long, lanky, Tar Heel, dropping a little "fluid slipricator," as he called it, on the working parts.

"Dat's de finest little ingin I eber see in my bo'n days, sho' as you lib," mused Uncle to himself.

"Hello, Pharaoh!" said Walker, good-naturedly, "what the devil does these letters mean here?"

Uncle took a look at the shield, put on his specs, and said "I don't 'zactly read dat kind ob writin', but I done 'spec, sir, dat mean Affrickin Meffodis 'Piskopal Cheerch, Souf.'"

"South, hey; south of what?"

"Souf? Sho' I don't know, sir, lessen it's souf ob de Lo'd. I reckon we get used to sayin' souf endurin' de slabe days an' done forget to cut it orf."

"Did you ever see the inside of one of these things, Uncle?" asked the spider, smiling as he wiped off his can.

"Bress you, sir, I neber done hab de chance."

"Well, just get up and take a look."

Old Uncle got up. Walker told him kindly what all the parts were for.

"Dat 'er a wonderfullest ting yet, Mistah, Mistah——"

"Walker."

"Wakker, Mistah Wakker, yessir. What de good Lo'd gwine to do nex' done mak' men crazzy—I tink mebby dey hab wings, leastwise de white men hab wings, den dey gib de steam kayrs to de niggah Den I be de ingineer, Mistah Wakker, you, you flyin' round like er big red-hedded woodpecker, yah, yah!"

"Jest set up on that seat and take a ride with me, Uncle I've taken a likin' to you, nobody but the Ginneral Superintendent ever gets to ride on this engine, but you just git up there and you'll have the best ride of the party."

Old Uncle got upon the fireman's seat, not, however, without some misgivings and many anxious looks at the many cocks and valves so close to him. At last orders came, the bell rang, the dapper new conductor shouted "All aboard," and they were off.

There was a mischievous smile on Walker's face as he read the order and handed it to the fireman.

"Run to Cañon City as fast as consistent with safety, regardless of all trains."

That's what the smoke-shoveler read with a leer, for he knew that such an order meant to Walker to run as fast as the gallant little scrap could turn a wheel.

Old Uncle was chilly as the steam hissed from the cylinder cocks as they got under way and narrowly watched Walker as he handled the levers and hooked her up as she gained speed. Walker got his head outside the window, where he could see the old man through the glass, and let her out.

As the fireman let up for a minute, old Uncle put his hands up to his mouth and yelled

"Tell Mistah Wakker I done wanter go inter de kayrs."

"I dassent," said the tormentor, "you know he's kinder crazy when he hears the steam a sizzin'. You mussent speak to him till he stops."

After the next fire old Uncle asked

"Kin I git off at de first stoppin' place?"

"Oh, yes, 'course!"

"Whar am dat?"

"Cañon City."

"For de Lo'd—we nebber git dar alibe. Mistah Wakker! Mistah Wakker!"

Don't," urged the fireman, as Walker tugged at the lever, blew the whistle and yelled at the fireman, "don't, it makes him worse."

After this Uncle held on to the cab brace and only groaned when the little engine rolled from side to side and bounded over the rails.

But all things come to an end sometime, and while "Mistah Wakker" and his fireman were having the most fun, they had to stop at Cañon, forty miles away. The minute the engine was stopped old Uncle hit the grit, and without as much as "thank you" made for the "kayrs."

The next year the "A. M. E. C. S." had another excursion. The cars were ready, the crowd happy and the engine decorated as usual, when an observer might have seen old Uncle slowly wending his way up the station platform leading a little boy by the hand and "toting" a basket of lunch.

"No, honey, I aint bot' de teckets yit, an' I aint got on de kayrs. I done gotter see who dat on de steam kayr, lessen it's one man, den we go all honkey, bress yo' little hea't, lessen it's dat crazzy loontic, Mistah John Wakker, den——"

Uncle was walking back, the boy crying pitifully.

"Den didn't I tole you, chile, dat if de crazzy man done 'lowed to run dat ingin we des go down an' fish kats in de ribber? Yo' ole uncle kno' all about dat man. Didn't yo' see his eye, honey? He wild crazzy when he heer de steem, like fire in de powder ho'n. Didn't yo' ole uncle done ride wid him last yeah? Didn't he go like de berry ole debbel atter him wid er club? Didn't we dodge all 'round de telegraff poles and outten in among dem little kottenwoods? Wozzent he offen de trac' 'mos' haff de time? Den when yo' ole uncle done 'spos'ulate wid him didn't he keeper urgin' on de ingin all de fasser? Mebbe nex' yeer, honey, mebbe we go den. For lissen what I'se tellin', dat Mistah John Wakker, de loontic, he gwine to run dat 'ere ingin in de kreek one ob dese days an' den he gwine to kill a whol' passul of peepel. Yo' old uncle aint gwine to be dar if he kno' hisself—an' he reccon he do!"

## Washers Ought to Wash.

A daily paper gravely announces as though it were an important piece of news, that

"A new combination washer and nut lock for railroad use has recently proved itself very useful. The nut can be released or tightened up with the greatest ease, and the washer can be rinsed frequently."

It is, of course, of the utmost importance that the washers used with lock nuts should be arranged so that they can be rinsed frequently. The writer or "condenser" of that item knew, of course, that the duty of a washer was to wash things that needed washing (probably in this case Pullman towels and pillow-cases), and in order to do this work effectually it must, of course, be rinsed out occasionally to remove sediment and keep it in good working condition. Hereafter we hope no inventor of a lock nut and washer will think of trying to impose on the public with a washer which cannot be rinsed as often as necessary.—*American Machinist*

Railroad Jack, the great American canine traveler, famed among railroad express messengers, has just completed a tour of the continent. He visited all the large cities of the West, and as far south as Havana, Cuba. He travels in the express cars under the guidance of the messengers, who are fast friends of his. With him he brought a large crate containing a collection of curiosities gathered on his trip.

The monthly list issued by Spon & Chamberlain just to hand, contains a great many books that are of interest to the railroad and engineering fraternity. Parties interested should send for this catalogue.


(93) A. B. C., Sherbroke, Can., asks Will you tell me why an engine will wear inside of stack more in the back than in the front? *A.*—This occurs only when something directs the blast against the part that is worn the most; a crooked nozzle or misplaced draft-pipe will do it.

(94) N. B. T., Graham, Mo., asks · 1st. How old must a person be to get a position as fireman? *A.*—Depends on rule of road; generally eighteen to twenty-five years. 2d How long will he have to fire before promotion *A.*—Much depends on himself and the rules of the road; from three to six years. 3d. Will he have to brake first? *A.*—No.

(95) E. B. B., Mussel's Canal, Ala., asks

Suppose an axle has wheels on the end 5 feet in diameter, and a wheel 12 inches in diameter is put in the middle of the axle and keyed on. Now, if three rails be employed and the middle rail raised to have the wheel bear on it, will the small wheel have to slide or slip to keep up with the large ones? *A.*—Certainly.

(96) S. D. W., Columbus, Ga., says:

What is the rule for finding required dimensions of a locomotive slide-valve, outside and inside lap and exhaust cavity when travel of valve, openings, etc., are known? Also, why is "saddle-pin" placed out of center on links, and give some rule for same. *A.*—These questions call for more information than we can give in this column. The information can be readily obtained by the study of Auchincloss on valve-gears, or in the chapters relating to valve motion in "Sinclair's Locomotive Engine Running."

(97) J. C. E., Palace, Mo., writes.

1. Is there any single-cylinder reciprocating steam engine in use that does not stop on the dead center? *A.*—Many single-cylinder engines have an arrangement of center balance weights which keep them from stopping on the dead center. 2. Has the Corliss valve gear ever been applied to locomotives with success? If not, why not? *A.*—The Corliss gear has been repeatedly applied to locomotives but without success. The first element of weakness is too many parts. the second, that the closing valve is not positive and is not adapted to the high speed of locomotives.

(98). A. B. M., East Las Vegas, N. M., asks two questions and answers them. He says·

1. Will some of your readers explain defect in valve-gear which causes two long exhausts from one side of locomotive and two short from the other side? He answers One side has more lead than the other, or the links are of different radius. *A.*—To this we would add that the link hanger on one side is probably longer than on the other. 2. What protects the top of flues in an upright boiler? He answers There is no combustion on top of flues, only conducted heat, which does not burn iron or steel. *A.*—We would add that makers of upright boilers take care to see that the flues are long enough to absorb the greater part of the heat from the furnace. If the heat getting to the top was very intense, it would burn the sheets, no matter what way it was conveyed.

(99) Machinist, Frankfort, New York, writes·

Suppose in going over the cut of a locomotive we find a valve on the right side cutting off at one end of the stroke at 5 and at the other end at 6 inches; and the left side at 6 and 7 inches respectively. How shall we proceed to right this wrong, the travel having been found correct at the beginning, or the same on both sides of the engine? *A.*—The usual way to remedy this is to set the valves by the cut-off, making them as square as possible at the point where the engine does the most work. The defect may arise from so many different causes that the correct remedies are various. Worn eccentrics, worn links or blocks, the lifting-shaft out of the proper place, the point of suspension wrong, are all defects that will throw out the cut-off, and each must have its own remedy.

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Chief Smith of the Department of Transportation has secured the promise of two monster locomotives to adorn the entrance to the Railway World's Fair passenger station, inside Jackson Park The Rogers locomotive works have agreed to furnish one and the Brooks company the other. Each locomotive will weigh 160,000 pounds, and be mounted on a pedestal. They will stand one on each side of the main entrance.

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## The Cause of Mysterious Fires.

Railroad companies are great sufferers from the burning down of repair shops. To not a few companies a big fire is a blessing in disguise and gives the opportunity of disposing of worn-out tools to the best advantage, but we do not believe that the officers of any railroad that has lost a shop lately failed to do the best they knew how to prevent fires. Much has been written of late years about the causes of fires, but many of the men whose duty it is to make provisions against the accidental starting of fires are extremely slow to learn the sources of danger The natural inference when a mysterious fire happens is that some one has thrown a match upon some inflammable material, and that it has smoldered for a time and then broken out into flame when no one was about to extinguish the incipient fire They issue edicts against smoking and against the use of matches in the shop, but they fail to comprehend that there are other ways of kindling fires besides the using of matches.

There are many substances used about shops that are very ready to take fire of their own accord under favorable conditions. Greasy waste is one of these and its danger is seldom appreciated. Many other substances when exposed to the air in a moist condition generate heat and will reach the igniting point if not checked. Some of the materials used in paint shops are extremely liable to generate heat sufficient to cause spontaneous combustion, and constant care is necessary to restrain this source of danger. If the men in charge would make themselves informed on what combinations are liable to cause spontaneous generation of heat there would be a likelihood of this source of danger being restrained. The diffusion of more knowledge on the subject is badly needed at present.

## Hints and Facts for Enginemen —Some Old Pointers in New Words.

By Clinton B. Conger.

The following ideas are old to many of us. Sometimes an old idea in a new dress will catch a man in a new place, so he will get to thinking over it. Most of us do not think and study enough.

Setting eccentrics on the road will be new work to men who have been brought up on a road where the eccentrics are properly keyed on the axle, so they can not slip around out of place; but there are still a great many engines running with set screws only, or set screws bearing on top of toothed feathers to hold the eccentrics in place. These last ways were good enough in old days when a 16 x 24 was a large engine, 125 pounds a heavy pressure of steam and forty miles an hour a very high rate of speed. It won't do with 18 x 24 cylinders, 60-ton engines, carrying 180 pounds of steam and running 50 or 60 miles an hour as soon after starting as they can attain that speed. There is the same good reason for fastening the eccentric cams on securely that there is for any other part of the engine which has only one correct place to be fixed.

It does no good to have them so they will slip when they get hot, as they only make a few turns before they seize fast on the axle and something has to break. It might as well break the first turn as the last, it will break anyhow if it gets hot enough. Where the eccentrics are fastened by set screws only, the strain of the screws is liable to crack the cam, break the bolts that hold it together if it is put on in halves, or twist it out of true with the axle or strap; so it runs hot and invites the very trouble you wish to avoid. When they are keyed on solid with a key let into the axle they come square, as the strain holds them square.

In the first place, sometimes it is quite a trick to find out that an eccentric has slipped. The sound of the exhaust will change suddenly, and instead of the beats being spaced evenly, thus, 1, 2, 3, 4, they will come 1, 2—3, 4 Of course there are other changes in the engine that will make the exhaust sound as if an eccentric was slipped. Some engines with double nozzles have bushings in them to make the exhaust sharper, if *one* of these bushings blows out, the exhaust from that side will sound much softer than the other and is apt to deceive even an old head. When this happens the engine will pull and run just as free, but does not always steam as good. With one slipped eccentric she will be square working one way; with a bushing out she will sound out of square when running either way. When the bolt holes in eccentric strap where blade is fastened on are all slotted, if the bolts work loose so the blade slips a little each stroke, the exhaust will sound something like a slipped eccentric. Occasionally a tumbling shaft will get sprung and the exhaust will be affected thereby, but the engine will be nearly square, working down in the corner. If the bolts that hold the two parts of the eccentric strap together get loose, or one breaks, it will make the exhaust uneven. There will be more lost motion on that side of the engine than the other, and lost motion takes off just so much of the lead. When an eccentric works back around the axle it takes off the lead on that side, when it works ahead or slips back nearly a full turn around the axle, it increases it.

We will conclude that you have noticed something wrong with the sound of the exhaust and the engine is not able to handle her train properly, that you have stopped at a station *inside the switches* or on a straight piece of track where following trains will have a good chance to see your flagman and get stopped, and that you have got down to find what is wrong. Feel of the eccentrics the first thing, if one of them is hot the trouble is likely there, although I have seen a hot eccentric caused by a valve commencing to cut the seat bad, so she was blowing through under it, making the exhaust uneven. Look over all the bolts and connections from the axle clear to the valve-stem, see if any have worked loose. If she is standing on the center the bolts through the link and eccentric rods on that side should be exactly perpendicular with each other when the lever is in the center. If they are not, look for the trouble on that side. When an engine stands on the exact center she should let steam out of the cylinder cock in the end of the cylinder, where the piston is, whether hooked clear down forward or clear back, if she does not trouble can be easily located.

If the valve yoke is broken the valve will be pushed to the front end of steam chest and cover the forward steam port, sometimes uncovering the exhaust port so steam will blow through the exhaust or out of the back cylinder cock only, no matter to what point you move the lever or in what part of the stroke that side of the engine stands.

If you find out right off an eccentric cam is slipped and which one it is, there are several ways of setting it.

By the marks on cam and axle, when there are any. That does very well if you are sure about the marks, but you can not put any marks on the axle for the cam next the driving box. If you know no other way of setting them right but by marks made when cams are in their proper places, before you go out with an engine place her near the forward center so all the cams will be handy to get at, put the reverse lever in the corner, mark across one of the cross-heads and the guides and across the eccentric cams and the straps where it can be seen easily, say the joints in the straps, and when the engine is placed in the same position the marks on all four eccentrics and straps should come exactly together again, if one set does not, move it around till it does. That is an old woman's way of doing business, however, and you are apt to get left at it, as the eccentrics and motion work will not all wear just alike, or some one may make some more marks for you

By the cylinder cocks. This requires that the engine be placed on the exact center on the disabled side. There are several tests for showing when the engine is on the center, some men can place them on the center by noting the position of the side rod when passing the center and having the center of the rod come just opposite the center of the axle; that is, have the middle or center mark in the axle and the center mark in the crank pin in that wheel the same perpendicular distance from the rail. Hook the reverse lever clear in the corner for the eccentric that is slipped and turn it in such a direction as to make the link nearly plumb, both cams about the same distance from the crank pin, and have a little steam come out of the cylinder cock under the piston, which shows that she is taking steam in the same end of the cylinder the piston is beginning its stroke from, and at the proper point, viz. just at the moment of passing the center

By the valve stem. This requires the engine to be on the exact center, as the position of the valve in relation to the good eccentric is used as a guide to set the slipped one. If the eccentric that is not slipped is not just exactly right this method doubles the error and when you get through she will not be square. Some engines have more lead on the back motion than forward. It is done purposely to give a wider port opening when hooked up close, as with lever in the 6-inch notch the cut off will probably not take place till 10 inches or more, which makes them stronger in 6 inches than if both cams had the same position for equal lead. To set by the valve-stem, after placing the engine on the exact center, if the forward motion eccentric is slipped, put the reverse lever clear in back and make a scratch mark on the valve-stem at the end of gland Then hook her in the forward corner and turn the eccentric till this mark comes to the end of gland again.

(*Continued in next number*)

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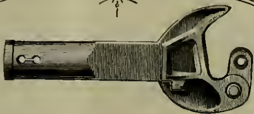

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VOL. V, No. 11. NEW YORK, NOVEMBER, 1892. PRICE, 20 Cts. Monthly. $2.00 per Year.



## The New York Central's Latest Express Locomotive.

The success of the "870" class of American locomotives, having six foot six-inch wheels, on the fastest train in America—the Empire State express—has induced Mr Buchanan to go a little farther, and try and do a little better.

His very latest is the "903," a magnificent eight-wheeler having wheels 7 feet, 3½ inches in diameter.

The "903" is not otherwise unlike the now famous "870" class, having the same sized cylinders, 19 x 24.

She weighs 120,000 pounds, carrying 80,000 of it on her drivers.

She has a 58-inch boiler, wagon top, with a grate 96 x 40⅞ inches and 268 2-inch flues 12 feet long, a grate surface of 27.35 square feet, and heating surface of 1,851.30 square feet. Pressure 180.

The tender carries 3,500 gallons of water and 13,750 pounds of coal, weighing ready for the road 80,000 pounds.

The boiler of the "903" stands very high, a man of ordinary height can stand under it, the center being 8 feet and 11 inches from the rail.

Our engraving shows Mr. William Buchanan himself standing by the rear driver, while the gentleman in front is Arthur G Leonard, assistant to the third vice president, for years Mr. Buchanan's secretary. The "903" is only two inches lower than the tunnels and bridge roofs. She was built by the Schenectady Locomotive Works.

One of the engineers standing in a circle of "the boys" was heard to remark: "She's a daisy if she beats the '870.'" Here he caught his first glimpse of her wheel, "Lord, what a kangaroo!" We are a little afraid if they are not careful the breed will be known as the "Kangaroo class."


CENTRAL-HUDSON'S LATEST ENGINE FOR THE FASTEST TRAIN IN THE WORLD 87½-IN. WHEEL

The Rhode Island Locomotive Works have lately delivered several Johnstone compound locomotives for the Mexican Northern Railway. The Johnstone compound locomotives are making a great reputation on the Mexican Central for saving fuel. As coal costs over $10 a ton in Central Mexico, a small percentage of saving counts large in reduction of operating expenses. The compound engines are used exclusively for mountain service and are pulling hard all the time they are using steam. One of these engines stalled while pulling a train on the Santa Fé up a grade of 186 feet to the mile. After the engine came to a dead stand working compound, steam was applied direct and the engine started easily and went over the mountain with little effort.

On the 12th day of October there were 75,000 foot passengers over the Brooklyn bridge and 225,000 carried on the cable cars.

The Southern California have as bright and intelligent a set of enginemen as we have ever met. There is a practice universal among these men that we never found elsewhere, and one which many engineers would condemn This practice is that the fireman always attends to feeding the boiler with water. All concerned agree that it is the most satisfactory plan. They say that considerable fuel is saved by the fireman attending to the water, for he can regulate fire and water to suit the working of the engine. There are no plugs among these firemen.

The passenger engines on the Mexican Central have a Miller hook at the back end of the tender The usual horn is provided for buffing, but it has an improvement in the shape of a spring buffer on the end, which presses against the central buffer of the car.

## A Four Million Pound Train.

[See Inset.]

The splendid engraving presented with this number of LOCOMOTIVE ENGINEERING, represents a train of unusual proportions, hauled all the way from Chicago to Philadelphia over the Pennsylvania Railroad by one engine, a distance of 824 miles.

This fine train consisted of forty standard freight cars, one caboose and a "Class R" consolidation locomotive.

The cars were the company's standard 60,000 pound capacity box cars, 34 feet in length; each carried 60,000 pounds of grain, the 40 cars weighing 3,824,000 pounds; the cabin car weighed 18,000. The train was 1,402 feet long.

The "203" has 20 x 24-inch cylinders, a 60-inch boiler with a firebox 117 x 42 inches and weighed, tender and all, 188,300. She took hold of this train at Chicago at 10 A. M. April 30th, last, and was not uncoupled from it until she reached Girard Point elevator, Philadelphia, at 4:22 P. M. May 4th, a total of 4 days 6¼ hours. Engine and train complete weighed 4,030,300 pounds.

The "203" was not equal to the job of lifting this load over the Alleghenies alone and had help as follows:

One helper engine, Pittsburgh to Derry, 46 miles; helper from Conemaugh to Gallitzin, 25 miles, and also from Columbia to Fifty-second street, Philadelphia, and from Thirty-sixth street over the arsenal bridge.

We could not find out the amount of coal consumed by this engine west of Pittsburgh, but from Pittsburgh to Philadelphia she consumed 20 tons of soft coal, and her helpers got away with 21 tons; 43 tons used in hauling this monster train over the mountains, a distance of 354 miles.

## Topeka Railroad Machine Shops.

MAKING THE BEST OF IT.

The machine shops of the Atchison, Topeka & Santa Fé, at Topeka, are worthy of particular notice as exemplifying how far personal ability, ingenuity and good management can overcome natural drawbacks. The building used as a machine and erecting shop was originally built for some other purpose, and is badly adapted for the business now carried on within its walls. It is low, badly lighted, and so constructed that tools cannot be conveniently located. It is far too small for the requirements, and the floor has to be covered with tools, making the movement of material difficult and inconvenient, and want of room has compelled those in charge to put the erecting department in two places. With all these drawbacks it is questionable if any railroad shop in the country turns out more work in proportion to the number of men employed.

This is done by close attention to details. The tools are all worked up to their full cutting capacity; many labor-saving devices are employed, numerous special appliances are used for doing work quickly, and the workmen are encouraged to devise improved tools and methods, and they have responded cordially.

The shops are lighted during the daytime with incandescent electric lights, the plant having been made from an equipment that had been used for car lighting and did not prove successful.

COMPRESSED AIR FOR SHOP PURPOSES.

Compressed air is employed for a great variety of purposes to provide power. The supply of pressure is generated by an air pump driven by the shop engine. An air cylinder is set in front of the steam cylinder in tandem fashion, and the engine's piston rod is extended into the air cylinder, working the piston of the latter. The pipes leading the air from the compressor are enveloped in a jacket through which cold water constantly runs, absorbing the heat developed by compressing the air. Pipes lead this compressed air to every shop and to the points in the yards where air is required. Small portable Brotherhood engines are operated by this air and, by means of Stow flexible shafting, bore cylinders, drill and tap stay-bolt and other holes, do all the drilling and tapping about frames and cylinders that cannot conveniently be taken to a floor tool, and provide the power for almost every operation usually done by men pulling on ratchets. The air also supplies power to a stay-bolt cutter and a portable uniting machine.

SPECIAL WORK HOLDERS.

They use a great many chucks or work holders for planers and other tools that greatly increase the output. One chuck holds six tender boxes, and the lid face of all are planed at one sweep. A long bar is bolted lengthwise on the bed of a long planer, and a row of driving boxes is placed at each side of it, the bar forming the guide. The boxes are bolted down and the two rows planed at once with the double heads of the planer. All passenger car brasses are bored out before being lined with soft metal. Nine of the brasses are held in a chuck which secures them in the form of a cylinder, and they are all bored out at once. All driving boxes are bored on an old wheel boring machine, and a great variety of other work usually performed by lathes is done on this tool. The man in charge has rigged up a brake formed by a strap encircling the feed pulley, which he operates with his foot, and can stop the table at any point. He bores out eight large driving boxes, and faces off the babbitt in five hours. All the boxes have babbitt lining for the hub of the wheel.

INCREASING CAPACITY OF HYDROSTATIC PRESS.

I noticed a curious plan adopted here to increase the capacity of the hydrostatic press employed for wheel work. Mr. Gunther, the general foreman, noticed that when working the press on the direct power it would run up to twenty tons, but would go no further without resorting to the small pump. This was too slow to suit his ideas, and he began scheming for the means of making the large pump give greater pressure. As an experiment he put a weight of 150 pounds inside the rim of the pump pulley. It looks like a counter-weight, but of course has the opposite effect and acts as a fly-wheel of increased rotative energy. When the pump was started up with the weighted pulley it was found that the pressure ran up to forty tons, which greatly increased the work that the press would accomplish.

A KINK IN SPEEDING UP TOOLS.

They have been speeding up all the planers on the return motion, and they found that the Sellers planers were made to return so fast that the reversing bar or its connections would break with the shock of stopping. After several experiments to find a remedy, Mr. T. Smith, the foreman of the machine shop, cut the reversing bar and connected it with the belt shifter by a spiral spring. In stopping, the spring yields and brings the table to rest without a jar.

TURNING TUMBLING SHAFTS.

An ingenious plan has been adopted for turning tumbling shafts. It is well known that this is one of the most awkward jobs that goes into a machine shop. If the shaft is swung, its long arms require a lathe of large swing, and the arms prevent the tool-post from getting near the work, so that a long tool has to be used, with which there is always more or less spring. In this shop the tumbling shaft is held stationary in brackets bolted to the lathe-carriage and the turning tool is secured on the face plate. The work is fed to the tool instead of the tool being moved to the work.

Mr. John Player, superintendent of motive power, is fortunate in the officials he has running these shops. Mr. George W. Smith, the master mechanic in charge, devotes infinite energy to the management of the establishment, and he is ably and cordially supported by a staff of first-class foremen.

A. S.

## Mexican Central Matters.

All the passenger locomotives on the Northern end of the Mexican Central R. R. are provided with piping for taking water out of supplementary tanks that are drawn over the dry regions. The engines are all well maintained and compare favorably in appearance with the locomotives run on the best managed lines in the States. Most of the engineers are Americans, but the firemen are Mexicans and are reported to be good men. A few of them have been promoted and the intention is to promote more of them as men are required. They have to pass an examination before being promoted and are required to read orders in Spanish and English. The conductors and train dispatchers are English speaking and orders are generally given in this language, but there are a few operators who know no language but Spanish, and orders are consequently given through them in the language of the country. The greater part of the locomotive engineers are Brotherhood men, but their order is not recognized on the road. Men who apply for employment are asked if they are Brotherhood men and if the answer is in the affirmative they are not hired. The officers say that the men looking for employment nearly always deny belonging to the Brotherhood. The officers of the road profess to have no objection to the Brotherhood of Locomotive Engineers as an organization, but they say that the grievance committees need too many conferences. This complaint is heard on all Southwestern railroads.

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In the Southern California shops at San Bernardino, they are using for brass making, block tin which is made from the ore in a tin refinery at Riverside, the sweet orange raising center. The tin is of an excellent quality and is reported by the foreman molder to be equal to imported tin. The price paid is $22.50 per 100 pounds, being a little less than the cost of the imported article. The concern at Riverside is reported to be rapidly increasing the output and the prospects are that sufficient tin will soon be smelted here to supply the entire needs of the Pacific Coast.

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Eccentric keys should be put in solidly and good at first, if never afterward. Some new engines were recently sent West by one of our big works with offset keys clumsily supplemented by strips of iron. Manufacturers should turn out work that is *right*. The roundhouse gang can be depended upon to do all the cobbling necessary.

GROUP AT BROTHERHOOD OF LOCOMOTIVE FIREMEN'S CONVENTION, CINCINNATI, SEPTEMBER 12, 1892. GRAND OFFICERS IN FIRST ROW. PHOTO BY BENJAMIN, CINCINNATI, O.

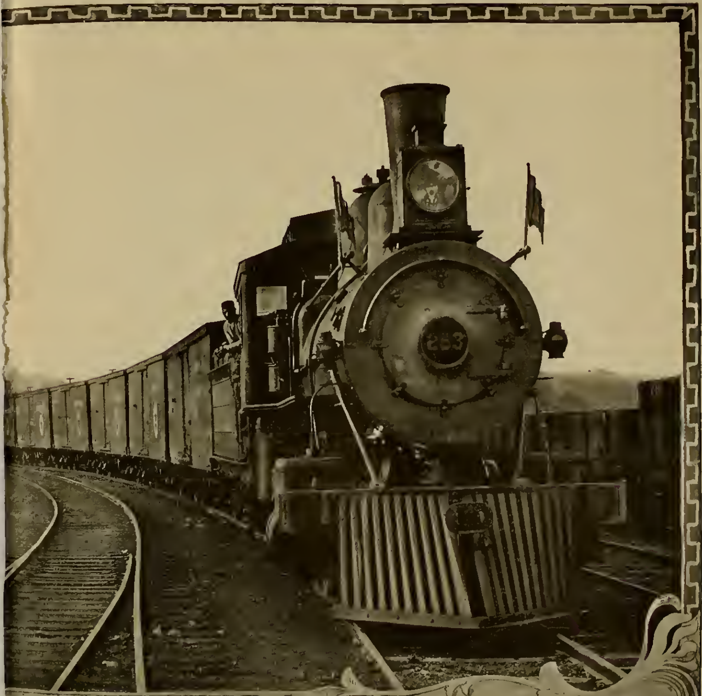
direction.

with thirty-five persons, 22,960 pounds.

time, especially on the start.

ington, Ind.


ment of material difficult and inconvenient, a great variety of other work usually per- formed,



MERICAN GRAIN TRAIN
ROM CHICAGO TO PHILADELPHIA BY ONE LOCOMOTIVE, 824 MILES.
TRAIN 1602 FEET, TOTAL WEIGHT 4.030.500., P.R.R. MAY 1892.

direction.

with thirty-five persons, 22,960 pounds.

time, especially on the start.

ington, Ind.

## The Steepest Railroad in the World—2,534.40 Feet Per Mile—48 Feet in 100, or 48 Per Cent.

Mount Rigi, in the Alps, has long been famous, and thousands of sight-seers have gone to its summit because it is reached by two rack-rail roads, and its summit abounds in hotels.

Mount Pilatus stands near Rigi, but is 1000 feet higher, a sheer, slim, barren peak of limestone, between five and six thousand feet high. It seemed for years too steep for a railroad, and every one despaired of ever seeing one up its barren breast. But the railroad is there.

Our engraving was made direct from a photograph taken this summer and shows one of the two combination cars and engines, on a grade of 48 in 100 feet, or 2,534.40 per mile.

All experiments made with ordinary racks, with teeth on top, proved failures, the pinions would mount the rack. At last a Swiss engineer proposed a double rack with teeth cut on the sides and guide wheels to hold them in mesh, this was a success.

The center rack is cut out of plates of mild steel, and are, with the other rails, bolted down to some 2 feet of solid masonry; every rail must stay "put" and not crawl down hill.

The boiler is placed crosswise of the track so as to maintain the water level without trouble, the engines are highly geared, the crankshaft making 180 turns a minute, but driving the horizontal track pinions 47 turns a minute, through a pair of bevel gears. This advances the car about 39 inches per second—1 meter, or 2.2 miles per hour.

The combination is provided with four separate and independent brakes: 1st, a compressed air-brake; 2d, a friction-brake on crank-shaft; 3d, a friction-brake on the leading pinions, and 4th, an automatic apparatus that applies a band to upper pinions as soon as the speed exceeds 1.3 meters per second.

The carriage part has four compartments, each carrying eight persons. The road starts at Alpnach, Switzerland, at 1,440 feet above the sea, and in a little less than three miles reaches an elevation of 6,790 feet. Not all the line is as steep as that shown, but the average for the whole is 42 in 100, the floor and seats being level at this grade. It takes one hour and thirty minutes to go in either direction.

There are two cars and engines, and they pass each other half way up, but with this system switches are an impossibility. So in lieu of one they have a movable section of track, or rather two movable sections. These are on one structure, not unlike a transfer table. The engine going up runs upon this piece of movable track and is then moved by power to one side. This side movement brings another section of track into the main line over which the down train runs. Then the climber is moved back into communication with the main line and proceeds to crawl toward the eternal snow and the clouds


ON MOUNT PILATUS, SWITZERLAND GRADE, 2,534 40 FEET PER MILE—48 PER CENT.

The principal dimensions of the engine and car are as follows:

Gauge—31½ inches. Cylinders—8.66 x 11.81 inches. Carrying wheels are flangeless—15.75 inches diameter. Drivers at pitch line—16.1 diameter. Wheel base—240 inches Grate area—585 square inches. Total heating surface—226 square feet. Pressure — twelve atmospheres, or 168 pounds per square inch.

The boiler carries 1,069 pounds of water in working order, the tank holding 1,763 pounds of water and 770 pounds of coal.

Weight of car and engine complete, with thirty-five persons, 22,960 pounds.

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The locomotives employed on several of the divisions of the Santo Fé have a very expeditious means of cleaning their ash-pans. The bad water used makes the blow-off cock an important attachment, and contrary to the practice on most roads this cock is always kept in working order. On the engines referred to a pipe is connected with the blow-off cock and leads into the front of the ash-pan. The end of the pipe is flattened so that when water escapes it forms a flat jet. Every time the blow-off cock is opened this jet cleans the ash-pan of every particle of dirt. It is used on all occasions when the ash-pan needs cleaning and is highly popular with the firemen. Besides offering a convenient means of cleaning the ash-pan, the hot-water jet is a certain remedy for frozen ash-pans.

The Schenectady locomotives, one compound, one simple, in use on the New York division of the Pennsylvania Railroad, are equipped with Leach sanding devices, and are favorites with the men. They say they use less than one-third the amount of sand the other engines do, but it gets to the right spot at the right time, especially on the start.

## Reckless Snow Bucking.

The Atchison, Topeka & Santa Fé have ordered two rotary snow plows, one to be held on the Eastern and one on the Western lines This company is not troubled much with snow, but they want to be ready should a blockade be threatened. Where snow comes seldom to the depth that will obstruct the trains, the men in charge are generally unequal to meeting the emergency when it arises. Santo Fé men tell funny stories about the way snow bucking has been done on the rare occasions when it was necessary There was a blockade on one division a few years ago, and the roadmaster took charge of snow plowing. He put a small push plow in front of a flat car and started out. When they were ready to dive into some deep drifts the engineer protested that the flat car would not stand the shock.

"You attend to your engine," remarked the roadmaster, "and I'll attend to the plow." To show his faith in his own judgment, the roadmaster seated himself on the flat car and signaled the engineer to come on with a rush. He did that, and when the plow struck the snow the flat car doubled up and threw the roadmaster over the plow A broken leg gave him time to reflect on the foolishness of refusing advice.

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The Norfolk & Southern Railroad Company have received from the Tredegar Company, of Richmond, Va., the first installment of the fifty new box cars ordered some time ago. They have also ordered two Vauclain compounds from the Baldwin Locomotive Works, Philadelphia, Pa, which they expect to have delivered this month The engines are duplicates of the freight engines No. 7 and 8, which have given such good service, and are 100,000 pounds in working order having a 56-inch wheel. One of them, however, is for passenger service, and will on that account have a somewhat larger wheel. Otherwise they will be alike in every respect.

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The Firemen's Convention, recently held at Cincinnati, voted $2,000 to buy a home for its founder, "Josh Leach," and $500 toward a monument to the memory of D. W. Rohinson, founder and first grand chief of the Engineers' Brotherhood, who sleeps in an unmarked grave near Washington, Ind.

## The Last of the Giants.

Our photo-engraving of the Great Western locomotive "Crimea" shows one of the great eight-foot wheeled monsters that for years have pulled the famous "Flying Dutchman" over the Great Western's seven-foot gauge from London up the west coast of England.

Brunel, the great engineer, was in favor of a broad gauge and stuck to seven feet, refusing to narrow up to four feet eight and a half inches when the other wide roads did.

The absence of all opportunity to exchange traffic without transfer has finally driven this famous road to narrow up to standard gauge.

The last broad gauge train went over the road on the [illegible] of last May, and the road was narrowed up in thirty-one hours. It was considered expensive and slow by the system of laying the wide track, the [illegible] not being used. The rails were laid on longitudinal stringers 6 x 11 inches, and cross sleepers at considerable distance apart were used to hold them up; all of these cross sleepers were tenoned into the longitudinals and part of them had iron tie-rods across to keep the gauge. The rails were flat bottomed and bolted direct to the timbers, the fish-plates being under the rail.

The work involved four principal operations. The removal of ballast, shortening the transverse members and tie-rods, the sidewise displacement of the longitudinals with the rails on them, and the bolting up and rough-ballasting. It is the intention of the company to do away with the longitudinal system, and replace it with the ordinary tie.

Five thousand men worked on the job from Saturday morning until Sunday afternoon; in that time the principal work was done on the 180 miles of seven-foot gauge.

There was a great deal of sentimental gush, and grief, and ink wasted about this destruction of the "pink of perfection," but it was, and is, all useless. It may be too bad that Brunel's gauge was not adopted as the world's standard, but that the one road of the kind using it should have to come down to the standard is best for the road and its patrons.

What magnificent chances the engineers of this road had to build engines of great power and speed, but somehow or other sixty miles an hour was fast, even for the Giants.

For more than three years the Great Western have been building engines and cars that could be narrowed up, so as not to throw away so many.

At the works at Swindon there were laid some miles of sidings, eight we understand, that were filled with the broad gauge stock, useless now—like a ship in the desert—because there is nowhere for it to go, except into the scrap.

The Last of the Giants—Seven-Foot Gauge.

## From Dirt to Cleanliness.

There is a division point on the Santa Fé in Southern Kansas called Purcell that used to be noted for being dirty. Dirty, slovenly ways were so common that want of order or cleanliness did not excite much attention; but this place was so exceptionally conspicuous for its filth that it was the talk and jest of the system. The place had gradually fallen into unsavory ways and the habits of the men harmonized with their surroundings, as they generally do. There were few people to criticise, and want of that salutory influence breeds evil habits. The upper officers were tolerant of the dirt and its accessories because changes were not easily effected and zeal for order or neatness was not a prevailing virtue.

It came to pass that a new regime came into power, and the new rulers loved order and cleanliness. They visited Purcell and were moved to wrath by its condition. A fiat of strong sound went forth calling upon all concerned to change their ways, but no change followed. The habits of years cannot be changed by an edict. The mogul in charge was more steeped in filth than the cohorts he ruled, and they all acted as a unit in their hatred of water in all forms, of soap as an element influencing change, and even cotton waste was regarded with suspicion as an article suggesting superfluous labor.

The men wore their clothes without change until they were worn out, when they were done with any tool or implement they threw in on the floor or prairie; when they took down a broken part they left it as it reached the ground. In the course of years the ground around the terminus formed divers layers of miscellaneous accumulations that would have greatly puzzled future geologists had the strata been permitted to remain.

The chief of the new regime, finding that the mogul of Purcell was more set in his ways than the laws of the Medes and Persians, arose on his ear one hot morning and dropped the mogul's head in the official basket. A new mogul named Klinclaus was appointed with orders to clean things up, even if it should take a leg. The new mogul was a man of infinite energy and he had struck a fruitful field for the cultivation of that species of fruit. He got the whole of the field to himself for a time, but being a persistent innovator his precept and example worked wonders.

After the new mogul had been in the place for two months, the rumor reached his ears that the chiefs of the new regime would, the following week, show the light of their countenance at Purcell. Then Klinclaus called a mass meeting and uttered words entreating the boys to aid and abet him in giving the greatest surprise party to the chiefs which they had met with on the Santa Fé. With one accord the boys agreed to co-operate. Paint brushes, scrubbing brushes, soap, handbarrows, rubber cars and divers other means for annihilating and moving away dirt were called into use, and the place from center to circumference was cleansed as it had never been cleansed before, and the men were arrayed in clean garments and washed faces.

When the new chiefs stepped from the car they looked around bewildered. The place was strange to them. Had they been carried to the wrong station? No, and Klinclaus' smiling visage appeared to identify the place. He had many triumphs to show but his greatest satisfaction was with the condition of the men's sleeping room, which was clean, and had an inscription in bold letters, "Please take off your shoes before going to bed." The instructions are obeyed although there were said to be many kickers against such ultra-refined practices.

The boys call the new mogul "Clean Close," which is near enough his correct name to pass muster in Southern Kansas.

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The prevailing low price of silver has greatly depressed railroad business in Mexico, and reduction of operating expenses is the order of the day. As usual the mechanical and road departments have to bear the burden of retrenchment. The officers in charge are all complaining of the crippled condition of their departments. The low expenditures allowed for maintenance of track appears curious to men not accustomed to the dry road beds of Southern countries. On a division of the Mexican Central, over 700 miles long, only \$5,000 a month is allowed for all kinds of track maintenance.

## An English Flyer.

The handsome engraving shown herewith gives our American enginemen a good idea of how a fast English express engine looks, well, anyway, how one on the Great Northern looks; all English roads have engines of their own peculiar kind and their own peculiar color.

This engine is painted green, boiler, jacket and all, striped black and white.

This is one of the very few English roads using outside cylinder engines, and these have inside chests and direct motion valve gear

The cylinders are 18 x 28, and the wheel 8 feet.

The boiler is 50 inches in diameter, has 1045 square feet of heating surface and 18.4 square feet of grate, weighing 101,136 pounds.

These engines start trains very well and swing ten carriages at 60 miles per hour ry easy.


Great Northern Railway Flyer. Eight-foot Wheel.

## Elementary Heat Problems.

By Angus Sinclair.

The burning of fuel and the boiling of water into steam are the fundamental processes by which the dormant forces of nature are converted inta the power that performs the heavy labor that carries the burdens of mankind. To keep a fire hot so that it will cause a kettle to boil seems a simple operation, yet every one who has to pay the bills for kitchen fuel knows that to produce the same result some firemen of this most simple kind of furnace burn more fuel than others. When we find the fire grate or stove developed to the furnace of a large boiler or the firebox of a heavy locomotive, the difference of the fuel used by a good and a poor fireman becomes a very serious matter. We know of no line where the power of knowledge is likely to effect so much saving for steam users and of the fuel treasures that have been laid up for the use of man as in the spread of information relating to the laws of combustion.

The burning of fuel being a chemical operation, the subject cannot be properly understood without some insight into the science of chemistry as it relates to combustion. To those whom the word science frightens, it may be well to mention that science is merely accurate knowledge. Those who have no inclination to follow the best way of doing things, generally have contempt for everything of a scientific nature. Knowledge and the sense to apply it make a strong combination and produce the man of ability. Science or knowledge does not, however, always bring wisdom. There is truth in Pope's lines on the Seven Sciences

> Good sense, which only is the gift of Heaven,
> And though no *science*, fairly worth the seven.

It is much better to have an engineer or fireman with good sense and no science, than one with much science and no sense. But the man having both is certain to be of greatest value to an employer and to himself.

In treating of combustion and steam making I will frequently have to refer to the laws of nature. Everything in nature is guided by a mysterious power which controls and regulates its formation, growth or action. For want of a better description this power is called the laws of nature. When a seed is put into the ground it produces a plant after its kind, when steel is poured into a mold the molten metal will cool into a very hard substance, when molten lead is treated in the same way the product will be a soft casting If a piece of wood or coal is raised to a certain high temperature in the presence of air it will burn. If the gases hydrogen and oxygen come together at a high temperature they will join into one gas and become steam. If that gas is reduced below the temperature 212° Fahr. it will become water. If the water in turn is subjected to cold greater than 32° Fahr. it will become ice. All these changes come about in obedience to the laws controlling the different substances. We know nothing of how the laws of nature were established and we are ignorant of how the power is applied that enforces them; but the human mind can conceive of nothing more absolute than their action. From the daily rising of the sun and the regular movements of other heavenly orbs, to the more familiar sight of how a seed produces its own leaf and how the frozen rain-drop forms a crystal of a certain shape, all are illustrations of the exactness of the immutable power that rules the universe.

Everybody is familiar with the sensation of heat, but how the sensation is produced is not popularly understood. A fire burns and it gives forth heat, the sun's rays are warm to the touch, the hand of a vigorous man feels warm, and the turnings that fall from a lathe tool making a deep cut are hot enough to burn the fingers. These are all different manifestations of heat. How are they produced?

The question is as old as scientific speculation. Few subjects have received more attention from philosophers. Up to the beginning of the present century heat was supposed to be a kind of subtle fluid which had no weight and was capable of insinuating itself into the inmost recesses of all visible matter This fluid was supposed to have taken up its favorite residence in all kinds of fuel and was resting in a semi-sleeping condition, awaiting the kindling spark to bring it into intense action.

Experiments were made by Davy, in the last year of last century, which led to a thorough scientific investigation of the subject by the ablest philosophers of modern times. By rubbing together pieces of ice, Davy demonstrated that heat could be produced by friction. Others proved the case even more conclusively. The discoveries subsequently made have led to the establishment of what is known as the dynamic theory of heat. This theory holds that heat is a form of energy, and that it is caused by intensely rapid vibratory motion of the molecules forming the heated substance. According to this theory, heat, light, electricity and chemical action are all merely different manifestations of matter in motion.

Heat is measured by what is called the thermal unit or heat unit. After a long series of experiments conducted with extraordinary care and exactness, Dr. Joule, a famous English physicist, discovered that the amount of heat required to increase the temperature of one pound of water one degree Fahr., represented energy sufficient to lift a weight of 772 pounds one foot. This is known as the heat unit, and is used in reckoning the value of fuel and for many other purposes relating to heat and steam.

The energy of heat is estimated by its power of doing work. In physical science the term work means the overcoming of resistance of any kind. All operations performed by animals or machines requiring the exe tion of power is classed as work Heat may be transformed with work and work changed into heat. The science relating to the conversion of heat into mechanical action is called thermodynamics, and its first law says. "*When heat is transformed into mechanical energy or mechanical energy into heat, the quantity of heat equals the mechanical energy.*" That is a scientific law that every one studying steam engineering ought to commit to memory.

If an iron rod set on an anvil is struck several sharp blows with a hammer it is made hot The mechanical energy represented by the descending hammer is converted into heat. If an ordinary drop-hammer is employed the amount of heat generated is the same quantity that would be required to raise the hammer to the point from which it fell.

Work is measured by foot-pounds, or the amount of labor represented by the raising of one pound one foot high. The work done by machinery and engines is gen erally estimated by the horse power, which is equivalent to the raising of 33,000 pounds one foot in one minute. It does not matter in what direction the power may be applied. It may be 330 pounds raised 100 feet in one minute or the height and distance may vary to any extent so long as the unit is 33,000 of weight by pounds and feet performed in one minute. The weight may be pulled or pushed horizontally, or moved at any angle from the perpendicular and the result will be the same so long as the pull or pressure represents 33,000 pounds with the distance in feet traversed in one minute.

The horse-power unit was established by Watt, who found that the heavy horses pulling drays in London were capable of exerting a steady pull of 150 pounds while traveling at the rate of two and a half miles an hour. This is 33,000 foot-pounds.

It is a common thing to find a locomotive that is capable of exerting a pull of [illegible] pound of the draw-bar when running at a slow rate of speed. An engine keeping up this pull at a speed of ten miles an hour exerts 440 horse power.

In connection with elementary mechanical questions an interesting problem for railroad men to solve is the foot-pounds of energy in a moving train and the heat units represented by the conversion of mechanical energy into heat when the train is suddenly stopped. When the losses from friction and air resistances are eliminated, it takes exactly the same amount of energy to stop the train that it takes to force it into speed. Suppose a train of one engine and seven sleeping cars, the whole weighing 600 tons, is running sixty miles an hour, required the energy of the moving mass and the heat unit represented by its conversion into heat? The problem is stated algebraically, $\frac{w \times v^2}{2g}$, in which $w$ is the weight of the train, multiplied by $v^2$, the square of the velocity, and divided by $2g$, twice 32.16 the velocity, which a falling body acquires at the end of one second. The weight of the train is 120,000 pounds, the speed is 88 feet per second, so we have the problem arithmetically

$$1{,}200{,}000 \times 88 \times 88 \div 64.32 = 144{,}477{,}600 \text{ foot-pounds.}$$

That is the energy in the train regarded as a moving body like a huge shot. But something else has to be considered. Each wheel in the train has revolving momentum in itself similar to the inertia of a revolving fly-wheel, and this source of energy has to be calculated, because it tends to keep the train in motion and is an important portion of the momentum to be overcome in the stopping of a train.

The tread of the wheels has the same velocity as the train. This is called the angular velocity of the wheel. If all the weight of a wheel were at the circumference it would be easy calculating the momentum. But as the weight extends from the center of the axle where movement is imperceptible to the tread, where the velocity is the greatest, the energy of rotation has to be estimated from a point called the center of gyration. To find this point with exactness is a complex problem, but it is near enough for practical purposes to assume that the center of gyration of a car wheel is at a distance of one-fifth of its radius from the circumference. The angular velocity of the wheels of our train is, therefore, four-fifths of the speed of the train.

Our whole train has about the following wheel and axle weights

| | lbs. |
|---|---|
| 7 sleepers, 42 wheels, 21 axles, total weight | 37,800 |
| 12 small wheels of engine, 6 axles, total weight | 19,200 |
| 4 driving wheels of engine, 2 axles, total weight | 6,000 |
| Total | 63,000 |

The velocity of our train was 88 feet per second. We have now ⅘ of 63,000 pounds to be calculated in the same way as the energy of the train was figured out. The problem is $63{,}000 \times \frac{4}{5} \times 88 \times 88 \div 64.32 = 6{,}040{,}000$ foot-pounds. This sum added to the energy of the moving train previously found, makes a grand total of 150,517,600 foot-pounds. This sum divided by 772, the number of foot-pounds in a unit of heat, gives 194,970 heat units, into which the mechanical energy of the train will be converted in stopping.


Devil's Cañon.

## A Mineral of Great Possibilities.

English papers have been publishing accounts of the characteristics of a new mineral compound, called litho-carbon, which will be very useful for many railroad purposes if it is half as good as claimed.

It is claimed that it makes a perfect insulator, that as a paint it will resist heat or gases of any kind; that it is capable of being rolled into a tissue free from odor, and practically indestructible when employed in the production of macintoshes, canvas belting, waterproof tents, etc. It possesses peculiar powers, enabling it to enter and fill the pores of iron and steel, rendering these metals impervious to acids, etc. It is also said to make common leather waterproof, and it can be applied to wood-pulp for the transformation of that material into what looks and acts like ebony or horn. The saturation of a ship's plates with hot litho-carbon frustrates the attack of barnacles, and the plate will neither rust nor foul.

A portion of the smokestack of the steamer *Dean Richmond*, where the heat, through the use of a blower, rises to 800 degrees Fahrenheit, was painted with litho-carbon several months ago, and remains undisturbed and unblistered, while other parts of the vessel have necessarily been painted many times. A piece of sheet-iron covered with litho-carbon japan is said to have been subjected to an actual heat of 415 degrees Fahrenheit, without crack or blister, and remained so tenacious that the iron could be bent at any angle without disturbing the glossy surface. For varnishing railway and private cars, painting iron bridges, roofs, steamships, houses, etc., this material acts as an insulator, and it is reported that it will neither crack nor blister under any known atmospheric temperature. At great heat, litho-carbon will soften, but it will not take fire at any point.

## Mystifiers of Science.

In studying scientific books, especially those written by college professors, we have often been led to believe that the information was purposely wrapped up in a form difficult of comprehension. Many writers seem to think that they would not be considered wise unless they involve their thoughts in language that is beyond the grasp of ordinary men. To writers suffering under this delusion we would mention that the most popular and profound scientific men like Tyndall, Huxley, Stewart and others, write in a style that any person with a common school education can understand.

A writer in the *Popular Science Monthly*, lecturing to the mystifiers of science, appears to hit a common ostentation on the head by saying: "Nobody wants you to bring down to popular comprehension that which cannot possibly be popularly comprehended, but we do want you to have, and show that you have, an interest in the general advancement of knowledge, and that you regard your specialty, whatever it may be, as simply a higher development of forms of knowledge that are within the popular grasp, and as being, if remotely, still vitally, connected with the practical concerns of life.

"If such is not the case, if, on the contrary, you are soaring in a region in which practical views have no place and no possible relevance, then we make bold to say that your so-called science is merely a laborious and pretentious idleness. It is one thing to wander far afield in search of that which may some time or other, if not immediately, prove of value to the human race. It is another and very different one to wander far afield for the acknowledged purpose of getting, not only beyond general comprehension, but beyond the sphere of all possible utility.

"The only condition on which science can claim the reverence of mankind is that it devote itself to human service, and it rests with the serious students of science to make good this claim. In order that the relations between science and the age may be what they ought to be, the world at large must be made to feel that science is, in the fullest sense, a ministry of good to all, not the private possession and luxury of a few; that it is the best expression of human intelligence, and not the abracadabra of a school; that it is a guiding light and not a dazzling fog."

## Baltimore & Ohio the Oldest Railroad.

To Baltimore, says Major J. W. Pangborn, belongs the distinction of having first conceived the railroad as the term is understood to-day, and to this city is due the honor of building the pioneer road of the world.

Major Pangborn has been delving into history for months, and has been looking up on both sides of the Atlantic the facts bearing on the railroad. The result, he says, is a mass of proof showing that not until the meeting at Mr. George Brown's house, in Baltimore, February 12, 1827, had there been a contemplation of a railroad save as a means of increasing the output of mines or quarries by facilitating transportation to water-ways. In other words, all lines up to the organization of the Baltimore & Ohio Company were tramways built by coal or quarry companies. The Stockton & Darlington, the English line that was opened in 1825, was a coal road, whose whole equipment consisted of "waggons" for carrying coal. Other freight was transported, but not by the company. Others ran "waggons" over the road when not interfering with coal traffic.

As late as 1833, says the Major, three years following the opening of the Baltimore & Ohio line, seven contractors had running privileges over the Stockton & Darlington for passenger carriages. It was not a railroad in the real sense, as a public servant, as was the Baltimore & Ohio from its inception, as the public had access only when the company was not discommoded thereby. Later it became a railroad.

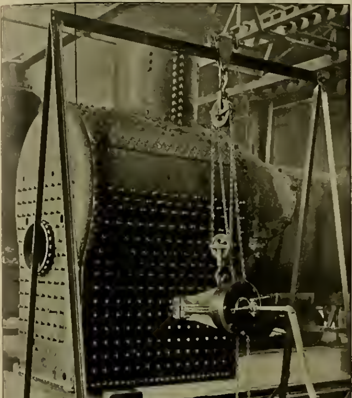
The Liverpool & Manchester was in reality the first European railroad, but it was opened to the public May 22, 1830, six months after the opening of the B. & O. The first shovelful of earth turned to the construction of a railroad in this country was on July 4, 1828, when the corner-stone of the B. & O. was laid. The first tram was the Leiper Road in Pennsylvania, in 1809. It was 180 feet long and was for mining. Later a similar one, a mile long, was constructed in Delaware county, Pennsylvania, to carry stone to Ridway Creek. A three-mile tram, for carrying stone exclusively, was built in Massachusetts in 1827. They have all passed away. The only one of the pioneer roads of the world retaining its original name, and which has ever maintained a regular succession of management, is the B. & O.

Letters, communications and questions sent in without the sender's name are thrown away, don't expect we will answer anything signed by initials only — we won't.

## A Mechanical Boiler Shop.

Any one wishing to see boiler-making, boiler-repairing and the miscellaneous work of boiler-making performed with the highest perfection of science and art should visit the boiler shops of the Santa Fé railroad at Topeka. The foreman in charge, Mr. Archie Baird, is not only one of the best practical boiler-makers of the country, but he is an inventor of high ability, and he has employed his inventive faculties to good purpose in devising appliances for performing boiler-making operations.

An air of neatness, cleanliness and orderly method strikes a visitor at once on entering the shop. These are the outward signs of good management. As we stand watching the business going on we find out that the work is pushed quietly but expeditiously along with power appliances performing the heavy labor generally done by human muscle in boiler shops. The shop is well provided with the ordinary run of boiler-making tools, but in addition to these there are many appliances worked out by the foreman. Compressed air performs a very important part in this shop. It operates the different forms of cranes that do all the handling of boilers and boiler material, it drives Brotherhood engines which do all the drilling, tapping and screwing in of stay-bolts, it operates a machine for cutting off stay-bolts, and it works an apparatus that does riveting at a rate at which riveting was never done before.



AIR-OPERATED STAY-BOLT CUTTER.

BAIRD'S STAY-BOLT CUTTER.

The first of these machines which was illustrated in the June number of LOCOMOTIVE ENGINEERING is shown in the annexed engraving, Fig. 1, as it is handled while doing its work. It is essentially a set of shears worked by air, and it clips off the ends of stay-bolts as neatly as a barber's shears cut off a man's hair. The machine is worked by two men, and working leisurely they can cut 500 stay-bolts an hour. I timed them when they were making an extra effort, and they cut off 24 bolts in one minute. The machine makes a much better job than cutting the stay-bolts by hand, for the operation puts no strain whatever upon the bolt or the thread.

PORTABLE PNEUMATIC RIVETING MACHINE.

The same principle has been employed in the construction of a riveting machine, shown in Fig. 2. The Santa Fé Company has a great many cars with iron trucks, and the riveting is always working loose. The work of repairing these trucks had to be done in the boiler shop, and it became so monopolizing that there was little time left to work on boilers. When cars are scarce the repair work must be done expeditiously, and the men looking for cars generally manage to put the stamp of urgency upon repair operations. Some one in these shops remarked: "The mother of invention is always punching us up." Under the prod of necessity Mr. Baird devised the riveting machine. It does riveting as fast as the rivets can be pushed into the holes, and makes an excellent job, much superior to hand work. The design of the machine is so obvious from the engraving that no description is necessary.

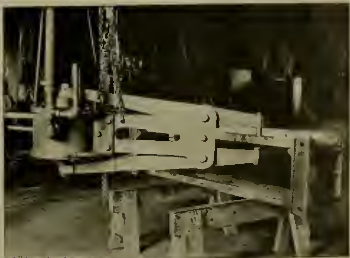
## Property Rights in Patents.

A decision was rendered last month by the United States Court of Appeals in a suit brought by the Edison Electric Light Company against the United States Electric Light Company, that is of interest to many people who are not in any way concerned in proprietary rights in electrical appliances. Edison was the original inventor of the incandescent lamp, where light is produced by the electric current passing through a resisting medium inclosed in a vacuum. Several parties imitated this invention, and have been selling incandescent lights which seemed to avoid the Edison patents. The court has now decided that every known form of incandescent lamp, and every possible form of this lamp, infringes the Edison patents.

This means practically that when an inventor secures a foundation patent for any device, the imitations which obtain the same results by different mechanical arrangements are infringements. The decision is a little more emphatic than several others previously made of the same tenor. The well-known decision on the Richardson safety-valve patents was substantially the same as that now rendered concerning electric lights.

This decision ought to be of direct interest to many railroad companies, for there is no class using mechanical appliances more given to patronizing articles that are notoriously pirated imitations of patents. The great variety of functions demanded of railway machinery presents an unparalleled field for inventive genius, and it is industriously cultivated. But no sooner does an inventor produce an appliance or improvement which promises to be in demand than there is a host of imitators doing their best to produce something which will do the same functions and avoid infringing the original patent. The principal work done by the mechanical engineers employed by some railroad companies is the designing of forms of patented articles which shall perform the functions of the original without incurring the liability to pay royalty. This is a small, mean business, and is nothing more than dishonesty, for it is stealing a man's ideas and dressing them so that their identity may be disguised.

The plain decisions of the courts ought to discourage this sort of industry. The only reason why railroad companies are not paying royalties on numerous patents that they are using illegitimately, is the delay and expense that must be incurred in law suits for infringements of patents. Law's delays are so notoriously tedious in patent suits, that those who have been injured patiently suffer wrong rather than engage in the long and expensive fight.



BAIRD'S AIR RIVETER ON TRUCK WORK.

We have recently heard of a movement among men of means to purchase the originals of patents that have been largely imitated by railroad companies. Should this be done, some of the companies are likely to have to pay damages that will put the money paid to settle the Tanner brake suits far into the shade.

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The D. & H. C. Co. have recently bought the right to use the Jerome metallic packing on the whole system. They have been using another metallic packing heretofore. The Chicago Elevated has also adopted the Jerome.

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The La Junta division of the Santa Fé road has some feed water that holds about 100 grains of solid matter to the gallon. It is considered fairly good water that has only half that quantity of impurities. It goes without saying that boiler repairs are heavy. An engine does remarkably well if it runs 30,000 miles without having the flues changed. Some engines do not make 20,000 miles. Means of washing out boilers receive great attention, but no amount of washing will keep the boilers clean. In cleaning out a boiler that had made about 30,000 miles, they removed over 6,000 pounds of solid deposit. They have tried all sorts of purifying devices and chemicals without success. The impurities consist mostly of lime, magnesia and soda in various forms. The only compound they find of any service is crude petroleum. This prevents the scale from adhering tenaciously to the hot surfaces.

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An observant traveler on the Pacific coast is likely to be struck with the strong personality of the men who have acted as pioneers in the railroads of that region. Among the striking mechanical men to be met in California is William McKenzie, master mechanic and chief engineer of floating equipment of the Southern Pacific, at Oakland, Cal. Mr. McKenzie did his first railroad work on the Chicago, Burlington & Quincy, at Aurora, Ill., and subsequently rose to be foreman of the shops at Peoria. On account of a general cut in wages he left there and went to Australia, where he spent several years in marine work and in setting up mining machinery. Returning to the United States he naturally drifted back into railroad life. He ran an engine on the Central Pacific for some years, and rose by the usual steps to his present position.

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H. Walter Webb, third vice-president of the New York Central & Hudson River Railroad, has issued an order removing all restrictions to the hauling of cars equipped with the New York air-brake and making no difference between that and the Westinghouse. This order is said to have been decided upon after the result of the recent 50-car train test on the Central, in which no practical difference was found in the action of the two brakes, either in trains of their own or when mixed together. This will probably settle a good many little disputes on this question now occupying attention in different parts of the country.

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LOCOMOTIVE ENGINEERING appears to have a very popular standing on the Pacific coast. Los Angeles is not a large town, but we found the paper sold at three different news stands. All the principal news stands in San Francisco have it for sale. Besides this, there are clubs at all the principal division points, some of them being very large.

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The December issue of LOCOMOTIVE ENGINEERING will contain forty-eight pages at least, and the edition will be 30,000 copies. It will go everywhere on earth where there is a railroad, and several places where they are only wishing they had one. Be in it.

## Weak Features of Freight Cars.

The best place to study the strength and the weakness of freight cars is in the repair yards. The most careful figuring in the drawing office and the most rigid attention to details of construction in the building shop will leave points of weakness that are clearly revealed in the repair yard when the car passes through the searching ordeal of heavy trains, rough roadbeds and violent yard service.

The writer has recently enjoyed the privilege of making close inspection of the work going on in a great variety of repair yards extending from New York to San Francisco. Everywhere he found that the same lines of weakness or the same species of defects were keeping car repairers busy. It is a conservative estimate to say that 50 per cent of the breakages that are holding cars in the bad order tracks are due to failure of some part of the draft attachments. Those who ought to be most familiar with the subject say that at least half the defects to cars are caused by handling them in switching yards. There is no class of railroad men so little under control as switchmen, and the destructive tendencies of this class appear to increase faster than the work of improving drawbars and their connections. The officers in charge of switchmen are frequently strangely apathetic in checking the destructive tendencies of their men. Damage to a car falls upon the mechanical department which is presumably to blame for sending out cars that will break. Where division superintendents and yard masters are required to make a correct report of all the cars that have sustained damage in the hands of their men, the destruction to draft appliances has been greatly reduced.

Where an evil exists it is natural to look for a remedy. The failure of the draft-rigging of cars is the source of so much expense to railroad companies that the ablest men in the service ought to be engaged devising means to prevent the breakage. The first line of cure which we would suggest is the means of placing the responsibility for breakage where it belongs. When that is done systematically there will not be so many bad order cars to care for. The next move is strengthening the parts that break in ordinary service. The practice which all railroad companies have followed of attaching the draft timbers below the sills makes this important part weak, since the line of resistance is not continuous. Some railroad companies strengthen their draft timbers by filling up the space between the needle-beams, making the draft timbers practically continuous, while the Chicago, Burlington & Quincy have adopted a radical remedy in cars lately designed and put the drawbar in the line of the sills. Both these methods strengthen the parts of a car most given to failing, and must materially reduce the cost of repairs. The different attachments designed to connect the drawbar substantially with the supporting timbers, such as the Butler drawbar attachment, are of decided value and strengthen a weak point. Cars that have the draft-gear secured to continuous timbers by substantial attachments rarely obstruct the repair tracks. They are coining money for their owners, while those having weaker draft rigging are rousing animosities between departments over the problem of dealing with bad order cars. The moral of this condition of affairs appears to be obvious enough.

Next to the draft attachments, the ends of box cars provide the most business for the bad order tracks. In the course of our inspections we found several cars that were nearly new which had the ends driven out. The shocks that prove fatal to weak drawbar attachments, project the load against the car ends, and they are not made strong enough to resist matter in motion. The measure of strength in the end of a car is two posts about 2 x 4 inches. It takes a very small blow to break them. Several attempts have been made to brace the end of cars but with very little success. The most obvious and common sense way of making this part stronger would be to make the posts the full width of the end sill. When cars reputed to be first-class are so weak in the ends that the sudden application of brakes has resulted in making the load of corn shoot through the end, it is time designers were working out a stronger form.

Middle sills of cars are also much given to breaking in a way which indicates that they are structurally weak. These sills are badly weakened at the transoms and fail accordingly.

Car trucks give much less trouble than they did a few years ago. The numerous wrecks, due to weak trucks, have conveyed a good practical lesson, and the parts have been strengthened to withstand the searching requirements. The hangers of swing beam trucks, or the pins supporting them fail occasionally, but swing motion trucks are becoming a thing of the past under freight cars, although a few roads still cling to them. Failures of arch bars which used to be common are now almost unknown. The only improvement now needed for the diamond truck is making the whole transom and bolster of iron. There are said to be a great many Fox trucks already under freight cars, but we failed to hear of any of them being in need of repairs.

Among the miscellaneous parts of cars that fail in service, the first part that deserves notice is the brake-beam. The plain wooden beam is fast disappearing, but it has too many representatives in use for the severe braking now necessary on heavy trains. Next to the brake-beam comes the hangers and the attachment that holds up the same. Hangers are frequently ridiculously weak and the bracket is nearly always unsuitable for resisting shocks and strains. This part is decidedly in want of attention. Another point of weakness in many cars is the under trussing. The queen posts are so short that the truss rods do little good, and the car sags in the middle every time a heavy load is carried. If all the weak points mentioned were strengthened, the repair tracks would not engage the work of half the men now kept busy there.

## Some Reasons Why English Roads Will Never Adopt the Long American Freight Car.

The average "goods waggon" in Great Britain is a four-wheeled concern weighing nearly as much as its load, and very clumsy looking to an American. Many of our railroad mechanics think the Europeans behind the age because they don't adopt the long American car, weighing less than half its load, capable of holding large freight, reducing the number of cars to look after, report and carry on books, and especially to handle.

If the English had to haul heavy trains long distances there is little doubt but they would have "bogie cars" quick enough—but they do not have such service to perform.

If we had the English freight service to handle we would do so at a loss until we provided rolling stock to meet it. Our long cars of 60,000 pounds capacity would be as useless to us with their conditions as their cars would be to meet our present conditions.

In Great Britain there are very few long hauls. We probably pull as many loaded cars without changing freight 1,000 miles in this country, as they do 100 miles. Their hauls are mostly short ones and they are made in good time. "Waiting to make up a car load" of anything is an absurdity there that would'nt be listened to. If a merchant in Liverpool has a barrel to go to Glasgow he takes it to the freight station and loads it upon an open car. If there is other freight to go, that is put on the same car, but if there is none that barrel goes alone ready for delivery in the morning.

The average freight car load on a big road there only averaged three tons each for a whole year, counting in coal and mineral cars, which are always fully loaded.

All the freight platforms in that country are cut full of stalls with room for one or two cars, and short turn-tables in the regular platform track allows cars to be turned into these stalls. As the platform is just the height of the car floor this facilitates loading and increases the "frontage" of the platform.

Car turn-tables are common, every station and dock having many. The long car would call for throwing away all these tables and doing away with the platform loading stalls, this would make it necessary to extend the station platform. Station platforms there are usually 4 feet high, of solid stone, they will last forever,—and it costs money to change them.

The introduction of the long American car would call for new car scales; thousands of expensive scales would be useless.

"Well," says the Yankee, "in coal and mineral trains, always loaded full, our cars would be best." Well, let us see. The coal of that country is hauled in four-wheeled cars with sides about 3 feet high, a large part of it goes into vessels either as their own fuel or for export. At all coaling cities elaborate and expensive cranes are provided that pick up these cars and literally *pour the coal out of them* into the ship, and set them back on the track, and that quickly. All this efficient plant would be useless with our 34-foot cars, and the coal would have to be handled twice or more before it reached the ship's bunkers. Then, again, all coal cars need weighing and they are fixed to weigh the little cars and not the big ones.

If all coal and mineral were hauled for their own use or to drop into yards, our system could be used with profit, but not under the present conditions.

Both countries have conditions of traffic that require a different service to handle it, and it seems to the writer that the railroad mechanics of each country have provided the equipment best fitted to take care of the work. Certainly, the English freight service would never get any where with our grain and cattle trade, neither would ours do for their—well, you might call it "retail" freight business.

There is no good reason why the abominable compartment system of passenger "carriages" should exist over there, and the American "coach" will surely take its place, but there are good reasons why their freight cars are the best for their work.

## How Good Bad Things Can Be If All Alike.

A well-known railroad man said, in the discussion of the car-coupler question at a recent convention, "If we only had adopted the *worst* one and stuck to it, we would have had a safer coupler as far as killing and maiming men is concerned."

This remark was brought to the mind of the writer this summer while in Europe, there they have a uniform style of coupler, and a very primitive one—the hook and chain.

This clumsy device, small and weak, gives very little trouble and men are very rarely injured in handling them.

On passenger cars there are usually two links drawn together by a bolt swiveled to one and threaded into a nut fast in the other; after hanging the links over the hooks the slack is taken up with the screw. Buffers placed at the corners of the cars receive the compression strains, the link and chain simply stand the pulling.

On freight trains there is slack enough left to put the links over the hooks, there is no provision for taking up slack.

Yet men couple and uncouple these cars during switching operations with considerable speed, and with safety.

They are not hurt because they know just what kind of a coupler and buffer they are going to find on every car that they get hold of—they are never ambushed and surprised.

Very few breakages occur and, reading of the grief and expense we have in America, lots of the best men there are surprised that we don't adopt the hook and chain. Their advantage comes, not from their superior coupler, but from its universal use.

When the American railroads are equipped with a uniform coupler—no matter what one or what kind—the record of coupler accidents will fade away like mist.

## We Have Met the Enemy—And We Are Theirs.

Experience is a good teacher—we know something now.

It pays to get taken in once or twice in a while—we've been "took."

After all our talking and warning of our neighbors to beware of the Brotherhood-souvenir fiend, he came along with his scheme while the junior philosopher (who has done most of the kicking) was away and faked the senior philosopher into giving an advertising contract, "just to help the boys."

"The boys" didn't get any great help, not even a copy of the noted "souvenir" for the grand officers—just enough of the promised 11,000 having been printed to go around to all the advertisers, perhaps 200.

This souvenir racket is a plain unvarnished swindle, handled in the name and allowed to exist to the disgrace of the Brotherhoods.

The orders get a mere trifle for letting some slick advertising schemers get up a book in their name, and hold up the manufacturers of the country. Isn't it obtaining money under false pretense.

Grand Secretary Debs, of the Firemen, roasted this swindle in his last report to the grand lodge in September. Mr. Arthur, of the B. L. E., has denounced it, and yet local lodges are allowed to farm out the privilege of robbing people in the name of the order.

No sensible business man expects that the "ad." buried in this book is going to do him any good. He does it to "help the boys." If he won't do this, he is blackmailed by an implied threat that "the boys" will make his goods a failure when placed in their hands. This is blackmail of the manufacturer and a libel on the men.

The firemen's souvenir of the last convention is before us, it contains 206 pages, half rot about the City of Cincinnati and the order, and the rest ads. from good houses. At a low estimate, $10,000 was collected for this thing; did the Brotherhood get a quarter of it?

The S. P. is posted now, and we won't do so any more, and we hope that every manufacturer will require a letter from the grand lodge of any order requesting his contribution—for such it is—to their entertainment committee, before they allow themselves to be bilked in broad daylight. The Brotherhoods ought to expel members who trade on their reputation. The gift fiend is only a dude compared to the souvenir robber.]

Brotherhood engineers and firemen get good wages, and are not beggars asking manufacturers of goods used by railroads to put up fifty or a hundred dollars every year or two to entertain their delegates. They would scorn to do this, yet they will allow, for a few hundred dollars, a swindle of this kind in the name of their order. It's about time some action was taken against this fraud, it is hurting the reputation of the Brotherhoods.

## How Palace Stock Cars Are Used.

The most arrant humbug in railroading to be seen on Western lines is the fancy line stock car. It is fitted up with numerous luxuries for the comfort and accommodation of stock that greatly increase the expense and weight of the car. The representatives of the owners interview stock-raisers and expatiate upon the advantages of using palace stock cars, and secure the bulk of the business. When the stock is shipped the water-troughs are kept upside down and the hay-racks are left empty, but the owners of the stock imagine that the animals are at liberty to eat and drink when they so desire. The owners of the cars get their mileage rates from the railroad companies, and the railroad men swear about the humbugs practiced to defraud their employers of legitimate revenue.

In the course of a Western journey of five thousand miles the writer watched the stock cars on numerous trains and did not find a single case where the water troughs and hay-racks were used. The train men questioned invariably said that they never watered the troughs.

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One of the principal reasons why there are fewer "busy seasons" on European railroads than on those in this country and the traffic more uniform there, is doubtless the condition of the common roads. The writer took particular notice, during this summer spent across the water, of the excellent condition of all the country roads that feed the railroad lines. In France, where the roads are exceptionally good, farmers can be seen every day drawing immense loads of produce along the country roads, perhaps in a heavy rain, with one horse. Two-horse teams are the exception, and I honestly believe that the average load is heavier than those hauled over the average American road with a span. The longer it rains there the better the road, the loose dirt and dust being washed away. In our country a heavy rain prevents the hauling of produce to market, and dry roads overcrowd the elevators, warehouses and railroads. Railroad officers do not pay enough attention to the condition of public highways; they are as directly feeders of their lines as is a mining or logging railroad. Would not the employment of the convicts of each State upon the public roads be a good thing for the commonwealth and better for the convict? This would do away with the curse of contract jobs, abuse of leased prisoners, the interfering with trades, and prevent the rising of working men against the introduction of convict labor into their special calling by contractors, an abuse they are justified in resisting. If the convict owes the State his labor for a time, let him pay it to the people to its full value in a lasting improvement of the public highways instead of giving the State forty cents per day through a contractor paying him twice that amount for doing the financiering. Our country needs good public roads more than any other public improvement.

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During the Columbian celebration in this city, October 10th, 11th and 12th, every mode of transit was crowded to its utmost and the elevated system carried the largest number of passengers ever moved by a railroad in a day. The record for three days (of 24 hours) was as follows:

| Date. | Passengers. |
|---|---|
| Monday, Oct. 10 | 945,002 |
| Tuesday, Oct. 11 | 901,325 |
| Wednesday, Oct. 12 | 1,075,537 |
| Total for three days | 2,921,864 |

Think of handling 1,075,537 people on thirty-two miles of road in twenty-four hours. Perhaps two-thirds of this number were handled on the lower half of the system and inside of eighteen hours out of the twenty-four. Because there was fearful overcrowding most of the papers in this city have attacked the road and its management for inefficiency. Every wheel was turning that could turn, and every effort made to move the trains quickly, but as there is no center track and all trains must stop at all stations, delays were caused by people trying to get on and off. However far the "L" comes from filling the ideal of the rapid transit crank, there is no other system at present in use that could have handled so many people. There was a slight rear collision caused by an engineer's neglect, in which some people were injured; otherwise, there were moved over the streets of New York almost three million people in three days with safety.

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There is war on hand between the metallic packing companies. Some time ago the first twenty engines that went to the Chicago elevated road gave trouble on account of the metallic packing leaking, it was of the U. S. make. More trouble was caused in this way than any other and Mr. Vauclain, inventor of the engines, put on five sets of Jerome packing as a trial, and, we understand, all the engines were finally equipped with it. Shortly after the change it was reported that an attempt had been made to bribe certain parties to destroy this packing by the use of emery or otherwise, and a row was raised. Since then Mr. C. C. Jerome has entered suit for $100,000 damages against the U. S. Metallic Packing Co. and Mr. E. D. Hurley, their representative. The suit promises to be interesting. We do not presume to know anything of the merits or demerits of this particular case, but the method of introducing goods by secretly destroying those of a competitor is far from a business or an honorable transaction, and we sincerely hope that when discovered it will be discouraged by punishment that will be remembered.

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In German shops and factories you will see all wheel pits in the floors and all belts running through floors or walls surrounded by an iron fence painted a bright red. All gears around the heads of lathes and drills, and the shifters on planers, are cased in tin painted as red as red can be. All exposed shafting, pulleys, etc., are protected in the same way. When a workman is crippled in a machine there the owner is obliged to foot his medical bills, and, if totally disabled, pay him a pension for life and his family one in case of death. Hence all this care. A foreman of a government railroad shop told the writer that since the rigid enforcement of this law accidents have decreased 45 per cent. Every exposed possible mangler was at once covered and a careless workman is discharged. Good thing, is it not?

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Men who ride bicycles soon learn to appreciate how great a figure wind resistance is to moving bodies. The least little breeze affects the rider, and professionals soon learned how to present less surface to the wind by stooping over. Enginemen know how wind affects the movement of trains, but don't recognize the amount of work the engine does to overcome it. Train dispatchers and superintendents who order trains lightened on a windy night, to let them make time, are few and far between. To a large majority of the latter class of gentlemen an engine is an engine—anything with a whistle and a number ought to pull a train, and weather that don't blow down the telegraph lines ought not to affect the running time of trains.

## NEW BOOKS.

SIMPLE LESSONS IN DRAWING for the Shops. By Orville H. Reynolds, Chief Draughtsman of the Northern Pacific Railroad. Eugene V. Debs Pub. Co., Terre Haute, Ind. Price, $1.

This little work will hardly need an introduction to readers of this paper as the chapters originally appeared in our columns. The design of the author was to teach shop apprentices and others how to make good working drawings with a set of instruments costing not more than ten dollars. He tells first how to select the tools and what to get, then how to take care of them. Simple lessons are given and a pattern set (there is a plate with each lesson), so that the green boy can follow a right line and the instructions teach the language of drawings. If a man studied this little book without ever trying to draw, it would teach him to "read drawings," a very important thing to a shop man in this day and age. We advise every machinist, apprentice, and all others interested in learning drawing, to send a dollar for this little book; it may lay the foundation to lift you above the ordinary level. It can do you some good if you let it, it can't possibly do you any harm.

POOR'S DIRECTORY OF RAILWAY OFFICIALS and Manual of Street Railways for 1892. H. V. & W. H. Poor New York.

This work contains a very complete list of railroad officials in the United States, a directory of the street railroads, and a list of roads that are projected or under construction. This feature might be made of considerable use by contractors and manufacturers of railway supplies. The book is an improvement over last year.

THE ENGINEERS' EPITOME. By N. J. Smith. Published by the Mason Regulator Co., of Boston, Mass. Price 50 cents.

This little work is composed principally of rules and tables for the use of engineers. The work is good and well worth twice its cost, but it abounds in algebraic examples and terms—something that should be avoided in cheap books intended for the masses of engineers. This is the third work of a series that the Mason Regulator people have issued and are making popular.

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The Union Tank Line Co. are putting the Smillie coupler on their new cars. This coupler seems to be gaining favor steadily. The Tank Line own upward of 7,000 cars and if applied to all, eventually, will make a nice little job of itself.

## PERSONAL.

W. S. Hughes, of Hopewell Junction, N. Y., has been appointed master mechanic of the Central division of the New York & New England in place of Charles W. Gates, resigned.

Morris E. Ward, for a long time with the Allen Paper Car Wheel Co., and latterly with the Wicks Refrigerator Car Co., has associated himself with a car roofing concern at Chicago.

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Mr. W. H. Johnson has been appointed general foreman of the Southern California shops at San Bernardino, Cal. Mr. Johnson is a New England man and before going to the Pacific coast worked on the Boston & Albany and on the Old Colony Railroads.

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Frank Arnold, past grand master of the order of Locomotive Firemen, was elected at Cincinnati to fill the office of secretary and treasurer, made vacant by the resignation of Eugene V. Debs. Arnold was for six years a faithful officer of the grand lodge, and will be found as good again.

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J. S. Chambers, formerly general foreman, has been promoted to the position of master mechanic of the St. Joseph Terminal R. R. Co. This road is composed of the city end of the A., T. & S. F. and the St. J. & G. I., and the work is done for the motive power and rolling stock for both lines under Mr. Chambers.

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Mr. W. J. Robertson, for many years in charge of the motive power of the Central Vermont, gives up the general supervision and will devote all his energies to the maintainance of the cars. No officer of a New England road has been more faithful to the interests in his hands, or has gotten along with less facilities and material to keep up his work

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Secretary John W. Cloud, of the Master Car Builders' Association, has issued the twenty-sixth annual report of the association and it is saying nothing against the other reports to aver that this is the most interesting one ever issued. There are 315 pages of matter besides a large number of folders containing drawings of the Association's standards.

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John Kirby, ex-president of the Master Car Builders' Association, and for the past 40 years at the head of the car department of the Lake Shore road, has retired from that position and taken an easier job in supervising the construction of new cars built by contract work It was in John Kirby's little office at Adrian, Mich., that the Master Car Builders' Association was born in 1866. He is succeeded as general M. C. B. of the Lake Shore by his assistant, Mr. A. M. Waitt.

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This summer, Henry Getner, chief draughtsman for Pedrick & Ayer, of Philadelphia, visited Europe, to renew old acquaintance, see what they had over there in the way of machine tools, and tell them what we had. Whatever else he saw or did we do not know, but that he convinced some of them that we had good tools here is shown by the fact that Fried. Krupp, of Essen, the great gun maker, has ordered two of P. & A.'s largest and best milling machines.

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Master Mechanic Charles W. Gates, of the New York & New England, at Plainfield, Conn., resigned on October 2d to go into business for himself. Mr. Gates commenced on the road as a fireman twenty-nine years ago, and went through the mill, engineer, roundhouse foreman and master mechanic. When leaving he was enticed into the roundhouse and given a complete surprise in the shape of a crowd of officials and men from all parts of the road, who gave him three cheers and a gold watch and chain.

Continuing testimony against the safety of using swing-beam trucks under tenders is given by Mr G. W. Prescott, master mechanic of the Southern California. This is a road with a great many sharp curves, and, therefore, a good test track for rolling stock All the tenders had swing-beam trucks and they were constantly getting off the track and the wear of wheel flanges was very great The swing beams have all been blocked and it entirely remedies the trouble A similar experience was encountered on the Sante Fé

Mr Alexander Campbell, general foreman of the Southern Pacific shops at Los Angeles, was run over by a locomotive two years ago and badly mutilated. He lay a long time in the hospital between life and death, but finally conquered and has lately got back to duty He needs a pair of crutches to help him around. The boys say that though his movements are more tardy than they were before the accident, his perception is in no way impaired, and that those who try to do any skulking find that crutches make rapid enough motion to overtake them

J. I. Davis, master mechanic of the Boston & Maine shops at Boston, Mass., has accepted the position of superintendent of the new Boies Wheel Works at Scranton, Pa Mr Davis is one of the best shop managers in New England, and we venture the prediction that the B. & M. will have a hard time to get so good a man in his place while Colonel Boies is to be congratulated upon his selection Brother Davis will feel lonesome for a while, not being called out to wrecks and having no chance to be called up in the night by an emergency, but he will get used to it

Mr James Collinson, master mechanic of the Santa Fé at Fort Madison, Ia., has some eight-wheel engines pulling passenger trains that he is prepared to back against anything in the country for efficiency. One of these engines has been pulling trains of from eight to thirteen cars daily for about a year and has made 100,000 miles without missing a single trip. Mr. Collinson thinks that this is a trifle ahead of anything else in the country, and is inclined to put up a hat on his engine beating anything else on wheels when the test is doing the work regularly with the least expense for repairs and fuel.

A. M. Waitt, who succeeded, on October 1st, to the position of M. C. B. of the Lake Shore, has for some years been assistant to Mr. Kirby and in actual charge of the work. Mr. Waitt, unlike most men in charge of the still independent car departments, came up through the locomotive department. He was formerly chief draughtsman on the Eastern Railway of Massachusetts, now part of the B. & M., under John Thompson, and made the drawings for the first extension front; this was some fifteen years ago. Mr. Waitt is one of the brightest men in his line of business, and there is no doubt of his success.

Mr. George Gregg, master mechanic of the Southern Pacific, at Los Angeles, Cal., is a graduate of Altoona, Pa., having been in the shops there when several men who are now prominent in the railroad world were apprentices. He worked in the shops along with Frank Thomson, who is now Vice-President of the Pennsylvania, and Mr. Thomson fired for Mr Gregg for a short time but retired from the scoop because it was too hard work Another of Mr. Gregg's shop associates was Enoch Lewis, now general purchasing agent of the Pennsylvania. He says that nearly all the young fellows who were his associates in the shops forty years ago attained prominent positions

Mr. J. Conroe, who attained much celebrity as chairman of the Brotherhood of Locomotive Engineers of the Santa Fé system, is now master mechanic at La Junta. The vim and energy which commended Mr Conroe for the position of leader among the engineers are now successfully employed in managing the hardest division on the Santa Fé system. With shop accommodation far behind the requirements of the rapidly increasing business, Mr Conroe contrives to keep the rolling stock in excellent order, and performs his duties in a way that is pleasant to the men and profitable to his employers. He was one of the best engineers on the road, and he is now making a record that entitles him to the reputation of being one of the best master mechanics in the West.

General Master Car Builder George Grambling, of the South Carolina road, died at Charleston on the 8th of October. Mr. Grambling has been a master car builder for many years. His father was master car builder for one of the Southern roads before the war. Mr. Grambling suffered from a severe wound received in the Confederate army, but was an uncomplaining sufferer. When Lee surrendered Mr. Grambling offered his services to the United States Government as a mechanic, and went to work for Uncle Sam in his old grey uniform. He was soon in charge of the cars on a division of the R. & D., and in 1880 went to the South Carolina. He was a member of a number of orders, some five or six turning out to escort his remains to the train. He was buried at his old home in Atlanta.

Charles E. Fuller, Jr., for the past two and a half years master mechanic of the Eastern division of the Erie, has accepted the position of superintendent of motive power of the Central Vermont. Mr. Fuller is a young man and has been quietly making a record for himself in his position at Jersey City. A banquet was given Mr Fuller by the men under him, and he was invited to a surprise party. The engineers and firemen did the principal talking, the burden of which was that Mr. Fuller had been just to them and fair to all; the division superintendent, train master, traveling engineer, and other master mechanics also spoke, and then Mr. Fuller was presented with a testimonial signed by 1400 men who had been serving under him. Mr. Fuller was unable to speak in reply, but the boys knew what was in his heart.

## Traveling Engineers—Notice.

Several prominent road foremen of engines met recently, and all agreed that it would be a grand good thing to have an association for mutual benefit and the exchange of ideas and information. Traveling engineers are not now eligible to membership in the Master Mechanics' Association, yet are welcome there; an association of their own would be of much benefit to them, as all the subjects discussed would refer directly to their work. As the master mechanic's assistant, the traveling engineer is generally intrusted with the duty of examining fireman for promotion, and a more uniform and better plan can be made and maintained where it is the rule rather than the exception. No doubt the roads will be glad to furnish transportation facilities to those men to meet once a year, and it will be beneficial if a man only sees what is done elsewhere, if nothing else. The expense of membership can be kept at nothing, for some time, at least. All traveling engineers or road foremen of engines are requested to correspond with John A. Hill, 912 Temple Court, New York, who will act as secretary until such time as a meeting can be fixed upon. If enough are found who are interested, a regular call will be issued next month.


## Notice to Correspondents.

Hereafter we must ask all our friends who contribute puzzles to these columns to send the answers with them; this will insure an answer without too long a wait, and give the "thinkers" time enough to solve the problems given, too. Don't forget this, you air-brake doctors.

## Boiler Turning Device.

*Editors:*

I have been requested to sketch the device used in these shops (C., R. I. & P.) for turning boilers, and do so herewith.

A similar plan, used by John Mitchell, foreman boiler-maker of the D. & R. G., at Denver, was shown in the LOCOMOTIVE ENGINEER for March, 1890, but his has no support for the fire-box end of the boiler, all right with a straight boiler, but not reliable and steady with a wagon-top, especially a long one. The horn bolted on back-head of boiler in our rig supports the fire-box end firmly and is not at all in the way. This plan has been in use here for some years.

JAS. HERON.

*Chicago, Ill.*

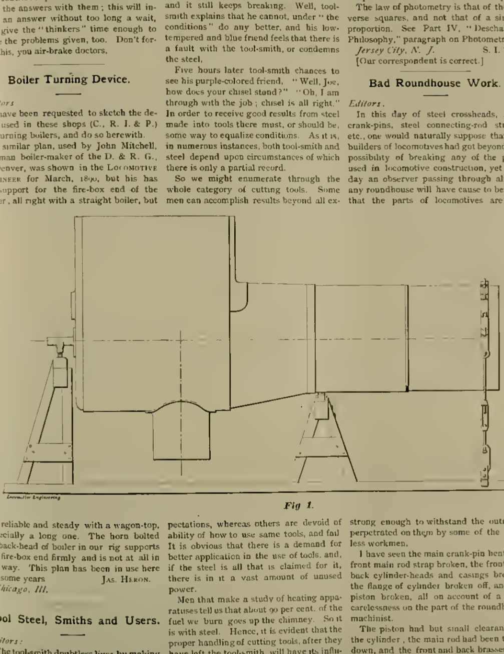


*Fig 1.*

*Fig. 2.*

## Tool Steel, Smiths and Users.

*Editors:*

The tool-smith doubtless lives by making and dressing tools, and it is equally true that he has a reputation at stake as well as a living. But there is a second element which must be considered—the user of tools. It is for the user that this article is written. Now, the relation of the tool-smith and the user of tools should be one of co-operation. Yet most of the risks are taken by the tool-smith. It is the rule of the trade.

Two machinists bring one chisel each, and the tool-smith dresses and tempers them carefully, but he makes a distinction in the temper. "He forecasts the user." One chisel is tempered to a purple or a dark straw, the other is left a low blue; both men work on the same class of work, metal being alike as to hardness. In about fifteen minutes in comes the blue looking friend complaining that his chisel is too hard; he has ground it a half dozen times and it still keeps breaking. Well, tool-smith explains that he cannot, under "the conditions" do any better, and his low-tempered and blue friend feels that there is a fault with the tool-smith, or condemns the steel.

Five hours later tool-smith chances to see his purple-colored friend. "Well, Joe, how does your chisel stand?" "Oh, I am through with the job; chisel is all right." In order to receive good results from steel made into tools there must, or should be, some way to equalize conditions. As it is, in numerous instances, both tool-smith and steel depend upon circumstances of which there is only a partial record.

So we might enumerate through the whole category of cutting tools. Some men can accomplish results beyond all expectations, whereas others are devoid of ability of how to use same tools, and fail. It is obvious that there is a demand for better application in the use of tools, and, if the steel is all that is claimed for it, there is in it a vast amount of unused power.

Men that make a study of heating apparatuses tell us that about 90 per cent. of the fuel we burn goes up the chimney. So it is with steel. Hence, it is evident that the proper handling of cutting tools, after they have left the tool-smith, will have its influence for good, bad or indifferent, and thereby increase or diminish the actual value of that most useful article, steel. There are many things that are difficult to overcome and they must be given some place in reckoning all the chances that tool steel is subject to. We read a great deal about heating, annealing and tempering steel, and strive to obtain all that is known.

Let me cite a very important instance. We have been using Mushet steel for turning hard steel tires and we have encountered more or less trouble on account of some very hard metal, and we came to the erroneous conclusion that if Mushet could not get there, nothing else could. But we learned different, we met with a hard tire, used Mushet, got good results, but we wanted to do better, so we made a pair of tools "right and left hand" out of 2 x 1-inch Crescent special, exercised the utmost care in heating and hardening, the result was that the Crescent tools gave better satisfaction than the Mushet. Now this is an instance where there must be some relation between the steel, the tool-smith and the man that used the tool.

G. F. HINKENS,
St. Paul & Duluth Shops.
*Gladstone, Minn.*

## That Lamp Problem.

*Editors:*

In your answer to query No. 92, of P. R. L., given in September number, would not lamp *C* be *nine* times the value of lamp *A*?

The law of photometry is that of the inverse squares, and not that of a simple proportion. See Part IV, "Deschanel's Philosophy," paragraph on Photometry.

*Jersey City, N. J.* S. I. T.

[Our correspondent is correct.]

## Bad Roundhouse Work.

*Editors:*

In this day of steel crossheads, steel crank-pins, steel connecting-rod straps, etc., one would naturally suppose that the builders of locomotives had got beyond the possibility of breaking any of the parts used in locomotive construction, yet any day an observer passing through almost any roundhouse will have cause to believe that the parts of locomotives are not strong enough to withstand the outrages perpetrated on them by some of the careless workmen.

I have seen the main crank-pin bent, the front main rod strap broken, the front and back cylinder-heads and casings broken, the flange of cylinder broken off, and the piston broken, all on account of a little carelessness on the part of the roundhouse machinist.

The piston had but small clearance in the cylinder, the main rod had been taken down, and the front and back brasses had been filed, and the rod and brass put back in place, without any attention being given to the position of piston in the cylinder. The result was that the piston hammered the inside of the back cylinder-head, which could be plainly seen by the marks on inside of back head; this broke the strap across key-way in front of main rod, the result was as described. All of this could have been avoided by taking the extreme travel of crosshead, or striking points, as commonly called, marking points on guides, and adjusting main rods accordingly, this is no uncommon occurrence.

Another bad practice I have observed by some workmen claiming to be A 1 machinists, when taking down connection rods to file brasses they will sometimes find the straps sprung together at open end of strap, which makes the brasses hard to drive out, instead of using the proper remedy, opening the strap a little, they will file off body of brasses until they slip through tight part of strap, the result is that when the brasses are put back in their position in strap, and keyed up easily in their place, that they are loose in the strap. When the engine is at work out on the road, the engineer finds that the rod pounds; he drives down the keys a little the first chance he has, but still it pounds, he drives down the keys a little more, the next time he stops, then the brass runs hot. It was not the brasses that were pounding the pin, *but the strap that was pounding the brass*. The machinist tells the engineer if he had left the keys in his rods alone, and would in future let *well enough alone*, he would not be troubled with hot brasses.

Another bad feature I observe is in filing brasses open; sometimes they are filed open on purpose, sometimes they are filed open through carelessness. Connection rod brasses should not be filed so as to be open at joints (excepting front end main rod brasses), but should be keyed brass to brass. I have seen a good many brasses filed open, but have the first time to see one that needed filing again, until there were liners sweat or pinned on face of brass, and keyed brass to brass, once filed open, they always file themselves thereafter. A good practice, when connection rod brasses are made new, is to bore them out $\frac{1}{16}$ in larger than crank-pin journal. In nearly every case, when rod brasses are new, they will heat up less or more on the start, when hot, the brass will expand more than the strap, compress the brass in the strap, then, when the brass cools, if bored out to fit crank pin, it will pinch the pin and cause it to keep heating for a time. But if bored out $\frac{1}{16}$ in. larger than journal, after the engine has made a trip or two, and the brasses of connection rods have worn down to their natural bearings, file a little off the face of the brass and you will then have your rod brass in good shape.

OBSERVER.

*Burlington, Iowa.*

## Where the Blow Was.

*Editors:*

We recently had a curious experience with a brand new Schenectady locomotive on the C. & E. T. Ry. that fooled all of us.

From the start she had a bad blow and no one could find it, sometimes she would run a full trip without blowing at all, then again she blowed badly.

Her valves and packing were examined early and her steam pipes ground in later, when it was found that when blowing

had she forced fire out of the door, in one instance burning the overalls off a fireman.

The master mechanic rode on her and the engineer from the works did the same, but neither of them discovered anything new.

Her flues were examined, as it seemed like a bursted flue, but they were sound. Finally the engineer and fireman were changed.

After a long time it was accidentally discovered. It was an arch pipe in the fire-box, used for supporting the brick arch. These arch pipes were put into the boiler sheets with a tapered copper ferrule, and when the engine was worked very hard the tube moved enough in the flue sheet to withdraw its taper ferrule and blow badly, and would take up as quick as it commenced.

The pipes were taken out and the blowing stopped altogether, grinding in steam and exhaust pipes, setting out Dunbar packing, and facing valves did no good.

*Chicago, Ill.* ARCHPIPE.

## Too Much Reduction for Service Stops.

*Editors:*

Brother George Holmes should inform the engineers on the Clinch Valley Division, that a 12-pound reduction with a 4-inch piston travel is not good braking, as your article would have us infer. In this part of the country, all good air-brake enginemen know that with standard equipment and maximum pressure the auxiliary and brake-cylinder will equalize under the above conditions. And if more than a 12-pound reduction is made, they are doing just what it appears to us that you are guarding against so strenuously—i. e., getting train-pipe pressure lower than that of brake-cylinder. We should have been delighted to have been present at the "love-feast," but sincerely hope you will enlighten us more fully as to what transpired on the occasion.

WISCONSIN.

*Kaukauna, Wis.*

## Answer to Relyea's Puzzle.

*Editors:*

In answer to my last puzzle will say that there was a small hole in diaphragm No. 7, of the pressure-reducing valve and dirt under valve No. 5, which allowed the air in drum to leak past valve 5, through diaphragm 7, and out of vent-hole in cap 3, thus reducing pressure in drum below that of train while handle was on lap. Throwing handle in release allowed train pressure to return to drum, which caused brakes to set, and now comes the "sticker." I am unable to explain why the whistle should blow under the above conditions and not blow while pressure was leaking off of drum from 50 pounds to 10 pounds.

*Syracuse, N. Y.* W. F. RELYEA.

## Those Breakdown Puzzles of K. T.

*Editors:*

I would like to answer the questions asked by K. T. in the October number.

First. I would take down the back-up eccentric strap and put it on in place of the go-ahead strap that was broken, leaving one of the bolt holes in back end of go-ahead blade vacant, then take a long bolt and put it through this hole and through one of the holes in back end of back-up blade, thus bolting the back ends of both blades together and go ahead.

Hooking the lever up will not have any effect on the valve travel on the right side, and you cannot back up, but you can take a full train in and run as fast as you wish.

Second. I would take down both back side rods, block engine so as to take as much weight as possible off of back drivers. If it was right back driver, would chain right side of back end of engine across to left side of front end of tank, keep front end of tank loaded heavy as possible and go ahead, running carefully, especially around curves.

Third. Place the engine on center, forward or back, it does not matter which, and put up your rod and look out for your striking points, and she will run all right.

*Wells, Nev.* M. B. B.

[The third question is not answered. K. T. wants to know *how*.]

*Editors:*

Please insert the following in answer to K. T. break-down questions.

First. Place reverse in full gear, take out broken parts. Now rob back-up eccentric on same side, and put in place of broken one. Now place a block of wood in link under link block, so it cannot move up or down, securing it there. Then you may proceed in this way; engine cannot be reversed, and will work steam full stroke.

Second. In my estimation you will be totally disabled.

Third. Place engine at ¼-stroke on disconnected side. Now measure from one axle-center to the other; the pin centers must measure the same; in case they don't they must be moved till they do, by means of bars and jacks. Having pin and axle centers to correspond, straps, brasses, rods, etc., will be marked where they belong; in case they are not, a walk to opposite side will aid you to find where they belong. Having found out proceed to box side rods by placing as many liners at one end of rod as the others. Having finished side rods, place engine you are working at on dead center. Push piston in till it strikes front head, and make a mark on guide-bars flush with crosshead; now pull out piston till it strikes back head; make a mark on guide-bars flush with crosshead. Now measure from mark on front of guides to crosshead. Suppose it measured 22¼ inches, now measure from pin center to axle center. Suppose it measures 11 inches, twice this = 22 inches, the stroke of the engine. The remaining ¼-inch equally divided for clearance on each end will be ⅛-inch; now connect rod to crosshead, equally divide the liners. Now push piston in ⅛-inch from mark on guides; lift the rod up and place in the brass; the space between the brass and rod must be filled with liners. Now place the other brass in strap and push it on, the distance it goes past the bolt holes is the amount of liners it requires. Having bolts and keys in, engine is finished.

R. BACHMAN.

*Beaver Meadow, Penn.*

*Editors:*

In answering K. T.'s third question on main-rod brasses, will say that engine brasses have oil holes drilled on top, and one is cut to allow clearance for set-screw for key. That will tell how brasses go to put engine on center, put up front brass, force crosshead back, and by looking at striking points on guides will tell how many lines to put in to allow clearance. Then put up back brass, key it up, turn engine on the opposite center, and see if clearance is equal. If not, change liners to make both clearances equal, and I think it will be all right.

EDWARD GIBSON.

*Wilmington, Del.*

*Editors:*

In reply to K. T. in your last issue, I will give him my own experience with a break similar to the one in question. The only possible way by which you could pull the entire train would be by moving the back-up eccentric in a go-ahead position. Take broken part of strap off of blade, bolt both blades securely together with a bolt taken from broken strap, which will be the required length, and to avoid link-pins chafing put a block about 1½ inches thick between butt ends of blades. By this method you can pull as many cars as before breaking.

Second. The only practical way that suggests itself to my mind would be to take out cellar, and block securely between axle and pedestal brace. Proceed carefully, but do not attempt to back up unless on straight track.

Third. Put engine on dead center, allowing about one quarter of an inch for clearance. It will be impossible to get the rod up wrong if the holes in strap match those in rod. If rod is too long put liner in back, if too short put liner in front. If you do not feel sure that your work is correct, pinch engine to front and back centers and notice whether you have the proper amount of clearance.

*Wymore, Neb.* OIL CAN.

## Results for Air-Brake Instruction Car.

*Editors:*

The New York Central air-brake instruction car has been here a week in charge of Mr. Shanon, who is so well known all over the country as an air-brake expert. The men are loud in their praise of Mr. Shanon for the able manner in which he has instructed them. This car is fitted up with a rack inside, on which is placed air-brake equipment equal to twenty cars. There is also an engineer's brake-valve with duplex gauge attached to show drum and train pressure, while other gauges show pressure on car cylinders and auxiliary reservoirs. There is also the standard and quick-action triple-valves and brake-valve with sections cut out to show how they work and where they are liable to give out. This car proves conclusively many points that have been the cause of much discussion and have been thought impossible by men who thought they knew something about air-brakes. Among the many things that this car proves to or convinces the unbeliever of are the following. First—If you have made a light application and placed the handle of brake-valve on lap, then throw it around to emergency notch, you don't get the benefit of the emergency brake, or in other words the emergency-valve don't open because there is not enough pressure left in train-pipe to open it. Second—With a very bad leak in train-pipe, brakes can be kept off and you can leave the handle in running notch all the while. Third—If when you slow down going into a station you think you are going to stop too soon, you can release the brakes and catch them again and not run by the place you want to stop at. Fourth—It shows that a reduction of twenty pounds on train line sets the brake in full, and a further reduction is a waste of air. These are but a very few of the many valuable points which Mr Shanon can prove to your entire satisfaction. Mr. Shanon has with him an assistant in the person of Mr. Burgess, of Buffalo, a very genial gentleman and thoroughly posted, who will have charge of the air-brake equipment on this road.

W. F. RELYEA.

*Syracuse, N. Y.*

## The Equalizing Discharge Valve.

*Editors:*

In reading the various articles written in the LOCOMOTIVE ENGINEERING about the equalizing discharge valve, one who is ignorant of the philosophy of this valve would say without hesitation this valve must certainly be something very fine, as every writer speaks so highly of it, but I, as a fireman, say darn the valve—no, not exactly the valve, but those who look after its welfare. I am a close observer of all things connected with air-brakes, and in consequence am inclined to be a critic when any of its parts are allowed to get out of order and go for weeks and months without being fixed. On a road in Southern California we have quite a number of engines equipped with the equalizing discharge valve, and the way the majority of these valves work is simply horrible. I am firing an engine equipped with the old engineer's valve, and the engineer can make a stop any place with from 5 to 8 pounds of air, but occasionally our engine goes up for a few light repairs and to be washed out, and invariably we get an engine with the equalizing valve on. Well, the first thing to be done is to start the pump, then wait and see what the results are. The first stroke the pump makes is one with the hammer; the next is a groan that would chill the hydrogen in an ice plant, then she slips an eccentric, and away she goes on one leg, one valve open, the other one shut, and the one that is shut is always the lower one. Why is it that the lower valve (when I say the lower valve I mean the receiving valve on the lower end of air-cylinder) always sticks? Some of the engineers use a compound for lubricating the air-cylinder made of the following elements. Water, engine oil, valve oil and signal oil, equal parts, mixed in the cover of the tallow-pot, and about one-half a teacupful is fed to the air cylinder through the lower valve once or twice a day. Still she howls for more, and the lower valve is stuck about one-third of the time. Does she need more oil?

When we get enough air to couple on the train, which consists of two coaches, we do so, but right here our grief begins, the pump has to run so fast to keep 70 or 80 pounds of air, that it would make a person sea-sick to hear it.

This is the way we stop in regular service, all the air is exhausted from the air gauge, and likeways, I suppose, from the train pipe, as both are connected, and when the pointer on gauge shows 0, the train pipe should be empty, but it is not, nine times out of ten there has not been enough air exhausted from train pipe to set the brakes, and why? The emergency port is opened wide every time, and as far as making a stop by exhausting air from small reservoir connected to top of rotary valve, you might as well spit on the rail, the one would have as much effect as the other. When the equalizing discharge valve is kept in good working order, it is, in my estimation, the only valve at the present time that is what may be called perfect, but when they are allowed to get out of order, and remain so, they become an all-around nuisance.

A FIREMAN.

*Los Angeles, Cal.*

[Our correspondent must not blame the equalizing discharge valve for the ignorance and abuse of those in whose care it is unfortunate enough to fall. The way your pump is oiled is enough to paralyze it—a spoonful of thin mineral oil once a week is enough in the air cylinder, and it should *never* be put in through the air suction. That the pump valves stick, it heats and pounds, is no wonder; clean out the valves and the air passages from them to the cylinder and you will have less trouble. A man used to the old valve, or a three-way cock, can do nice work with a two-car train, but the new valve will do as well, if clean and given a show. Probably that oil cocktail that the pump has been taking has got the engineer's valve so stuck up that there is no chance for it to work. Clean house and read up on handling that valve.]

## In Virginia.

*Editors:*

In the writer's estimation, one of the best railroad shops to visit and see new kinks and wrinkles being constantly worked out, is that of the Richmond & Danville system at Richmond, Va., under the direction and management of Mr. T. W. Gentry, master mechanic.

It would take more pages than you could spare in your monthly reports of the doings of our many hundreds of machine shops to give in detail all the new things that are valuable which Mr Gentry and his efficient lieutenant and general foreman, Mr. J. J. Bayley, have devised to cheapen the cost of repairs since my last visit.

One of the first things that strikes a visitor through the foundry is the cleanli-

...ness to be found in every corner and the fine quality of their castings. I saw heavy cylinder castings direct from the sand that were smoother and freer from blemishes than some stove-plate work I have seen, and I found on examination that they were just as hard as it was possible for them to be and have Mushet's tools cut under the scale and hold their edge. A rotary screen rigged up inexpensively on wooden uprights and used for mixing sand and facings serves its purpose well in reducing the pay-roll, and is one of the small items of practical economy in their foundry department. Every casting made is by piece-work, and the cost is quickly estimated and kept at a minimum.

Several heavy engines are being overhauled for freight service, and I was surprised at the small force employed in the machine shop in comparison with the amount of work being turned out. A device I saw here impressed me very favorably with Mr. Bayley's quick adaptation of ideas foreign to the shop to accomplish his ends. Needles for rod-cups are very essential, also very much in demand as they are constantly getting lost. To point a needle in an engine lathe in the ordinary way is a tedious job requiring some care, so he had a "pencil sharpener" made on an enlarged scale. It is caught in the lathe chuck, the ends of the needles forced into it, and say, they sharpen wire-rods just as nice as new lead pencils.

In the tool room, which, by the way, is too small, they have a system of "size cards" whereby the boys in charge of tools can tell just what sized drill to give a workman when he asks for a "tap or reamer and drill to suit." All the apprentices in the shops have to serve a certain portion of their time in the tool room, learning the uses of and becoming familiar with the various mechanical appliances used in shop practice. Regarding apprentices, I discovered that the sons of employés of the company are always given preference over other applicants, and that all "cubs" at work were the sons of employés.

Air has become quite a factor of importance around many shops, but I have never seen it so thoroughly utilized as it is here. All through the car-repair yards "air hydrants" are to be found for testing air-brakes. It is used in the roundhouse for testing engine-brakes and pumps; it is also used as a blower whereby a cold engine can be got out on the table hot within twenty-five minutes from the time the air nozzle is coupled to her blower pipe. In the oil house it is again to be found in use emptying oil from barrels into the various tanks, and they are just completing a set of rolls for rolling the leaves of driver springs the top roll of which is raised and lowered by an air cylinder. This machine is going to be a "money saver" for them, and looks very neat, while its cost is but a trifle, as the majority of its parts were resurrected from the scrap-pile.

In the machine shop they have discovered that the turret lathe is the most important tool in the place when rapid lathe work is required and that it is not good only as a screw machine.

The pattern shop is a picture of neatness. While in this department I had an opportunity to see the result of too much labor and too little brains in the drawing room. A blue print of a cab bracket had come from the draughtsman, who had made a front and two end views of it marked right and left, dotted lines ran everywhere and the pattern makers lost considerable valuable time studying out the puzzle before beginning to work on it, and probably after they were putting it together their doubts on the matter caused them to go slow. Remember this drawing was correct, what I am condemning is that there was too much of it. If there had been simply a front view and a view of it in section, the idea wanted would have loomed up before that pattern maker as plain as the Capitol at Washington, and it would have been so much easier for the draughtsman, not mentioning the time saved both in the drawing room and pattern shop.

I called on Master Mechanic O'Brien, of the Atlantic Coast Line, whose shops, just at the end of the long bridge across the river, are so antiquated that it keeps my friend John busy thinking all the time how to make both ends meet. There are several young men I am acquainted with in the North who are sitting in comfortably furnished offices and who are being continually flattered on account of their success as superintendents of motive power, who would prove total failures if they were suddenly transposed from the aid of their helpers in subordinate positions and placed in John O'Brien's office on the Petersburg Road.

Two compounds from the Baldwin Works have just arrived on this division of the Coast Line for trial in comparison with simple engines. As Mr. O'Brien is just as conservative on the compound question as Mr. Lauder, of the Old Colony, or Mr. Dolbeer, of the Buffalo, Rochester & Pittsburgh, results on his road will be devoid of all sentiment and without favor.

*Richmond, Va.* AN OLD MAN.

## Troubled With Too Good Memory.

*Editors*:

I see in the *Sun* an account of Jackson Richards' 100-miles-an-hour (?) engine. Can't you get a cut and description of it for your readers? It is disagreeable to be an "old cuss" with a retentive memory.

Some time about 1850, the P., W. & B. R. R. Co. built a three-cylinder engine, two out and one inside, connected and set at thirds. Inside was equal to the two outside, and there was the blunder, as you will see. She was to do wonders! Did you ever hear of her? Only *one* was built.

Shortly after a Baltimore firm—Smith & Perkins, I think—built or designed to build a "binary" engine to compete with and excell Ross Winans' eight-wheel connected. The "binary" had, or was to have, four cylinders, two out and two inside, the inside connected to a crank-axle, and the two pairs of drivers were coupled with side or parallel rods. Outside cylinders were coupled same as any other four-wheeled connected engine. The benefits supposed to be derived from this arrangement were perfect counter-balance and freer curving, as only two pairs of wheels were coupled. It was to knock the "camel-back" higher than Gilderoy's kite. (By the way, who in thunder *was* Gilderoy, and what kind of a *kite* did he have?) The camel-back *stayed*, the "binary" did not *materialize* to any extent. I do not know that any were built, although pamphlets were sent all over the country, one of which I had.

You see, from foregoing that the *Shaw* 4-cylinder-double-back-action-perfect-counter-balance idea was not original, and I think Richards' 100-mile-an-hour engine embodies most of the essentials of the two engines I have quoted, and will fall in line with them and the *Fontaine*—on the scrap pile!

Newspaper accounts of railroad inventions are, as a rule, interesting reading matter, but not always instructive. When "Norris Sons" first put on the "V" hooks, dispensing with "starting bars," they had an engine on exhibition (jacked up) at the Franklin Institute Exhibition in Philadelphia. The engineer would reverse her under steam. Of course the wheels would change motion instantly. Newspapers said, No more railroad collisions! Engineers could now stop a train *instantly* and go back Lately I saw a statement of a brake that would stop a train at fifty miles per hour instantly. I have known of cases where the head end of a train stopped *almost* instantly, but the rear kept right on and made it bad for passengers or freight.

E. J. RAUCH.

*New York, N. Y.*

## Hints and Facts for Enginemen—Some Old Pointers in New Words.

BY CLINTON B. CONGER.

[*Continued from Page 379, October number.*]

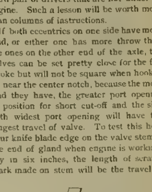
When the mark on the valve stem comes to the right place again it shows that the valve is opening for the forward motion just where it did for the back motion. If the crank-pin is a little below the forward center, the back motion will have the valve *almost* ready to open; of course if the go-ahead is set to the same place it will be "blind," as they say. From this you can understand how important that the engine is on the exact center, *not pretty near*.

Some men uncouple the eccentric rod of the slipped eccentric from the link after hooking her down in the corner in gear with the good one, then put the lever in the other corner, taking good care that the rocker arm does not get moved; then move the slipped eccentric till the eccentric-rod can be coupled on the link again. The principle involved in this method is the same as using the valve-stem, but it is more trouble and less exact.

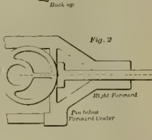
Four out of five engineers set their slipped eccentrics by the spoke of the wheel, by which they mean, set one eccentric about the same distance or same number of spokes of the wheel from the crank-pin as the other. When the crank-pin is on the forward center the forward motion eccentric should be nearly over the axle, less than a quarter of a turn behind the crank-pin, the back motion one will be below and in front of the axle, or ahead of the pin. Once fix these positions in your mind and the reasons for it, and you will not need any instructions about eccentrics. Neither will it be necessary to pinch the engine on the exact center to set them, as you can set the cams at any place in the revolution she may stop. It is a little handier to have her near the forward center, as in that case both cams will come on front side of axle away from the firebox, where you can get at them handy. If there was no lead or lap on the valves, the cams would come on the opposite side of the axle just a quarter of a turn from the pin; they have to be moved toward the pin enough to move the valve the amount of the lap, say ⅞-inch, which on a 6-inch axle for 5-inch throw will be about an inch at the surface of the axle; then enough more to give the lead in full gear, say $\frac{1}{16}$-inch, and you will find the spoke or brace in the middle of the cam is quite a distance around toward the pin. If the good eccentric has its spokes or brace opposite the fourth spoke of the wheel from the pin, set the slipped one the same distance from the pin on the other side of it, set up your set-screws tight and pull out—she will go all right. If it is less than four spokes from the crank-pin, set at the same distance. Remember it is not *always* four spokes from the pin, some engines are three and a half spokes away, but it is the same distance from crank-pin to each eccentric. See Fig. 1.

There is another way of setting the eccentrics, in which we use the position of the cam for the same motion on the other side of the engine for a guide. For instance, the forward motion eccentric on left side is out of the proper place. Turn it around till it is just exactly at right angles, or a quarter of a turn behind the right side one, for same motion. The crank-pins for same axle are exactly a quarter of a turn from each other and the cams should be also. If you can pinch the engine, get her a little below the forward center on right side so the forward motion cam on that side will point straight ahead, parallel with the frame and the forward motion on left side should be above the axle, parallel with the shoe or at right angles with the frame. The illustrations will make it plainer. Fig. 2 shows right side in proper position, move your left forward motion eccentric to position in Fig. 3 and she will be O. K. Remember these eccentrics are on opposite ends of the axle. Fig. 1 shows the position of eccentrics on same end of axle back up next the box. When you get the hang of setting them this way you will be able to locate them in their proper positions without pinching or otherwise moving the engine, as you can judge by your eye when they are a quarter of a turn apart. Get in the back shop with some one who knows how, and practice on a forward pair of drivers that are not under an engine. Such a lesson will be worth more than columns of instructions.

If both eccentrics on one side have more lead, or either one has more throw than the ones on the other end of the axle, the valves can be set pretty close for the full stroke but will not be square when hooked up near the center notch, because the more lead they have, the greater port opening in position for short cut-off and the side with widest port opening will have the longest travel of valve. To test this hold your knife blade edge on the valve stem at the end of gland when engine is working say in six inches, the length of scratch mark made on stem will be the travel at








that point, then compare it with mark made on the other stem in same manner, working in same notch. Try it also in full stroke and sometimes the results will give you pointers. If one valve-stem has more travel than the other it is fair to suppose its valve has more travel.

When the link on one side hangs lower than the other, the lowest one gives longer travel when working ahead and shorter when working in back gear, because the link block-pin is a different distance from the end of link and moves further each stroke. If the link hangers are same length and pins in connections not worn, raise one end of tumbling shaft a little to correct this error, but it is impossible to make an engine exactly square if the motion work is not the same on both sides of the engine. When the valve-rod has a turn-buckle or stretcher on it with a right and left hand thread, and they are put up the wrong length, after disconnecting out on the road, it is hard to fix on the exact length again. This mistake can be avoided if you will make a mark on the valve-stem and one on the valve-rod on opposite sides

of the stretcher some exact distance apart, say twelve inches, when you put it up again it can be set to these marks. I speak of these other derangements of the valve motion because the eccentrics may be just right and still the engine will not beat square. If she is not square at all points have her run over while under steam, so connections will all be warm, by the machinist-valve setter and made square where you work her most; the 10-inch notch is a good place.

When your engine is pulling *very* slow, walk along beside the guides, at the instant she makes an exhaust make a mark just behind the crosshead across the edge of the guide. Do this for all four points of the exhaust and you will have four marks showing how far from clearance points the piston has moved when exhaust takes place; these marks should be nearly the same distances from the striking points at ends of guides, but they won't be, and no one can make them exactly the same. But if there is a great difference, say two or three inches, it should be remedied, and you can soon see which exhaust is too quick and which too slow. Where the difference is slight it is caused by the "angularity of the main rod." The eccentrics are set in a certain relation to the crank-pin; when the pin is on the dead center, the piston and crosshead is at the extreme travel on that end, but when the crank-pin is half-way between the dead points, on the quarter, the piston is not half-way between the dead points, it is nearer the wheel than half-way, so exhaust will be some later from front end of cylinder. Moving the pin in the link-saddle or frog corrects part of this error. Of course this pin cannot be changed out on the road unless the frog is put on wrong. The pin should be nearer the back half of link than the center line. When a young runner begins to monkey with the valve motion, unless it gets out of square on the road, the wrath of the round-house machinists settles on him because they are sure he don't know anything about it. Learn how to go about it right and get it done right and they will be ready to help and take your say so on what is the matter.

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## Locomotive Running Among the Bushwhackers.

By Old Soldier.

*(Continued.)*

I should have mentioned that, previous to putting on this hospital train, we hauled the wounded and sick in box cars. I mention this so that you can see the necessity of this kind of a train. If I should explain the suffering of human beings in those box and stock cars it would make your hearts ache. The coaches we had were not sufficient, but they relieved a great deal of suffering. I have heard many of our wounded soldiers say that our coaches were palaces alongside of the hospital tents, but my readers must not think they were any comparison to the trains that roads are running at the present time.

As I stated in my other article, we were soon to be out of Nashville. We only stopped there long enough to unload the wounded, then we proceeded South with empty train, excepting nurses and crews. The nurses cleaned out the cars under way.

About this time engineers and firemen came to Nashville very thick. Among the good runners that came and staid were Billy Smith, Dave Gardiner (we called him Sugar Foot), Bill Lenning, George Preston, Tom Doyle and Mike Hughes.

Mike was an old fireman on the Chattanooga road, and was set up there. I remember one poor fellow by the name of Jack Bryan. I think he came from the Pittsburgh & Fort Wayne Railroad. I remember of his telling me he had been foreman of a roundhouse. He had a watch presented to him when he left that road. I think he only made one short trip on the Nashville & Chattanooga road when he was captured by the Johnnies. they did not hurt him, but only took his watch and jewelry and all his money and exchanged clothes, as he was better dressed than any of the Johnnies.

Poor Jack was a hard looking citizen when he got back to Nashville. The next morning after he got back, he came down to the M. M.'s office, and was telling us all about it, and planning how he would get revenge out of the Johnnies. I could not help but laugh at him. While he was talking to us he kept feeling his left breast. I made the remark to him that we must all expect to be robbed or killed running on such roads. I just stepped into the office and said something to the clerk, when the news spread that Bryan was dead—he keeled over and never spoke afterward. It was caused by heart disease and the excitement of the time. I think his yarn made some of the new men hunt their way back North. I never learned whether his watch was recovered or not.

I will mention a little more in regard to the hospital train. The fare at the table could not be beaten anywhere, nor could the train be surpassed in war times for safety. Now I imagine you young runners will say that this train was the kind to stick to in war times; well, a few trips satisfied me and I gave it up and have wished a thousand times I had never seen it. The horrors of that train will never be erased from my memory. My partner, old Charley Butterworth, and myself gave it up, and Tom Doyle and George Preston took our places. Old Charley Butterworth, I think, gave up running altogether. I took my old run on passenger train back again.

I see Mr. Anderson writing up the Johnnies' side in the last issue. The Johnnies' orders must have been very severe on tail-end collisions—about the same as they are at present in Mexico. We did not have any such orders as those, but I would have hated to have been the one that run into the hind end and killed or hurt a Yank.

I tell you a soldier at this time was worth more money than a negro in slave times. I can say one thing for our train crews, engineers, firemen, conductors and brakemen—you never met any of them drunk on duty, and the old boys, if they chose to tell it, would say that there was more whiskey carried over that road than was ever carried over any other road of its length, and the boys all know what I mean by this. This whiskey fell into the hands of sutlers. Do you remember, boys, the cotton cards, which were $1.50 in Nashville? Now, you old sly coons, you all know the price along the road. Messrs. Editors, we were not running there for glory or $145 a month, but we could not afford to let Uncle Sam into the secret because he might blow on us. If I had formed an idea then of writing this up I would have kept a diary.

I would state here that whenever we wanted to push forward the Johnnies had to move. We could raise three men to their one. You know some say we overpowered them, while some say we whipped them. I leave this matter to history, for you to judge, but it mattered not how far we pushed them ahead, bushwhackers were left in the rear and their sole aim was to capture and rob trains. At one time we were compelled to carry five or six rebel prisoners and barricade our engine with them. We would do it in this way. Say we carried five prisoners, we would put two on each side of the tank and make one sit out on the front end of the engine. We would have the shackles on them, and the train-guard to watch them. I tell you my heart ached many a time for them, but you know war is war, and what brutes we all got to be on both sides! One cannot believe it unless he was there to see it for himself. It becomes disgusting for a man to sit down for one moment and think of civil war carried on for the benefit of politicians that would faint at the smell of powder. Well, boys, it is exciting and gives you lots to think about if you go through safely.

I am well acquainted with an engineer running a passenger train out of Houston, west, to San Antonio. He has passed through twenty-six hard-fought battles with only one or two slight wounds, but he has wrecked his constitution and he does not draw a pension, but he should draw one.

How much would any of you good runners or machinists take to go out with a gun and stand up in a three-days' fight, like the battle of Stone River, where 25,000 or 30,000 men were killed on both sides and as many more wounded? I guess the most of you would rather serve on the Grievance Committee. When we ran from Nashville to Chattanooga we hardly ever made a trip without being fired into. I was coming down Cumberland Mountain one night, about half a mile from the corner. I reached forward to open the pet-cock, and just as I started to straighten up a bullet came through the side window and close enough up to raise a blue blister on my back. I thought I was cut in two. The fireman thought the bullet passed through me. He was back in the well of the tank. I dropped on the deck; several shots were fired on us and struck the cab and jacket. I was suffering intense pain, but had to stand it until I reached Nashville, as I had no one to relieve me. When I reached Nashville I was laid up for a couple of weeks. After I got well I took my old engine and run again.

The army pushed on to Big Shanty and Atlanta, Georgia. I do not remember who was in the lead with the supply train, but I had orders to proceed with the passenger train to Big Shanty and from there to Atlanta.

Now, boys, just imagine what a looking country this was after two large armies passed through it. I always thought that the Rebs in evacuating their own country devastated it more than we did. They thought they would not leave anything for us to forage on, but that did not bother us, as we always had plenty. In saying us, I mean the whole Yankee army.

Sometimes a supply train would get belated and the boys in front would get a little hungry, but train crews did not suffer, nor the guards at bridges and stations. I think about the hardest time our army had for grub was at Chattanooga. They got there several weeks ahead of the rebuilding of the road. They were put on half rations for some time, and before wagon trains or the railroad could be gotten there they were down to one hard cracker a day, but this did not last long, as old Uncle Sam pushed up his grub trains as fast as he could and soon gave the boys a good feast.

I will say here, to you readers who do not know what a government ration is, that no hearty man can possibly eat one soldier's ration a day. I tell you this so you may know that our army was well supplied with plenty to eat, while the poor Johnnies were always short, and some of them looked very gaunt when captured, and after they were taken I never saw one that did not enjoy a square meal at Uncle Sam's traveling boarding-houses. How their old lantern-jaws would palpitate at sight of a good big cup of coffee!

Now, boys, if we had gone hungry as long as they did we would have been lantern-jawed too. I do not think history could record any great army in the world that was as well fixed and clothed as the Federal army was. I think all good soldiers will bear me out in this statement, but the poor Confederates suffered for clothing and went hungry, but fought like devils, and I defy anyone to gainsay this. I have seen more suffering among Confederate families while passing along the road than I could possibly describe to you. I always carried my coffee mill, coffee and coffee-pot and made coffee whenever I wanted it. I had a good drip-pot and could always get hot water from my gauge cocks by removing the dripper. Of course I always had a part of mine and my fireman's rations in the boxes, so, you see, I fared better on military roads than I did on civil roads. I do not know how many of the boys did this, but I advised all who talked to me to do the same.

Well, as I said, we proceeded on our journey to Atlanta, and when we arrived there what a sight it was. All of you that know Atlanta to-day could not think it possible that it was the same place it was the day we arrived there. It was desolate and in ruins and all its people—women and children—left by the Confederates to take care of themselves until their husbands and fathers returned, which many of them never did. But in as far as my memory serves me, none of them appealed in vain to our commanding generals for food. It is hard when you hear little children and women crying for bread, but may all of you who read this remember, that should you ever be called to go to war, this fate may meet your loved ones as it did the poor Southerners who once lived on the best that the land of the United States afforded, surrounded with their black slaves to attend to their every wish. So remember, hot-headed young politicians, how you move, or this may be your fate.

Tell your readers to have a little patience with me for getting off of my subject. In my next I will give them a little account of General Grant's trips on the military roads, as I was the man that pulled him around on his special trips, and I am in a position to deny the story of some of those trips that he is said to have taken through the enemy's country on horseback.

Please say to your readers that my time at present is not my own, as I am in the employ of a railroad and have a great many duties to attend to besides writing up. Writing is not my forte. Setting valves and setting up wedges and driving-rod keys suits me better, but in my next I will tell you all about how I took General Grant over the mountains, and how we parted.

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Numerous improvements have been effected lately in the works of the Egan Company, Cincinnati, Ohio. They have built a large addition to the works, and it is in running order and equipped with the best machinery to be found for finishing machine work accurately and expeditiously. A new Brown engine has been provided for driving the machinery, and the whole place is well lighted by electricity. Every machine in the shop is provided with a portable incandescent light protected by a wire cage. A superintendent of motive power noted for shop ability in walking around these shops lately remarked that the tools had the leading attributes necessary to success. They are evidently made of good material, have stiff, strong frames, ample bearings, heavy gearing accurately made and a good margin of belt power.

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The mechanical department of the Chicago & Alton are preparing drawings for a class of heavy engine adapted for the hard work to be done on the steep grades of the Western divisions. The engines will be ten-wheelers, suitable for freight or passenger service. The cylinders will be 19 x 26 inches, and the boiler will be made large enough to supply steam freely under the most severe conditions of service. About ten of the engines will be contracted for as soon as the drawings are ready.

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The Barney & Smith Manufacturing Company was reorganized some time ago, and formed with a joint stock company. Stock in the new company has been offered to many railroad officers with a view of interesting that class of men in the prosperity of the car-building company.

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**WANTED!** Ever since April has come the demand for January and February copies—we've been out since then. Now, here is the last and only chance to get them. We have 100 copies, 50 of these will be bound up with the year's issue in time for Christmas. Price of volume, $3.00. The other 50 will be sold with the full year's numbers only—no single numbers of either month can be had. Price of year, 12 numbers, $2.00. Single copies of any month, except January and February, 20 cents each. We will receive orders now for these papers—first come, first served. This was our reserve for binding. There will be no others printed.

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## New Side-Dumping Coal Car.

Engravings will be found on this page showing the arrangement of a new 50,000-pound capacity side-dumping coal car, recently put in service on the Lake Shore road. Mr. A. M. Waitt, general master car builder, describes the car in the following letter:

"The car is intended especially for carrying coal to be unloaded on our standard coal chutes. The cars run up on the trestle, and, by means which I will describe below, the coal, without shoveling, runs by gravity into the compartments in the coal chute, all ready to be dumped into the tender of the locomotive. These cars can also be used for ore, although the incline in the floors of the cars is not sufficient for ore to unload itself without the aid of shoveling.

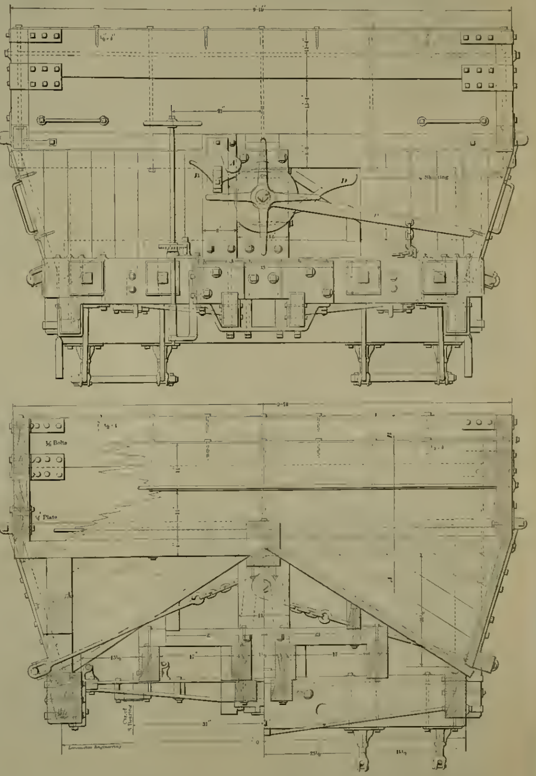
"The car is divided into five compartments, each of which has a door on each side. The bottom of the car slopes at an angle of about 30 degrees from the horizontal from the center of the car toward the sides. The sides of the car, the bottom part of which is composed of doors, slope inward, so that when the doors are released from the closed position they naturally swing open from their own weight, allowing the contents of the car to slide out.

"Through the center of the car, the entire length, runs a 1¾-inch square winding shaft. Located on this shaft, opposite the space between the doors, are cast-iron worms, having connected with them short chains and tie-rods, which extend on each side to the side of the car, and connecting with a strap extending across the space between each of the doors, the strap being securely bolted to each door.

"When the doors are closed and the car is loaded and it is desired to dump the load, the dog, *A*, is turned around until it rests upon the projecting arm of the ratchet pawl, *T*. The lever, *C*, connected with the unwinding shaft, is forced down far enough to allow the ratchet pawl, *T*, to disengage itself from the ratchet wheel. The lever, *C*, is allowed to travel as high as the short chain attached to the end of it will allow. Then the lever pawl, *D*, is released from the ratchet wheel. If the weight of the coal is not sufficient to start them open when thus released, the arm wheel, *E*, at the end of the winding-shaft is used to unwind the chain, which being done, the doors, from the force of gravity, will assume a vertical position.

"To close the doors the lever ratchet pawl and dog for ratchet pawl are placed in position, as shown on drawing, and the chain wound up on the winding-shaft by means of the lever alone.

"The trucks which we use under these cars are our regular standard truck for 60,000-pound capacity cars, trucks having the standard M. C. B. 4¼ x 8 axle."



## Where Brake-Shoes are Made.

Passengers passing over the Chicago & Erie Railroad have for years been familiar with the sight of a modest foundry about four miles from Chicago, marked Congdon Brake-Shoe Co. Within the last few months this foundry has developed into iron and steel works, with several large buildings for the accommodation of a plant which is devoted to producing various kinds of metal used on railroad rolling stock.

The company now call themselves iron and steel founders. The cast-iron work that built up the place is not neglected, and an excellent foundry, provided with the best facilities for doing work, is in active operation. Brake-shoes are the principal product of this department, but the company undertake to make any kind of castings for railroads, and they do a good general business in this line. They employ molding machines to good advantage in doing work that calls for many products of one pattern, and they are preparing to further develop this line of business.

The radical additions to the plant have been facilities for making steel. They have put in a fine open-hearth Siemens-Martin furnace, with a capacity of twelve tons per heat, and by running continuously they can get three heats per day. This furnace was designed and built by Mr. J. Herrick, the well-known metallurgical engineer. An eloquent testimony in favor of the ability displayed in building the plant, is the fact that good serviceable steel was produced at the first heat.

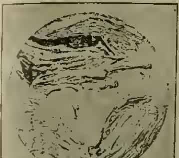
This open-hearth plant is devoted to the making of steel castings. Besides their steel shoes, the company are making a steel coupler and all sorts of coupler knuckles. They are also making steel gears, rocker-arms, crossheads and any parts that railroad companies prefer to have formed of steel. A place where thoroughly reliable steel castings were made has been badly wanted in the neighborhood of Chicago, and this place appears to fill the want.

As crucible steel must be employed for the eroding pieces of the consolidation brake-shoe, this company concluded that they had better provide themselves with a cast-steel plant, and they have done so. They have a 24-pot Siemens crucible furnace, and are making all the cast-steel they need.

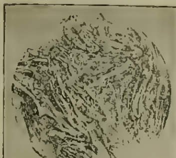
The whole of the plant is put up with a view to combine convenience in operating with the production of first-class material. They make their own gas for the furnaces, use oil under their boilers, and have good electric means of transmitting power. The works are traversed in every direction by the C. W. Hunt system of tramways, and cars and material are handled with the least possible expense and delay. The works are run under the immediate charge of Mr. Will Sargent, son of Mr. George W. Sargent, president of the company.

## Dangerous Axles.

The etchings shown in the annexed engraving were taken from a car axle that broke and caused a wreck which cost the Santa Fé Company $8,000. The axle was under a lot of refrigerator line cars built by the Michigan Car Company, and is a good illustration of the ultimate result of the race for cheapness which we have commented on at different times. The axles under several of these cars broke, causing much destruction of property, and the railroad company has decided not to permit any more of the cars to be run until the axles are replaced with others that will be safe. An inspection of the etching will show that the metal is inferior. Inspection and tests of the iron itself seem to indicate that it is a mass of cold short pieces of iron very badly stuck together with cinder. When subjected to



¾-inch Plate cut off end of axle near where it broke
Print taken from face nearest breaking point



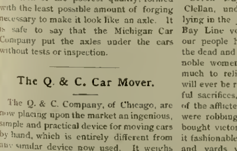
¾-inch Plate cut off end of axle near where it broke
Print taken from face farthest from breaking point

physical tests, one specimen from this axle broke under a tensile strain of less than 28,000 pounds. The axle when broken showed a crystalline mass of globules as large as the crystals of sulphate of iron. The axles are stamped M F & I. Co. They were supposed to be made of scrap iron, but it must have been iron of the poorest quality, formed with the least possible amount of forging necessary to make it look like an axle. It is safe to say that the Michigan Car Company put the axles under the cars without tests or inspection.

## The Q. & C. Car Mover.

The Q. & C. Company, of Chicago, are now placing upon the market an ingenious, simple and practical device for moving cars by hand, which is entirely different from any similar device now used. It weighs only about thirty pounds.

The working grip of the mover on the axle of the car is obtained by a sharp pull on the handle, so that, with a little prac-




tice, the operator is enabled to take advantage of the momentum gained and thereby keep the car moving. It is possible for one man to move a loaded car quite readily and with comparatively little effort.

In Fig. *A* the "mover" is shown on axle in position to push the car from the operator, while Fig. *B* shows it in position to move the car toward the operator. This latter is a feature not possessed by other movers.

## Effects of a Washout.

The disastrous wreck illustrated in the annexed engraving happened on a Western railroad to a heavily-loaded passenger train, and resulted in the death of seven persons. It was during the time of a severe sudden flood, which sent a large volume of water through the trestle. The engineer pulling the train stopped before passing over the trestle, and thinking from an examination that the structure was sound, attempted to proceed. The engine went over all right, although the piling under the sills was washed out. The cars were not so fortunate. Under their weight the structure collapsed, and several cars were crowded into the deep gully, trestle timbers and fractured cars making a scene of devastation and ruin. The first sleeper rested as shown and the others remained upon the track.

## Train Running for the Confederacy.

By Carter S. Anderson.

As I stated in closing my last letter, the stormy and terrific battle of Malvern Hill, which was fought at night, closed the "Seven Days Fight." General McClellan, under cover of his gun-boats, lying in the James River, arranged for a Bay Line voyage to Washington, while our people had their hands full burying the dead and caring for the wounded. The noble women of Richmond helped very much to relieve the suffering, and they will ever be remembered for their beautiful sacrifices, which they made in behalf of the afflicted whom pain and suffering were robbing of the joys of their blood-bought victory. Richmond society made it fashionable to deck the parlors, porches and yards with the cots, pallets and benches of the crippled boys, carrying and sending delicacies to the hospitals for the more seriously wounded, who could not be allowed outside. "*Belle Monde*" tied on Bridget's apron and gracefully performed her duties, making the boys feel at home. At that time Richmond had lost nothing by the war (by the way, the war made Richmond), and so was well prepared to entertain the visitors whom the fortunes of war had suddenly cast upon her Virginia women, while they do not meddle with business or politics, do not ask any advice or take any suggestions as to how they must manage the disbursement department of the family.

We felt now that the Confederacy was a government *de facto*, and that the offensive must be taken at once. Many of our officers obtained a twenty-four or forty-eight hour furlough, in order to run home and let their people know that they had escaped the fire of battle, and in many cases to receive the last fond kiss before going back to Northern Virginia to meet the enemy, for our boys were always saying "We can whip the Yankees, but they won't stay whipped—like Banquo's ghost, they will not down." But I beg pardon for this digression, and will now confine myself to my railroad narrative and try to stay on the track.

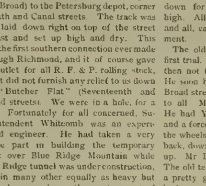
We will now go back a few days before the "Seven Days' Fight." General McClellan, you remember, had destroyed all the bridges on the Virginia Central between Richmond, Fredricksburg and Potomac Junction and Richmond, which would throw all of our machinery and rolling stock into General McClellan's hands, should he defeat Lee. Like all other fights, of course nobody knew what the result would be. I know our railroad president, Fontaine, and Superintendent Whitcomb felt very much anxiety as to how it would end. The government was equally as much concerned in this matter of transportation, as the railroad men had already laid a track in Eighth street, from the old R. F. & P. depot, (corner Eighth and Broad) to the Petersburg depot, corner Eighth and Canal streets. The track was just laid down right on top of the street ballast and set up high and dry. This was the first southern connection ever made through Richmond, and it of course gave an outlet for all R. F. & P. rolling stock, but it did not furnish any relief to us down in "Butcher Flat" (Seventeenth and Broad streets). We were in a hole, for a fact. Fortunately for all concerned, Superintendent Whitcomb was an experienced engineer. He had taken a very active part in building the temporary track over Blue Ridge Mountain while Blue Ridge tunnel was under construction, and in many other equally as heavy but not so long grades on the western part of our new Chesapeake & Ohio Railroad where it intersected the North and the Allegheny mountains.

One Sunday afternoon, while we boys were all gathered in the corner room of the large brick building, corner of Broad and Seventeenth streets, Superintendent Whitcomb came in looking serious. We knew something was the matter. Walking up to the front window, which looked out upon Broad street and through which we had for an hour or more watched the pretty girls going to and from church, he said: "Boys, we must get our engines and cars up *that hill* or we will run the risk of going into the army, for if General McClellan gains the victory, he will clean us up of railroads." We soon found he was in dead earnest, and early next morning, having gotten permission from the authorities to lay a track from our Seventeenth street track to the R. F. & P. depot, corner Eighth and Broad, we soon had Broad street full of cross-ties, rails, etc., and a very large force of laborers.

He had Mr. Stephen Hunter and all the depot force, the Seventeenth street shop-carpenters and of course all the trackmen working at it. He was much laughed at, (the idea of running an engine up *that* hill!) and was of course much abused for obstructing the street. Mr. Whitcomb, however, very soon had the track laid, connecting it with the Eighth street track corner Eighth and Broad. The grade will average 350 feet to the mile and in one place (at intersection of Jail alley) it must be 375 feet or over to the mile. To make sure of this grade I have had the city engineer give me the figures from his office. At Broad street and Eleventh the street level is 160.50 feet above tide; the distance from Seventeenth to Eleventh is 1,950 feet, the engines had to raise 131.31 feet in this distance. At the intersection of Seventeenth and Broad the street level is but 28.99 feet above tide. The up-hill Broad street track intersected our Seventeenth street track with a Y running out east on Broad street so that the engines backing down from the roundhouse into the Y would switch front into the Broad street track. The engines were brought down for trial. Then excitement ran high. All of the city, government officers and all, came out to witness the experiment.

The old "Millboro" was to make the first trial. Engineer Fendal Ragland was then not the nervous old man he now is. He soon had the "Millboro" headed into Broad street, and an odd sight she looked to all. Mr. Whitcomb showed anxiety. He had Yard Master Dandridge Lowry and a force with "chocks" to place behind the wheels to prevent the engines running back, down the hill, should they fail to go up. Mr. Lowry told Ragland to go ahead. The old ten-wheeler took out up the hill at a pretty good rate until she struck the highest part of the hill at Jail alley, then she commenced slipping her drivers. The fire flew. We placed the "chocks" and held her fast, but never an inch would she budge further up. "Just as I said," could be heard all around. Ragland kept cool, he told Mr. Lowry to remove the "chocks" back and let him try her a short distance lower down. Same result. By this though, Ragland found that he could let her back and told them to take the "chocks" up and let him go back, which he did, and backing as far back into the east end of the Y as he could, he sent for Mr. Whitcomb, who came to him at once looking mortified and disappointed. Ragland told Mr. Whitcomb that he must either run her up the Seventeenth street track to pump her up or *run* her up the hill. Mr. Whitcomb replied: "Why, Ragland, you have just tried and failed, so you had better let some of the other men try her or try their own engines, but if 'Millboro' won't go up, none of them will."

This nettled Ragland, and he said firmly and determinedly: "Mr. Whitcomb, if you will throw them 'chocks' away and let me have my own way, I will be at Powhatan

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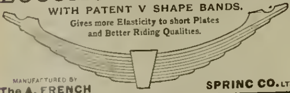

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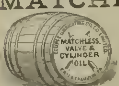


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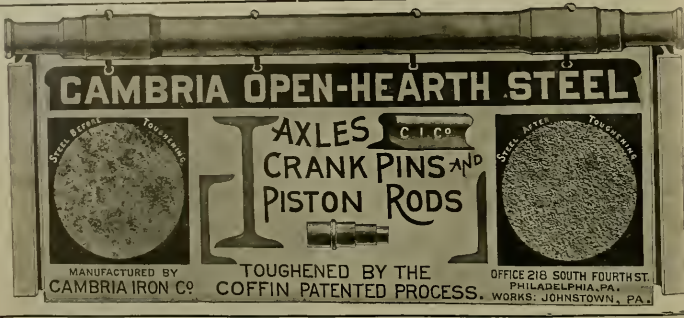


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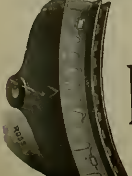

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Shoes should be ordered in accordance with the above allotment of Territory.

Hotel (the top of the hill) in ten minutes from the time I pull my engine open." Mr. Whitcomb granted him his request, cautioning him, "By all means don't burn her, but put out the fire just as soon as you get up the hill." The men heard what passed and stood aside to see her launch. Ragland gave her a good oiling, he crept all down under her and examined her machinery quickly. Crawling out, and wiping his hands with the waste, he patted the "Millboro" and said

"Well, old girl, you and I will be in h—— or at the Powhatan Hotel in ten minutes!" He slipped up and pulling her wide open, she bounced up and jumped on the unsurfaced track, and by the time she got to that tight place in the grade, she had gotten such a swing that the old

Broad street, or about on the R., F. & P., or Petersburg side. Remember this was all prior to the battles, and now that the fortunes of war had left us in possession again of our road, we headed at once all of our rolling stock back down the hill. In getting the cars back, some cars got loose near the R., F. & P. depot and took the half-mile flight down to Seventeenth street. They came like lightning, hitting broadside against a car which happened at this moment to be standing in the street, lifting it entirely off the wheels and throwing it around into the vacant lot south of Broad street.

Yardmaster Lowry could say some funny things. Walking up to the box as it lay on its side, end toward the track, and seeing that it was not much broken,

consummation in cr^d succession of curves shops. The lake in ^as in a rich coffee-pro- the pond seen behind t^e transportation of almost entirely filled up, and of fre' are building a fine new roundhouse in the front and a car shop behind. Both shops are substantial brick buildings, the roundhouse being one of the best buildings for that purpose we have ever seen. It is eighty feet between walls, and is built on stone arches that sustain the brick walls.

## Strength of I-Section Rods.

One of our leading railroads has a number of locomotives with channel side rods of the section in Fig. *A* of the annexed engravings. The rods began to break and the mechanical department proceeded to

st ins

## Notes from Brazil.

BY LEWIS GLEASON.

GENTLEMEN: As it is many days since I have had the pleasure of receiving a copy of LOCOMOTIVE ENGINEERING, I regret to say that there must be a hitch somewhere in the post-office business between the States and this country. I received two copies O. K. April and May, since then I mourn its absence. I presume the post-office is conducted in this country in keeping with all other institutions, a kind of "go-as-you-please" manner, so to speak.

The especial duties for which I was sent out here are now about completed. I erected two engines at this place, one of which has been in service during the past three months and is doing good work and giving excellent satisfaction, the other has been ready for service for some time, but the track-laying is not far enough extended to require two engines; however, I have made a trial trip with her and everything worked to perfection. The home road of these engines is about eighty miles from this place, we run them under steam to destination. So far as the trip through the country is concerned, it is pleasant, but the accommodations in the hotel line are far from sumptuous, however, I am treated very kindly, and on the whole I have not much to complain of.

The average Brazilian railroad is run on a system rather peculiar to us people. As I am not acquainted much, only on one road, the Leopoldina, I will speak more particularly of that system. The Leopoldina, with its main line from Nitheroy to Campos, and several branch lines, furnishes the State of Rio de Janeiro with very fair facilities. Nitheroy is situated on Rio Bay, and to get there from Rio you have to take a not very commodious nor over clean ferry boat. After a ride of forty-five minutes you are landed on the railroad pier.

B., C. R. & N. SHOPS, CEDAR RAPIDS, IOWA.

clumsy thing shot up to the top of the sharp grade.

The track being laid on top of the street ballast, as the old engine rose, she looked to us, down in the bottom at the Seventeenth street depot, as if she had concluded to wing Ragland in a heavenly flight instead of that down grade he threatened her with before starting. The shouting crowd having followed up the hill, we soon saw the old Millboro standing in front of the Powhatan Hotel, with a crowd of curious spectators standing around her. The hotel proprietor, Scammell, told Ragland that as soon as he could leave his engine to come down into the bar, as one of the servants had *found* a bottle of old rye in the *lumber-room* and he wanted Ragland to help him to hide it.

At that time the government had a strict prohibition law in Richmond. It was the only time in my life of fifty-five years that I ever loved and drank whiskey, but to get it and drink it on the sly was so funny and the whiskey was good. But to explain about "finding a bottle"—the barkeeper had a dark room in the basement of the old Powhatan. He had a couple of bricks loose in the partition wall between his room and the "old lumber-room," through which aperture he would pass the bottle to the middle man, who would give out that he had found "a bottle of rye in the old lumber-room." The bottle was taken care of and the finder rewarded, and the "Dark Horse" too.

The next engine which came up was the "Whitcomb," J. W. McClandish, engineer, and soon all were up. It only needed what our present energetic M. M., T. G. Lloyd, tells his engineers when they complain of their engines not pulling a certain number of cars on certain grades "Give her the swing before you strike the tight place."

Soon all of our engines and cars that were on our Richmond end were up on

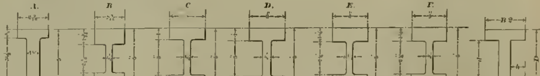
he remarked, as he turned and looked at the mess of wheels, etc., in the middle of the street "Old lady, it's well you did get out of the way."

Mr. Nathan Wildman soon had the Seventeenth street shop on double duty day and night getting ready the machinery and coaches to carry the army to North Virginia. The government was pressing our officers for unbroken transportation—Richmond to Gordonsville—which brings us back to where we left Thomasson building the bridges.

The road was soon *in statu quo* to Staunton, Va., and how we got the first train of Gray Jackets to Gordonsville to actually see from the depot the Blues com-

ascertain the cause. Calculations indicated that the rod was a bad form which did not yield strength in proportion to the weight of material employed. The same weight of material was put in another form, *B*, and tests proved that the rod was greatly strengthened. A still stronger form was obtained with less material in the form shown in Fig. *C*. In the sections shown in Figs. *D*, *E* and *F*, a little more material was put in with a very decided increase of strength. This is an excellent illustration of how material may be distributed to obtain the greatest strength. It was not desirable to make the rods any heavier, as all the counterbalancing would have required re-adjusting, but the required results were

The train on which I rode was composed of six cars, such as they were, two of these were transferred to a branch line about twenty miles out from our starting point; four went through to Macahe. They consisted of two first-class cars of American manufacture, one English carriage (about the size of a Saratoga trunk) for second-class passengers and a box-car for baggage, all drawn by a very fine looking eight-wheel engine of Baldwin build. A passenger is not allowed any free baggage, only what he can crowd into the car—all that goes in the baggage wagon must be paid for, and I know from experience they are not very moderate in their charges. Power brakes are not used on this road, only on the engines. They are equipped with Eames' vacuum brake. Each station on the line is furnished with a bell, from




ing down those little mountains—and many silly and ridiculous occurrences such as only we can produce, I will have to tell you later, if it will interest your readers.

## Cedar Rapids Shops.

The engraving on this page gives what is almost a bird's-eye view of the machine shops of the Burlington, Cedar Rapids & Northern Railway at Cedar Rapids, Ia., for the photograph which is reproduced in the engraving was taken from the top of a high smokestack on a hill overlooking the place. It is a very striking scene, the grounds where the shops are located being almost surrounded by the Cedar River.

Great improvements are in course of

obtained with the old weight of rod. The following table givas particulars obtained by the tests:

| | A | B | C |
|---|---|---|---|
| Breaking weight in pounds | 13,104 | 11,816 | 11,806 |
| Section area in square inches | 7.78 | 7.78 | 7.5 |
| Weight of rod in pounds... | 222 | 222 | 214 |
| | **D** | **E** | **F** |
| Breaking weight in pounds | 15,120 | 15,825 | 10,063 |
| Section area in square inches | 7.84 | 8.13 | 8.47 |
| Weight of rod in pounds | 225 | 232 | 240 |

The tests were made by Robert W. Hunt & Co.'s Bureau of Inspection, Pittsburgh. The tests were done under the formula illustrated in Fig. *B* 2. Ends supported; weight in center. $K$ = 68 cwt. $L$ length between supports.

Formula—$4 K L$, $B D^2 - 2 b d^2$ = breaking weight in cwts.

which a cord is in communication with the agent's office. When the agent thinks that all the passengers are received and discharged, and the time being up, he rings the bell, the conductor blows his whistle, the engineer gives one short blast of the engine whistle and starts the train.

As the train leaves it is heralded at the next station by the agent ringing his bell. The system of ticket collecting is the same as on our American roads. On arrival of train at Macahe, a station about 110 miles from Rio, all passengers for Campos and intermediate stations must change cars, as the road changes gauge here, from Nitheroy to Macahe the gauge is one meter ten centimeters, from Macahe to Campos the gauge is one meter. Just

think of a road in the States with a main line of 175 miles having two different gauges, and the difference only four inches. On the Brazilian Central, the chief road of the country, a similar state of affairs exists between Rio and San Paulo, only the difference is much more, the gauge out of Rio is five feet and three inches, into San Paulo it is only three feet and three inches—shriveled up on the way, as it were.

The equipment on this road is principally American, with a few freaks in the shape more or less of locomotive engines built in England, and the boss freak of all is a German built engine; it is fearfully and wonderfully made.

The working force, such as train and engine crews, shop hands, etc., are all native, but I cannot say that they are "to the manner born" in their different vocations. Somehow or other they do not appear to be intended for the business; however, they get along, and furthermore if you ask any information from a conductor or brakeman on a passenger train, provided you can speak Portuguese, you will be politely replied to, and the information sought will be given if they can possibly do so, in that respect they are far ahead of our average American train crews.

I cannot find out from any official the number of miles operated or the number of engines in service. They have no shop of any importance, a small repair shop at the end of each division answers their purpose, except Imbetiha and Porto Novo. At these shops they employ, I am informed, from 150 to 200 men, and do general repairs for the system.

It was always my idea that the "walking delegate" was an institution not to be found outside of our own beloved country, in this surmise I am vastly mistaken, for his Brazilian brother can give him points in how to get rid of an obnoxious official and as to the formalities of inaugurating a strike, as the following facts will vouch for.

The *chefe de locomotion*, or, in plain English, the superintendent of motive power, of the "Leopoldina" happens to be, so it is said, a very unpopular person amongst the working classes. In the first place he is not a mechanic, nor has he had any experience in railroad business in any manner until his appointment to his present position, which was secured by influence with the director. What few good mechanics that were in the service of the company, as master mechanics in the various branches, left the service on his appointment, consequently their places have been filled by people just as incompetent as their chief. To one of these appointees the workmen having taken a decided antipathy, he has been driven away from every shop he has been sent to; on his appointment to any particular shop he would be greeted by flaming notices reading "Death to ——," with the customary illustrations in the shape of skull and crossbones. I do not write his name simply because it is about a yard long, consequently I have not the time to put it all down. His last appointment was to the shop of Porto Novo, one of the principal shops, he was accompanied by a guard of forty-five soldiers; but, notwithstanding the guard of brave Brazilian soldiers, the shopmen proved the more valiant of the two, and to the martial music of a tin-can band, official and soldiers made a very masterly retreat, after a sincere promise on the official's part that he would leave the field of mechanics to those whose qualifications entitled them to occupy it. So you see, the Brazilian is not that submissive creature that our people may describe him. I cannot vouch for the above from personal knowledge, but my informant is a man whose reputation for veracity cannot be doubted.

In closing, I might add that, on Brazilian passenger trains, they have no baggage masters on the train, the baggage is put off and taken on at each station by a man kept there for that purpose. The news butcher is an unknown quantity. The mail agent has no nice room partitioned off for his especial use, with hooks, bags, pigeon holes, etc., he takes his seat in the passenger coach, and has his mail matter tied up in bundles for each station. That it is a crude and slovenly way of doing business is apparent from the fact that, in the country towns, if you receive one letter out of six addressed to you, you might consider yourself fortunate. As very few, if any, trains are run by night, they have no tail lights, nor markers by day. When trainmen have to work at night, they use a lamp about ten inches square and equal height; it has a light of glass on each side, and the illumination is furnished by a fat-looking tallow dip.

That very useful and generally very busy person on home roads, the train dispatcher, is an unknown person here. An official styled the *chefe de traffica* has charge of all trains, but on this particular road of which I write the trains are few and generally run on time card. When a special is sent over the road, all stations are notified, and somehow or other they manage to get through.

At this point I had to cease writing on account of being informed that the "Santa Maria Magdalena" engine was ordered to her home road. I have just returned after four days' absence in that weird and mountainous country. We started out with a train of two box cars and one passenger coach. "The Director" and a few of his friends were on board. On the engine was a *machinista and fogista* (engineer and fireman) and your correspondent. Our journey lay over the roads of two different companies, and we got there in good shape, the engine working to perfection. We made the journey without a brakeman, pilot or conductor, without any orders, only permission to use the tracks. Twenty-five miles of this journey was made up the mountain. A grade of 4 per cent. the entire distance, the little "Brooks" got down to business like an old timer, it did me good to hear her bark as she swept around the curves, her gauge showing the maximum pressure the entire distance. Considering the poor fuel and indifferent firing, she proved herself, in steaming qualities as in all other respects, A No. 1. At our journey's end we were greeted with fireworks and music. The musical part of the programme consisted of an accordeon, operated on by aged gentleman of color. The "Doctor," whose name the engine bears, set up a bottle of champagne in honor of the event, and everything went "as merry as a marriage bell." I am glad to say that the two first engines built for this country by the Brooks Locomotive Works are a grand success. I have watched over these engines from the time of their arrival until I turned them over to the owners with much solicitude. I was bound to make their maiden effort a grand success. I am proud to say that there are no two better engines in this or any other country for their size and weight. I am sorry they are placed on a road where they are virtually buried from the sight of people whom it would be desirable to reach. The road is amongst the mountains, and, I might say, the clouds, and such a road! It's a succession of curves and heavy grades; it is in a rich coffee-producing district and the transportation of that berry will be its only source of freight.

I return to Rio de Janeiro to-morrow. While I have had a very pleasant time at this place, on account of sea bathing and heathfulness, yet I was cut off from the business world. The only information I could glean was from the daily paper we got from Rio.

When I get to know more of the country I will get up an article for the paper. This is not written for publication, but if there is anything in it you can work into an item, very good; do so.

I hope that the post-office people will be good enough to let me have a copy of the paper in the near future, as I miss its well-stored pages very much.

*Rio de Janeiro.*

## Solid Rod Cups.

Many roads are now making rod cups solid on the rods, forged on, and the advantages of such a plan are self evident.

Figure 1 shows a cup forged on a strap and machined up as thin and light as a brass cup. Figure 2 is the same cup forged on a solid-ended rod with a plug in it to prevent rod bush from turning. These cups were made by the Schenectady Locomotive Works and are in use on the Pennsylvania compound of their make.

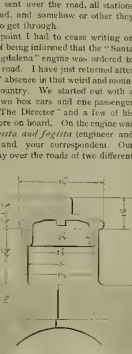


*Fig 1.*

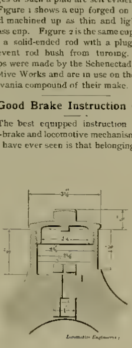


*Fig. 2.*

## Good Brake Instruction Car.

The best equipped instruction car for air-brake and locomotive mechanism which we have ever seen is that belonging to the Burlington, Cedar Rapids & Northern, at Cedar Rapids, Iowa. We have seen cars of the kind that were of a much more costly character, and we have seen others more elaborately fitted, but for the practical work of instructing trainmen and for making the mechanism intelligible to the learner we have seen nothing equal to the equipment and arrangement of this car.

A long way car with monitor roof was used to hold the equipment. Brake cylinders, reservoirs and piping for thirty cars are used. The bulky parts are arranged compactly along the middle of the car and the piping is secured in the least possible space around the clear story. The air-pump, triple-valve and engineer's valve of the Westinghouse brake are shown in sections, the parts moving along with like parts of the valves in operation. They have also the principal parts of the New York air-brake, and of the Boyden brake. Besides these they have lubricators, injectors, Leach sanding apparatus, a valve-motion model and other mechanism that trainmen ought to understand the construction and working of.

The car is in charge of Mr. John H. Burns, the traveling engineer, who used it as an office and is ever ready to give instruction to those seeking information. Mr. Burns is one of the best posted men in the country on air-brake and train mechanism, and he has in an eminent degree the faculty of making what he knows intelligible to others. The car is set beside the roundhouse and has connection with the steam pipes, so that the air-pumps can be started at any time. All trainmen belonging to the road, conductors and brakemen as well as engineers and firemen, are required to show themselves proficient in the knowledge of brakes. Firemen and brakemen have to pass an examination before they are promoted, and in this car they explain what they know about brakes. If anything happens to conductors or engineers of the older school to indicate that they are not properly posted about brakes, they are sent here to receive instruction from Mr Burns. The training given to the men by the aid of this car has greatly reduced the delays due to trouble with brakes.

## Successful Electric Car Lighting.

The Atchison, Topeka & Santa Fé have one train of four cars which is lighted by the Silvey system of electricity. This is a storage system and appears to be specially designed to stand the jarring incident to train service. The train has been running constantly since February last, and has not cost a cent for repairs of the electrical apparatus. Two batteries, each containing six cells, are placed in each car, a reservoir for the batteries being provided beneath the floor of the car. The two batteries weigh about 1,000 pounds.

The plates, forming most of the storage batteries tried for car lighting, have been placed on edge and the jarring shook them apart, so that failure soon ensued. In the Silvey system the plates lie flat and appear to be unaffected by the vibration they are subjected to.

Each car has ten incandescent lamps, eight inside and one over each platform. They give an excellent light, and the train is very popular with the patrons of the road on the Topeka & St. Joseph division, where the train is run. The guarantee of the inventor of this light is, that the lamps in the car will burn the same length of time that the batteries were subjected to the process of charging. In practice, the railroad people find that when the batteries have been charged for ten hours the lamps will burn seventeen or eighteen hours. The cost of the light is about three cents per hour for each lamp. This includes fuel, attendance and rent for the engine and dynamo.

Trainmen on the Northern portion of the Santa Fé system remark about a peculiarity of the natives of different States. If an accident, wreck or other casualty occurs to a train which causes delay in Missouri, there is soon a crowd of the natives round, and they lounge about the place till everything is cleaned up. If the same kind of an accident happens in Iowa, Illinois or Kansas, there is seldom a native to be seen about. The bump of curiosity appears to be abnormally developed in Missouri.

The Pullman Palace Car Co. held its annual meeting in Chicago on October 13, and the financial statement of the year showed a total revenue of $10,002,356. Of this $5,061,081 was from the earning of cars, and the remainder was from patents, manufacturing, etc. The disbursement was $6,751,967. The total assets are $53,345,050, and the total liabilities $31,361,370. The company owns or controls 2,239 cars, and 415 sleeping, dining and parlor cars are under construction to meet the demands of the World's Fair. During the last year 5,279,020 passengers were carried and the number of miles run was 191,255,656. The company employs 12,809 persons and paid out in wages last year, $6,619,156.

The method of using the piston of an air-brake cylinder as a ram for forcing the fittings into air-brake hose, which is to be seen in use in a variety of railroad shops, was invented and patented by Mr Ludlow, master car builder of the Southern Pacific shops at Oakland, Cal., and by Mr Angwin, one of his workmen. The patentees are after the royalty from roads that are using the invention.

## Pittsburgh Compound Locomotive.

We present herewith photo engraving of the compound locomotive recently turned out by the Pittsburgh Locomotive Works and now running on the Vandalia road.

This engine has the Colvin plan of reducing and intercepting-valve (illustrated in our issue of January last). The runner can work the engine as a "simple" just as long as he wants to, both cylinders having an exhaust to the atmosphere, and the reducing-valve automatically admitting enough steam to the large cylinder to do the same amount of work as that done in the high-pressure cylinder.

When starting, or on a grade, the engineer can have a plain engine as long as he wants to, and throws in his compound gear whenever he wants to.

Pittsburgh Compound Locomotive

The general dimensions of the engine are as follows

Type, 10-wheel freight, gauge, 4 feet 8½ inches; cylinders, 19 inches and 29 inches by 26 inches; driving-wheel base, 11 feet; total wheel base, 21 feet 8 inches; driving wheels, 56 inches diameter, total weight, 120,000 pounds, weight on drivers, 95,000 pounds.

The engine has not been put down to any fancy test, but the engineers and firemen say she is very economical of fuel and will run over a whole division without having to have her fire cleaned.

There are some remarkably fine indicator cards from this engine illustrated in Mr. Tabor's article in this paper.

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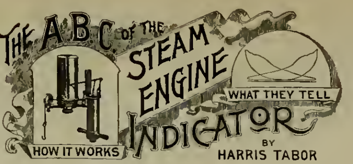


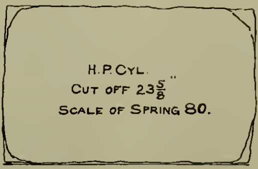

An article over the signature of "Compound," condemning generally large steam ports and long travel valve, appeared in your October issue, which contains considerable food for thought. A single instance of reducing steam ports and valve-travel does not prove that the general tendency to make ports larger and valve travel longer is wrong or that the locomotive valve gear of forty years ago was right. There are many conditions to be considered in putting this question on its merits. In each case cited by "Compound" there may have been conditions unfavorable to free admission. Wire-drawing of steam is not due to small ports and reduced valve travel solely. The friction offered to the steam by the walls of the ports is small when compared to a long steam-pipe of insufficient size The throttle may also wire-draw. In the case of the Rhode Island locomotive, if the throttle and pipe were insufficient to deliver all the steam the ports would pass, a reduction of ports and valve travel would be followed by good results. The same reasoning would apply to the Lehigh "flyer."

Before passing final judgment on isolated cases like these it would be interesting to know what would be the effect of larger steam-pipe, and possibly more ample throttle area. If the larger pipe would increase the coal efficiency in the case of the Rhode Island, it would prove that the steam-pipe had been too small for the port openings, and account for the better results when the ports were reduced On the other hand if no gain appeared from an enlarged pipe, and the engine were driven under the best conditions, the case would prove too much expansion for the best economy It is right here that "Compound's" statement becomes interesting. Where is the economical limit of expansion in one cylinder which is exposed to generally low temperature, as in the case of the average locomotive If the running conditions were all fair in the case cited by your correspondent it would seem that the limit had been exceeded and less expansion was demanded. The reduction of port area did lessen expansion by wire-drawing.

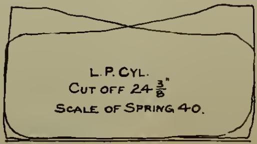
Admitting the loss, with the larger ports, came from condensation, there would be a gain, aside from reduced expansion, which would follow reduced steam ports Wire-drawing tends to dry the steam and reduce initial condensation In this case, the reduced ports made the gain, and it is probable that we must look to less waste by condensation as the cause, and that the reduced condensation came from less expansion and dryer steam as a result of wire-drawing.

Assuming that the limit to economical expansion is so soon reached as your correspondent's statement would indicate, it is only a stronger argument in favor of compounding and expanding through two or more cylinders This also brings up the question of the correct ratio between the sizes of the cylinders in a compound locomotive. If, with forty years' experience in building American locomotives, our best designers have been moving like

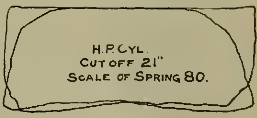
**No. 1.**



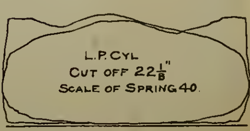

BOILER PRESSURE 170 LBS
REV. PER MINUTE 66.
LIFT OF THROTTLE VALVE 9/16".




**No. 2.**




BOILER PRESSURE 175 LBS
REV. PER MINUTE 132.
LIFT OF THROTTLE VALVE 1".

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We have been interested in the examination of baggage by Custom House officers in many places and in a variety of countries, but the deliberate, thorough and imposing way the work is performed on the border of Mexico is far beyond any previous experience. All the baggage is taken into a shed, trunks, valises, handbags and every other kind of personal impedimenta. This shed is full of fierce-looking officials, armed with clubs and blood-thirsty revolvers stuck conspicuously in their belts. One legal bandit opens the article and dives down to its foundation, turning the contents upside down. Then another associate gives it an overhauling while two men with guns guard his flank and keep a suspicious eye on the owner of the baggage. We did not see anybody shot, and concluded that the lack of bloodshed arose from no contraband goods being discovered.

the crab, backward,—and have over-reached in expanding steam too many times, who is wise enough to determine the number of expansions that may be profitably used in the compound? The fact that some builders make the low pressure cylinder twice the size of high pressure, and others make the difference three times, proves nothing. The engineer who has charge of the compound with the greater ratio will soon discover if he is expanding his steam too much, and will correct the evil with his link, even though he may have to wire-draw at the throttle. If the man with the smaller ratio of two to one discovers that his fireman has an easier time when he is expanding freely in each cylinder, he will keep his link well hooked up and will run with full throttle. It is possible that about the same expansion will be used in these engines with widely different ratios.

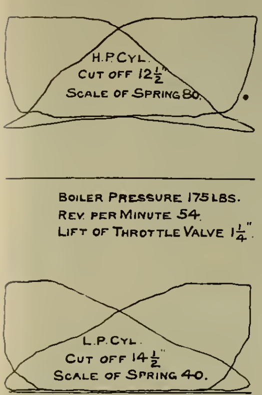
Time only can determine the best practice. It is fortunate that so many ratios between high and low pressure cylinders are in use, for from this large range the best proportions may be selected.

The following diagrams were taken from a compound locomotive recently built by the Pittsburgh Locomotive Works, of Pittsburgh. In some ways it differs from the standard type put out by other makers. It is of the two-cylinder type, as the cards would indicate. It has no automatic intercepting-valve. In its stead a reducing-valve, and admission-valve to low-pressure cylinder, operated by hand, are used. Each cylinder has an independent exhaust to the atmosphere, under control of the engineer, so that the engine may be used simple for any length of time The reducing-valve checks the danger of getting too high pressure in the low-pressure cylinder.

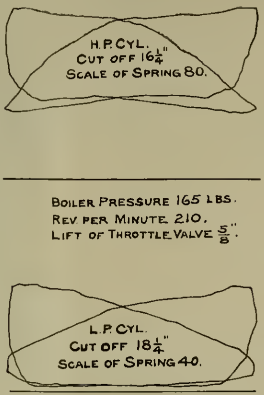
Diagrams No. 1 were taken when working, with the high-pressure cylinder exhausting through its own pipe to the air. These cards show no expansion except a trifle in the low-pressure cylinder, which is due to wire-drawing. As the engine is intended to work in this condition only at starting and during a hard pull, economy may be ignored.

No. 2 were taken when running compound with a late cut-off in both cylinders. These may also be considered heavy work cards, and do not represent average running condition. No. 2 are interesting from the fact that they indicate clearly a feature which belongs to the two-cylinder type of compound with a small receiver, which is shown in the undulating steam lines on low-pressure card. If we follow the relative movements of the pistons, in connection with the cards, we shall discover the cause of these irregular lines.

No. 3.




No. 4.



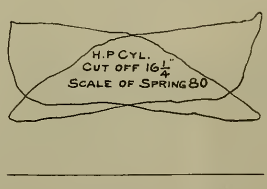

When the high-pressure piston is at the commencement of its stroke it has exhausted into the receiver or steam-pipe to the low-pressure cylinder, and is moving from its slowest to its highest velocity, the low-pressure piston is at mid-stroke and is moving from its highest to its slowest velocity; the increasing motion of the high-pressure piston and the reducing motion of the low-pressure piston change the ratio of size between the cylinders and cause the fall in the steam line on low-pressure card near the beginning of the stroke, and the rise at mid-stroke. Just before the low-pressure piston reaches mid-stroke the exhaust from the high-pressure cylinder takes place and adds to the pressure in low-pressure cylinder at this point. When the cranks are at an angle of ninety degrees there are points in the stroke of both cylinders where they are too large and too small. It is only when the motions of the two pistons are coincident that an exact ratio may be had throughout the whole stroke. This can be obtained only by placing the cranks at an angle of 180 degrees, which is not practical in the two-cylinder compound. A large receiver, such as is used in stationary practice, would reduce these irregularities. But the introduction of a large storage reservoir would be substituting, in this case, a greater for a lesser evil. The effect of this varying ratio is not felt when the engine is running under average conditions, as the cards Nos. 3, 4 and 5 show. These are all the vainest designer might hope for.

No. 3 were taken when the position of the link allowed liberal expansion in both cylinders. They are excellent cards and are creditable to the designer. Such cards, showing as they do more than five expansions, would show remarkable duty in a stationary engine, where the cylinders may be protected from cold It is a question, however, whether they would show as high duty on the road as the two following sets with less expansion.

Nos 4 and 5 were taken with the link in the same position. Any difference that may appear in the lines is due to the increased speed when No. 5 was taken. The back pressure is very low reaching only eight pounds with a piston speed of 1,373 feet. The entire steam distribution is excellent. The horse powers developed when these cards (No. 5) were taken was 1,466, of which the low-pressure cylinder furnished 57 per cent.

If the man who did the counting is correct, this is a remarkable performance.

No. 5.

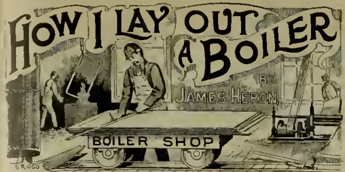



## Inconvenient and Uncomfortable Locomotives.

The designers of locomotives intended for service on railroads that have numerous curves, ought to take into consideration the importance and necessity of the engineer seeing ahead when the engine is rounding a curve. We have enjoyed the best of opportunities for observing the limited outlook from the cabs of a great many locomotives employed on very crooked roads, where cuttings are numerous, and the impression received is that the practice is becoming general of making a solid line of obstructions from the cab to the smoke-stack The cabs are now so placed that an engineer cannot step to the left hand side to see that all is clear when he is rounding a curve; the duties of the fireman are too arduous to give him any time for keeping a systematic lookout on curves, and so the practice is for the engine to rush along blindly, depending on the good fortune of finding a clear track. We have heard of more than one instance where tail-end collisions have happened that could be directly traced to the engineer not being able to see ahead in rounding a curve. There is a growing sentiment among railroad commissioners to require a third man to be carried on locomotives where the fireman is so located that he cannot keep a lookout ahead When juries begin to find out that accidents are happening through the engineer being unable to see the reach of the track visible on curves, they will stimulate public sentiment to demand the presence of more eyes on the monster locomotives that are becoming the rule as train haulers. The proper way to stave off this source of expense is the devoting attention to opening the view for the engineer across the boiler This can be helped materially by a little attention to the locating of dome and sandbox.

Another thing that demands attention is the location and width of cab. Many cabs are made as if they were intended for lilliputians, a man of moderate size having to squeeze himself to get in position to reach the working levers. This may be quite comfortable as viewed from the drawing office, and it entails no great hardship upon the man who goes in inspecting the arrangement when the engine is cold in the builder's shop. On the road it is a different matter. With hot weather and the intimate proximity to a hot boiler, the man in the cab is parboiled during a great part of the time he is at work Is it surprising that the man who is subjected to this ordeal, day after day, gets convinced that engineers are a poorly paid class considering the discomforts they have to endure? A very little forethought and no extra expense would make the cab comfortable. Apart from humanitarian considerations we believe that it would pay railroad companies to effect a reform in the locomotive cabs

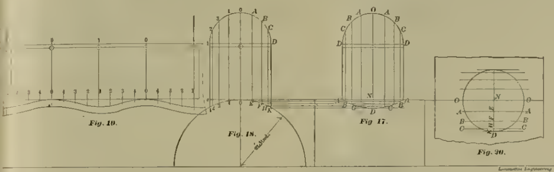
The P. R. R. are figuring on 1,500 new freight cars.




## Laying Out Dome Sheets.

Figs. 17 and 18 show front and side views of dome on boiler. To lay out a dome sheet it is not necessary to lay down Fig. 17, but when you want aperture, or dome hole, very accurate, then you must use that figure. Strike radius of segment of a circle, the size called for on drawing, draw center line $OD$. Height of dome is of no importance. I have put it full size to make it more plain. Strike radius or semi-circle on top. The dome of boiler we are laying out is 30 inches inside diameter. Thickness of material, ¼-inch, so as to have our lines an equal distance apart on semi-circle on top of dome, Fig. 18. And on flat plate, or Fig. 19, we must strike our radius 15¼ inches or 30½ inches diameter of dome. Divide semicircle into any number of parts, the more parts or spaces the more accurate will be your line of curvature. But four spaces, as on sketch, will answer all practical purposes, as at 1, 2, 3, 4, 0. Strike perpendicular as from 1 to 1, 2 to 2, etc., intersecting radius of boiler. Strike line on top of boiler parallel with center of boiler. The distance from where your perpendicular lines cut parallel line to radius of boiler, is the space to be added at corresponding numbers on flat plate. Now we roll up a plate to form a dome, with all edges square with each other, and put it on top at points marked 1 on Fig. 19; repeat with all the numbers measuring from parallel line down to radius of boiler on the lines as numbered, and from parallel line down at flat plate at corresponding numbers; this will give you your line of curvature. Now you must allow for flange and laps all around your sheet and the plate is complete.

Fig. 20 shows method of finding shape of aperture, or dome hole, in plate when flat, you will note that hole is not round when plate is flat, but will be when rolled. *K H F E O* are the same distance apart as corresponding letters at Fig. 18. Square sheet at center of boiler, plumb the sides. Then you would find you were short of stock as from 1 to *s*. Now, suppose we set divider that distance and scratch a line on dome, by letting dividers follow a radius of boiler, we would have to cut dome away at 0, the distance from 1 to *s*, to make sheet fit boiler. Fig. 19 shows plate when flat, laid out to form dome sheet. Inside diameter 30 inches, plate ¼-inch or 30½, 30.50 x 31416 = 95.95, or 96 inches nearly. Divide this into four equal parts, as at 1, 0, 1, 0, 1. Sub-divide these quarters into four parts or spaces, as at 1, 2, 3, 4, 0 Now, by setting your dividers at 1 *s*, Fig. 18, and marking the distance there on all where you are to locate dome Set divider from *N* to *D*, Fig. 20, mark distance from *N* to *N*, Fig. 20; do the same from *N* to *A*, on line marked *AA*. Do the same on lines *BB*, *CC*, *D*; this will form your aperture. I will give a simpler method later.

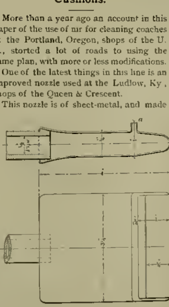



## Air-Nozzle for Cleaning Plush Cushions.

More than a year ago an account in this paper of the use of air for cleaning coaches at the Portland, Oregon, shops of the U. P., started a lot of roads to using the same plan, with more or less modifications.

One of the latest things in this line is an improved nozzle used at the Ludlow, Ky., shops of the Queen & Crescent.

This nozzle is of sheet-metal, and made

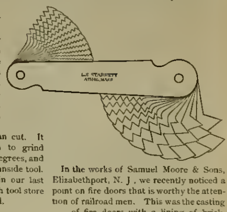



as shown in accompanying cut, the outlet is a long slot, located on the *side* of the nozzle and in front of a heel or raised bead. The orifice is closed at the ends by a rib. Now, when this nozzle is used the opening is down and the heel, marked *A*, is pressed down on the plush it opens up the pile (if that is the right word) and the air has a chance to get clear down to the scalp—so to speak.

These sides and heel prevent the dust from being blown backward or sideways, and a current carries it ahead, away from the operator and the work, and can be made to throw the dust out of a window or into some place where it can be got rid of.

This little device will do much more effective work that a plain nozzle, because it gets its jet of air to the right place and takes the dirt out and removes it Try one of them, and you will waste no more energy pounding cushions with tennis racquets.

## A New Screw Pitch Gauge.




The accompanying engraving shows the plan of a screw pitch gauge having more and coarser pitches than usually found in such devices. This tool is the handiest made, as the gauges will go inside of a nut as well as on a bolt; it has the following pitches 4, 4½, 5, 5½, 6, 7, 8, 9, 10 11, 11½, 12, 13, 14, 15, 16, 18, 20, 22, 24, 26, 27, 28, 30. The teeth are sharp and clean cut. It is a reliable gauge by which to grind and test a threading tool at 60 degrees, and is especially convenient for an inside tool.

This is the tool mentioned in our last paper as exhibited in an English tool store window as the best in the world.

There was a considerable assemblage of prominent railroad men at the office of the Railroad Commissioners of the State of New York, at Albany, on Monday last, October 17th. This meeting was for the purpose of making application for an extension of time in which to apply automatic freight car-couplers to cars running within the State of New York. The New York State law requires that all cars shall be equipped by November 1, 1892, and it is asked that this time shall be extended for one year, that is until November 1, 1893, on the ground that it would be a physical impossibility for railroads to make the change within the time originally fixed. The meeting adjourned at 1 P. M., and all the gentlemen present were invited to the Fort Orange Club. After lunch the party took a run about Albany on an electric car of the Albany Railway, which has been recently equipped by the Consolidated Company with its electric heater, and during this run a visit was paid to the new offices and large factory of the Consolidated Company just completed. Among the railroad men present were Messrs. Tuttle, vice-president, New York, New Haven & Hartford R. R., MacKenzie of the "Nickel Plate," Boon and Bradley of the West Shore, Lentz of the Lehigh Valley, French of the Chateaugay, Baldwin of the Central Vermont, Hedding of the Lake Champlain & Mariah, Hammond & Blackall of the Delaware & Hudson Canal Co., Hinsdale of the Long Island, Robeson of the Boston & Albany, Armstrong of the Philadelphia & Reading, Locke of the Delaware Lackawanna & Western, Merchant of the Buffalo, Rochester & Pittsburgh, Marden of the Fitchburg, and many others.

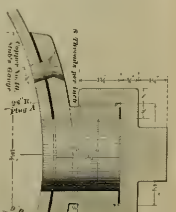
The Santa Fé people have to haul water for use on some of the divisions of the road, and they use for this purpose wooden tanks which are carried on flat cars. The country is so dry where these tanks are used that they are always leaking or falling apart from the shrinkage of the wood. To remedy this the management have called for iron tanks, and the mechanical department are getting up a tank-car that will be adapted for carrying water or oil. There are oil wells on some parts of the system that promise a good supply, and it will be carried to market soon. A novelty in these tanks will be a frost-proof valve.

In the works of Samuel Moore & Sons, Elizabethport, N. J., we recently noticed a point on fire doors that is worthy the attention of railroad men. This was the casting of fire doors with a lining of brick. The bricks are laid in the sand and a frame of cast-iron poured around them, making a light lining that does not burn out readily. With the shallow locomotive fire-boxes now in use, there is much difficulty with the burning out of the fire-door lining To those wrestling with this difficulty we would suggest the fire bricks as a remedy.

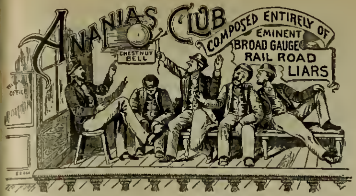
The Shaw four-cylinder locomotive has recently been overhauled at the Baldwin shops and put in condition to run. It was claimed that one fault prevented her from properly showing her speed—a small dry pipe. A new 8-inch pipe has been put in, and it is hoped that this will deliver all the steam that four ten-inch cylinders can use

## Cap Wash-Out Plugs.

The annexed engraving illustrates the form of boiler cleaning and wash-out hole plugs adopted by the Cleveland, Cincinnati, Chicago & St Louis mechanical department as standard. With the ordinary wash-out plug hole where the thread is cut on the sheet, the wash-out rods constantly tear and grind the thread, with the result




that there is a constant round of leaking, tapping out and putting in bigger plugs. This plan of a sleeve on which the thread is cut obviates all the ordinary annoyance This form of wash-out hole cap has been in use on the Pittsburgh & Fort Wayne divisions of the Pennsylvania Railroad for several years and is found to be highly satisfactory.




## No Place to Put It.

"Pete Beckley got one of his eyes put out chippin' a crosshead one day a long while ago," said the Long Island machinist, "and was known far and near as One-Eyed Pete."

"Pete was a good all-'round man, and usually got in considerable overtime, repairing tools, lining up shafting and overhauling the engines.

"One time our old man—an awful dry old customer—struck Pete in the yard; says he:

"'Peter, I reckon you'd better come back to-night and bore them tire; we're behind on 'em; you don't mind a little time-and-a-half, hey, Pete?'

"'Well,' says Pete, 'you know, sir, I worked overtime last night till 1 o'clock.'

"'Oh, well, that's nothin'—when I was your age I didn't mind a——'

"'But I worked night afore that, and I——'

"'Well, well, what if you did, you can——'

"'But say, don't you suppose I want some sleep. Jones worked two nights, but he wouldn't come last night, and ain't I as good a right to as much sleep as him?'

"'No, sir,' said the old man, dry like; 'you ain't; you don't need as much, and you can't git as much. Half as much ort to do ye—*you've only got one eye!*'"

## A Way to Tell.

"I see," said the old timer, wiping his mouth on the back of his hand, "I see a good deal in the papers about the exact right heat to flange boiler steel and forge tool steel, to say nothin' at all about the exact amount o' heat required to heat a train that you can git out o' the front end for nothin,' and the heat saved in compounds and manufactured in receivers.

"Heat is the main thing on a railroad; anyway it's a good thing to know when you've got it jest to a T'yt; and that reminds me o' a receipt o' Cy. Pratt's, an old chum o' mine, for hot crown sheets. Cy. were sent out on the road to haul in an engine as had her rafters cooked, and the stopper and starter, a no-good sorter a drinkin' cuss, says to Cy. says he, 'I'll take my oath on a stack o' Bibles higher 'en this cab that I had three gauges o' lime juice in her. Them 'air radius stays ain't no good. Jest look at that sheet an' see what you think o' it.' Cy. got up and took a look in the fire-box door; the crown-sheet was hanging half way down to the grates, blue and crooked. 'Well,' says the plug, 'what'd you think?' 'I think perhaps you biled it too long,' says Cy., 'for when pertaters crack open like that, they're done.'"

## A Dead Corpse.

"It was on the C., B. & Q.," says the *Express-Gazette*. "The east-bound passenger train, then called the 'Cannon-Ball,' had on board five corpses. It was in hot weather. The baggageman, finding the atmosphere in the car becoming undesirable, moved three of the boxes, containing a corpse each, to the platform of the car, outside, one on top of the other.

"As the train was nearing Ottumwa, the baggageman, upon looking out, was horrified to discover one of the boxes missing. Surmising that one of the boxes had slid off in rounding a curve, owing to the high rate of speed the train had been running, he wired Superintendent Dugan apprising him of the loss. Dugan wired the section foreman at Ottumwa as follows

"'Patrick McGann—Look out for corpse lost off Cannon Ball three miles west of Ottumwa and report condition of same when found.'

"Patrick immediately started out with the section gang and found the box intact. It was seldom that Patrick received orders direct from the superintendent, the roadmaster being his immediate superior. Consequently Patrick concluded the time to win promotion had arrived, and after reading Dugan's order over for the twentieth time, wired his superintendent as follows

"'Mishter Doogun—I hev found the koropse and the koropse was dead.'"

## A Transaction in Watermelons.

There is a curious legal question stirring the people of Topeka. A car load of watermelons was purchased by a citizen of this thirsty town, and while he was unloading them a gentleman of color happened along and asked for a watermelon. The request was denied.

"Say, boss, can I have a melon out o' de nex' kear?" asked the darky.

"Yes," replied the citizen, who was fond of a joke, and knew that the melons in the next car belonged to a rival. "Yes, you may take all you want."

The colored man carried away all the melons he could carry and spread the joyful intelligence among his sisters and his cousins and his aunts, that a car of watermelons was on the side-track free to all. Just as the colored population began to gather round the car the shop whistle blew and word spread among the men going home from work that the melons were there for the taking. In the twinkling of an eye the car was empty, and a string of men were walking home with cooling mouthfuls under their arms.

The owner of the watermelons called for his fruit the next day and found the car empty. The story of how the melons had been distributed became known, and the originator of the joke assumed a grin so broad that it threatened to permanently widen his face. The man who lost his melons called upon the railroad company to reimburse him for the loss and their attorney notified the joker that he would be required to pay for the melons that he had given away. His face at once turned from broad to long, and the citizens feel that the joke is widely distributed. They are still torn with uncertainty as to who will pay the bill. Meanwhile the watermelons have gone where they will do the most good.

The Consolidated Car-Heating Co., of Albany, N. Y., have recently put on the market a special steam-valve for their heater system and a dust guard for the rear hose on train, this guard is fastened to the chain of the hose and serves to hold up the end when not coupled.

## Origin of the Bell Rope.

A correspondent writes us As you have been saying a good word for the old Erie lately I send you particulars of an event which is interesting to every person who has anything to do with railroad trains. The bell rope is fast giving way to the pneumatic signal, but it has played an important part in train control and its origin ought to be matter of proper record.

In the early days of the railroad in this country the locomotive engineer was the master of the train. He ran it according to his judgment, and the conductor had very little voice in the matter. Collecting fare, superintending the loading and unloading of freight, and shouting "All aboard!" were all that the conductor was expected to do.

The Erie Railroad was then the New York and Erie Railroad. One of the pioneer conductors on this line was Captain Ayres. He ran the only train then called for between the two terminal points. It was made up of freight and passenger cars. The idea of the engineer, without any knowledge of what was going on back of the locomotive, having his way as to how the train was to be run did not strike the Captain as being according to the propriety of things. He frequently encountered a fractious passenger who insisted on riding without paying his fare. As there was no way of signaling the engineer, and the passenger could not be thrown from the train while it was in motion, the conductor in such cases had no choice but to let him ride until a regular stop was made.

Captain Ayres finally determined to institute a new system in the running of trains. He procured a stout twine, sufficiently long to reach from the locomotive to the rear car. To the end of this string next the engineer he fastened a stick of wood. He ran this cord back over the cars to the last one. He informed the engineer, who was a German named Abe Hammil, that if he desired to have the train stopped he would pull the string and raise the stick, and he would expect the signal to be obeyed. Hammil looked upon this innovation as a direct blow at his authority, and when the train left Piermont he cut the stick loose. At Turner's he told Captain Ayres that he proposed to run the train himself, without interference from any conductor. The next day the Captain rigged up his string and stick of wood again.

"Abe," said he, "this thing's got to be settled one way or the other to-day. If that stick of wood is not on the end of this cord when we get to Turner's, you've got to lick me or I'll lick you."

The stick was not on the string when the train reached Turner's. The Captain pulled off his coat, and told Hammil to get off his engine. Hammil declined to get off Captain Ayres climbed to the engineer's place, and Hammil started to jump off on the opposite side. The conductor hit him under the ear, and saved him the trouble of jumping. That settled forever the question of authority on railroad trains. Hammil abdicated as autocrat of the pioneer Erie train, and the twine and stick of wood manipulated by the conductor controlled its management. That was the origin of the bell rope. The idea was quickly adopted by the few roads then in operation, and the bell or gong in time took the place of the stick of wood to signal the engineer.

The Illinois Central are reorganizing their service preparatory to the World's Fair business. They have shortened the divisions as formerly operated, the Chicago division ending at Homewood and the Freeport division at South Addison. The line between Chicago and Homewood, including the South Chicago and Blue Island branches, and between St. Charles Air Line Junction and South Addison, including the Addison branch, will form the Chicago Terminal District. John T McBride has been appointed superintendent of the new district.

The Baltimore & Ohio Railway Company will make a historical exhibit at the World's Fair which will be of absorbing interest to all railroad men. Major J. W. Pangborn has charge of its preparation. The Baltimore & Ohio claims to be the oldest railroad in the world, its two or three predecessors having been mere tramways for transporting coal, stone or ore. The actual construction of the road began on July 4, 1828, and its first section was in operation six months before the Liverpool & Manchester road, the first railroad, in the present sense of the word, in Europe. The Baltimore and Ohio claims also to be the only one of the pioneer roads which has retained its original name and has remained under a continuous succession of management.

A long time ago old John Alexander described the short-comings of overclothes and brought attention to the fact that railroad men wore more overclothes than the men in all other trades combined. John kicked about the uncomfortableness of the blasted things—and he told a heap of truth There is a quiet sort of a railroad man, H. S. Peters, an ex-engineer, in Brooklyn, who is making overclothes to wear—the things actually fit and feel good—and all the engineers and firemen (Peters belongs to both Brotherhoods) who read this ought to help a brother out by asking for and insisting on having overalls with the buttons marked "Brotherhood." They are just as cheap as the "Sheeney Shrinkable" brands and far better.

One of the large number of railroad men who have succeeded in business off the road is John J. McGrane, the wholesale jeweler of 48 Maiden Lane, this city. Mr. McGrane put in a long term of years on a locomotive and still retains his membership in the B. of L. E. His place of business is headquarters for all railroad men around New York who want anything in the shape of time-pieces or jewelry. John always keeps the best, tells the truth about them and lives up to his guarantees—hence his business grows. He sells a great many fine watches direct to railroad men all over the country, who dispose of them to their friends direct with a profit to themselves and a saving to the buyer.

The Pond Engineering Co., St. Louis, Mo., have sent out an illustrated circular of a dry-steam separator which they have on the market. The separator consists of an outer cylindrical shell into which the steam enters with the entrained water and leaves through an inner pipe extending from the top down to about one-half the length of the separator, leaving an annular space between the two. The separator is guaranteed to relieve the steam of all entrained water and return this water to the boiler, either direct or by means of a trap, as the location of the separator may determine.

Railroad companies that use retaining valves on the air brakes of their freight cars, find great difficulty in preventing the brass fittings from being stolen As a remedy most of them have adopted the practice of making the fittings of cast-iron. Even this does not entirely prevent thieves from carrying away the parts. In some regions they would carry away the whole car if it was not too heavy.

Stannard & White, of Appleton, Wis., have announced that they will give a year's subscription to LOCOMOTIVE ENGINEERING to every purchaser before January 1st of one of their Brotherhood cab seats. This is the best seat in the world, and any engineman who rides one will have less backache and live longer. A neater Christmas present couldn't be given to an engineer or fireman.

The Ingersoll Milling Machine Co., Rockford, Ill., have just built one of the largest slab milling machines which has ever been turned out. This machine mills at one cut 42 inches wide. Total weight of machine over 11 tons.


(100). L. D., Harlem, N. Y., asks:

What sized grates are used on the N. Y. Elevated locomotives? *A.*—42 x 52 is the largest, we believe.

(100) W. H. T., St. Helen, Mich.

Will you please give me position of locomotive valve with lever in center notch, and why "out of gear." We disagree on that point here and want to settle it. *A.*—The valve is in position to cover both ports, and is called "out of gear" because the engine will not run in either direction with lever in center notch.

(101) H. T. F., Kent, Va., writes: Are not the drivers on the Dickson engine, which is shown in the L. E., on page 381, of the October number, put very far forward? On all the eight-wheel engines that I ever saw, the drivers are located just as they are on the Rogers engine illustrated on same page? *A.*—The engine shown is a good specimen of hard-coal burner as used on some of the lines in Pennsylvania.

(102) H. W. K., Auburn, N. Y., writes: Will you please tell me through your column of "What you want to know" where and how long ago the build of engines, called "Tweed engines," were built? *A.*—Mr. Tweed was for years agent of the Taunton Locomotive Manufacturing Co., and many of the engines turned out during his time were known as "Tweed engines." These works quit building locomotives some three years ago.

(103). R. Cutter, Alton, Ill., asks:

Can you let me know in your paper the proportions of different kinds of metal to make metallic packing for pistons and valve stems? *A.*—The exact proportion of metals varies with different makers. Many use regular babbitt with success. One of the best makers (Jerome) keeps his mixture a secret. The U. S. people use 100 parts of tin, 9 of copper and 6 of antimony. The latter metal is used to harden. Vary it until you get the desired result.

(104). J. T. E., Gottenburg, Neb., asks.

What is the best protection for the valves, cylinders and rods of an engine that lays idle nine months in the year. *A.*—Graphite grease is as good a thing as we know of, especially on the cylinder and valves. It can be introduced with oil and a few turns of the engine made by hand to coat the surfaces. Tallow and white lead are excellent and will stand considerable handling without rubbing off, but you will have to take off the chest cover and cylinder-head to apply it.

(105) A. S. S., Kingston, Jamaca, asks: Is not a two-cylinder compound, high-pressure cylinder 18 inches and low-pressure 26 inches, both 24-inch stroke, 180 pounds pressure, supposed to be more powerful than a simple engine with 18-inch by 24-inch cylinders carrying 170 pounds pressure; engines otherwise alike? *A.*—Hardly. The rule of the Schenectady Works is to make two-cylinder compounds with the high-pressure cylinder 1 inch larger in diameter than a simple engine of similar design and for similar work, the low-pressure cylinder is usually made 2.2 times the area of the high-pressure cylinder. Engines so built have been found to do the same work as simple engines of their class.

(106) Edward Gibson, Wilmington, Del., writes:

Would it be asking too much to get you to explain the answer you gave to the question asked by E. B. B., Mussels Canal, as I don't understand why that small wheel would have to slip or slide to keep up when everything is solid. *A.*—E. B. B. asked if an axle had three wheels on it, one at each end two feet in diameter and one in the center one foot in diameter, these three wheels resting on three rails, the center one raised up to the wheel, if the small wheel would have to slip to keep up with the large ones. The 2-foot wheels would roll about six feet in one revolution, the 1-foot wheel would roll but about three, hence if it kept up it would do more than roll.

(107) M., Frankfort, Ky., writes:

My question and answer (No. 99) was perhaps misunderstood, so I am not quite satisfied. What I wish to know is this: "The travel being found correct and the cut-off *out*, can the cut-off be made correct and still leave the travel as it was before the cut-off was corrected?" In correcting the cut-off wont it change the travel? *A.*—The length of travel is fixed by the throw of eccentrics and length of the rocker-arms, its even movement each side of the center of the seat is adjusted by the length of the eccentric blades. The point of cut-off (and all other functions of the valve) can be hurried or retarded by moving the eccentrics on the axle, as this can not affect the throw of the eccentrics, the length of the arms of the rocker, or the length of the blades, it is plain that the cut-off may be changed without changing the travel.

A patent has been granted to Mr. F. W. Johnstone, superintendent of motive power of the Mexican Central Railroad, for an improvement in brick arches for the fireboxes of locomotives. The improvement consists principally of the supporting of the brick arch by means of a girder attached to the mud ring instead of hanging the arch by the side sheets. As the damage done to side sheets by the expansion and contraction of the bricks is held by some men to be a serious objection to the use of the brick arch, the plan adopted by Mr. Johnstone will overcome the difficulty.

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The Mt. Vernon Car Manufacturing Company have recently booked orders for 1,000 Hicks' patent stock cars, to be operated on the C., C., C. & St. L., 100 box cars, 150 coke cars and 10 cabooses for the Monterey & Mexican Gulf, 100 box and 100 palace stock cars for the Illinois Central and 200 coal cars for the Evansville & Terre Haute. This plant have six months' work ahead, and have been obliged to refuse orders lately.

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The Butler Drawbar Attachment Company, of Cleveland, O., have just issued a neat catalogue and price-list. The pamphlet contains drawings of their draft-gear applied to all kinds of drawbars and cars, the drawings being large and clear. The prices of each pattern of stops and springs is also given, the whole being neat and convenient. It should be on the desk of every car-builder and inspector—there's pointers in it.

"Inventive Progress" is the title of a small pamphlet just issued by Wm. A. Rosenbaum, electrical expert and patent attorney, *Times* building, New York. The book contains a great deal of readable information about the patent office, with good pictures of prominent inventors and inventions. If you are interested and say you saw this in LOCOMOTIVE ENGINEERING, Mr. Rosenbaum will send you one of the books. We notice one statement that may interest men with a new car-coupler bug in their ears: "There have been 4,931 patents issued on car-couplers."

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After we had accompanied Master Mechanic Symons around his clean and orderly shops at Raton, N. M., he remarked "Come into the office and I will show you something you will be interested in." We went and certainly were interested to find an engine board made up after the style of board designed by Mr. J. R. Groves, superintendent of rolling stock of the St. Louis & San Francisco, and illustrated in LOCOMOTIVE ENGINEERING. Mr. Symons is proud of his board and considers it a great convenience.

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A correspondent of the *English Mechanic* writes that he had the misfortune to break off a tap in a half-inch hole at the end of a shaft. After trying unsuccessfully to soften it by the blowpipe, he bethought himself of trying electricity, and accordingly, by means of an arc-light carbon, brought to bear on the shaft an electric current of 30 or 40 amperes, which raised it to a dull red heat in about three minutes. When cooled the tap was of course easily drilled out.

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The fashionable thing among railroad men in Southern California is to be owner of an orange grove. Some of the finest groves in the neighborhood of Los Angeles belong to railroad men. One trackman on the Southern California has an orange grove worth $10,000. It originally cost him about $500 of hard scraped earnings. The rise in values has a kind of gambling aspect that is very attractive to men with small sums to invest.

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After the last meeting of the Southern Railroad Club at Atlanta was over, a few of those who were at the Kimball House had a little joke at the expense of Mr. A. G. Richardson, of the Ewald Iron Co. Shaeffer, the champion billiard player, happened to be in the hotel and they started Mr. Richardson to play with the famous expert, without knowing who was his opponent. The jokers did not get much to laugh over.

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The N. Y. C. & H. R. Ry. are taking off the buffers, or dead-woods, each side of the drawhead of their freight cars equipped with vertical plane couplers. It is said 15,000 cars are being changed.

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All over Europe, wherever Pintsch gas is used for car lighting, they employ lead pipe to fill train receivers where we use rubber hose.

## A Grave Condition of Affairs.

There is something curious about the tenacity with which landowners in many parts of the West cling to their possessions in land. This characteristic is developed with remarkable prominence on the Pacific coast, and it causes railroad companies great inconvenience at times. Mr. W. G. Curtis, assistant general manager of the Southern Pacific, tells an amusing story illustrating this peculiarity. A certain man who had obtained extensive possessions in land was, after much persuasion, prevailed upon to part with enough ground to permit a railroad company to pass through his numerous acres. A station was established on his land, and demand for town lots arising, he was induced to sell lots enough for the building up of a small town. Houses were built and the community began to increase. The course of nature also called for the use of a burying-ground. But about the time this necessity arose, the owner of the land was seized with a spasm of pride of possession and he would not grant a foot of ground for a cemetery. The result was that the people had to carry their dead seven miles for burial to the land of a man with less restrictive sympathies, and they are doing that to this day.

The worst of the case was, that the new cemetery was located under a high trestle which the railroad passes over. The company are now anxious to fill up the gap that the trestle spans, but they cannot get the work done because it would obliterate the only burying-ground in the district.

## Whetstones.

The use for which the stone is wanted must always be considered carefully, for then the general character of the stone desired is easily decided, and it only remains to find a suitable stone. A few tests to decide what sort of stone is being offered one by the dealer are often useful. The hardness may be tested by a pocket knife. If the stone is soft, like the water-of-Ayr stone, the knife edge will cut it easily on its flat sides without injury to the knife; stone of medium hardness, like the Hindostan, will cut on the edges with some difficulty; a hard stone, the Ouachita, for example, can be scratched by the knife point; while a very hard stone, like the Arkansas, receives no scratch from the knife point. The fineness of the grit can best be judged by drawing the edge of the finger nail backward over the stone; the sensation produced indicates well the coarseness of the grit, and a little practice with various stones soon gives one expertness in judging their fineness. The finger nail will tell whether the stone is coarse or contains coarse particles by showing scratches; fine gritted stone will make no visible scratches. The sharpness of the grit also will be indicated by the amount of the nail worn away.

A dull tool with a notched edge should no more be placed on a good whetstone than a carpenter's chisel should be used to drill rock; yet such a use of whetstones is a common one. The purpose for which a whetstone is bought should be kept in mind, and it must be remembered that if used for purposes widely different from those for which it is best adapted, the stone will be spoiled for its ordinary work. For this reason it is economy to have stones of different grades wherever tools are in constant use, as in carpenter and machine shops. For reasons already given, it must be expected that a whetstone will lose a little of its abrading quality with use; if it loses much, however, the conclusion may be drawn that it is not being properly used, that proper care is not being taken of it, or that it is a poor stone; only do not be too ready to condemn the stone. Many good stones are condemned and given a bad reputation, when the fault lies either in the original choice of the stone, or in the use made of it, or the care taken of it.—*Ark. Geo. Survey.*

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Mr. John Hinsey, of Sioux City, Iowa, who got up a large club for LOCOMOTIVE ENGINEERING in the beginning of the year, writes us that his house was destroyed in the recent Sioux City flood and he lost his entire outfit of names and sample copies. He requests us to send him a new outfit to help him in renewing his club when the time comes, and says that he will try to get a larger list than ever.

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The Midland Railroad, of England, have decided to build a new station at West Bridge. This station was built by the old Leicester & Swannington road in 1832, and has been in continuous use as a railroad station for sixty years. The grandfather of them all.

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The Beach Creek Road are letting ten engines.

# FOR YOUR LODGE ROOM!

PRICE REDUCED TO $60.00

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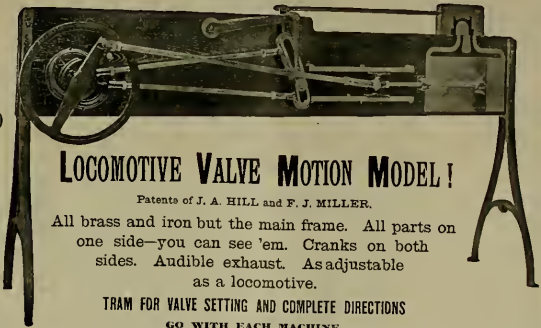

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Patents of J. A. HILL and F. J. MILLER.

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TRAM FOR VALVE SETTING AND COMPLETE DIRECTIONS GO WITH EACH MACHINE.

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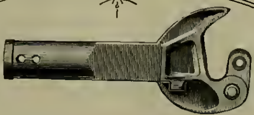
# THE JANNEY FREIGHT CAR COUPLER



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INDEX AND PREMIUM LIST,

50 PAGES.

A Practical Journal of Railway Motive Power and Rolling Stock.

VOL. V, No. 12. NEW YORK, DECEMBER, 1892. PRICE, { 20 Cts. Monthly. $2.00 per Year.



## Brooks Compound Locomotive.

The perspective engraving on this page and the sectional views that follow, illustrate a two-cylinder compound locomotive built by the Brooks Locomotive Works for the Lake Shore & Michigan Southern Railway, and now at work on that road.

The component parts of a compound locomotive that require particular care in designing are those that regulate the admission of steam in starting in such a way that the engine will start as easily as a simple locomotive. It is known to most of our readers that in a compound engine the over to the high-pressure cylinder. In the Brooks compound the appliances for giving the engine sufficient starting power were designed and patented by Mr. John Player, mechanical engineer of the works. The engine is of the receiver type, the steam pipe leading from the high-pressure to the low-pressure cylinder constituting the receiver. High-pressure steam is employed in both cylinders simultaneously, the supply being automatically reduced in pressure and controlled at even pressure, so that the mean effective pressure is equalized on both sides of the engine. Means are taken to prevent the live steam in the low-pressure cylinder, the intercepting-valve at the same time closing. When the exhaust steam from the high-pressure cylinder raises the pressure of the receiver above the pressure of steam in the low-pressure steam-chest, the intercepting-valve is opened and the engine begins working compound.

Referring to the engravings, Fig. 1 shows a transverse sectional view through the cylinders, receiver, steam pipes, combined valve, steam-chest, etc. Fig. 2 is a plan of the cylinders and connections. Fig. 3 is a longitudinal view of smokebox and low-pressure cylinder. Figs. 17, 18 and 19 starting passes through the small pipe *J* to the pressure-regulating *G*, forcing it open, and flowing through the inside of the valve, passes by openings through the intercepting-valve into the receiver. The pressure-regulating valve has a greater area on the low-pressure than on the high-pressure side, which tends to close the valve when a certain pressure is attained in the receiver. This pressure is regulated by the designers. When the exhaust steam escapes from the high-pressure cylinder and reaches a pressure greater than that in the low-pressure side, it forces the intercepting-valve open, and the area of the


BROOKS COMPOUND TEN-WHEELER.

steam is admitted direct from the boiler to the high-pressure cylinder, and after doing its work there is exhausted into the low-pressure cylinder, where it performs more work. As the low-pressure cylinder in ordinary working is dependent upon the exhaust of the high-pressure cylinder for its supply of steam, it is readily seen that in starting from a state of rest there is no steam in the low-pressure cylinder unless it is admitted directly from the boiler. This is usually done. As the steam-chest of the low-pressure cylinder is in open communication with the exhaust passage of the high-pressure cylinder, pressure admitted direct from the boiler to the low-pressure steam-chest will act as a back pressure upon the piston of the high-pressure cylinder unless an intercepting-valve or some equivalent device is employed to prevent the steam from passing low-pressure steam-chest from passing over to act against the high-pressure piston. Provision is also made for automatically shutting off the supply of live steam from the low-pressure steam chest or receiver when the exhaust steam from the high-pressure cylinder reaches the same pressure as the directly admitted steam in the receiver. At the instant the direct steam is shut off both ends of the receiver are opened so that the exhaust steam from the high-pressure cylinder may pass unimpeded to the low-pressure steam-chest.

To perform these functions there is introduced into the receiver-pipe (*D*, Fig. 1) between the high and low-pressure cylinders a combined admission pressure regulating and intercepting valve *G*. On the throttle being opened the combined valve admits steam at reduced pressure to the show views of the intercepting and pressure-regulating valves in different positions. The intercepting-valve is a cylinder closed at one end, the closed end forming a disk which covers when closed the steam pipe opening to the high-pressure cylinder. The inside of the intercepting forms a seat for one end of the admission and regulating-valve.

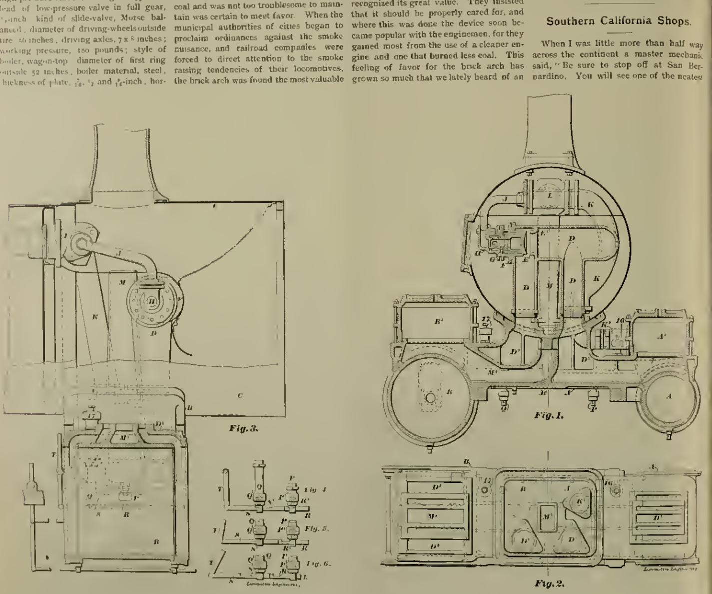
In Fig 17 the combined valve is shown in the position it stands in when the engine is working compound. Fig. 19 shows the position of the valve when steam is shut off, a spring being used in the intercepting-valve to close the latter. The action of the valves can be followed by reference to Figs 1 and 18. When the throttle-valve is opened the steam passes through the pipe *K* in the ordinary way to the high-pressure steam-chest. The steam intended to use the low-pressure cylinder in intercepting-valve disk is so much greater than the area exposed by the starting-valve to the live steam, that the valve is held closed until steam is shut off.

Figs. 4, 5 and 6 show what are called controlling-valves, which are used for admitting a small quantity of steam for moving the engine light. They are operated by a lever in the cab separate from the throttle, and are seen beneath the cylinder saddle in Fig. 1.

The details of the starting appliances appear to be well worked out.

Figs. 7 and 8 show in transverse section and plan an arrangement which may be employed where the intercepting valve is placed in the saddle of the low-pressure cylinder.

The leading particulars of the engine are Weight in working order, 102,000 pounds, weight on drivers, 75,000 pounds, wheel base, 23 feet 3 inches, driving-wheel base, 13 feet 3 inches, cylinders, 17 and 28½ x 24 inches, steam ports of high-pressure cylinders, 16 x 1⅝ inches, exhaust ports of high-pressure cylinders, 16 x 3 inches, maximum travel of valve, high-pressure cylinders, 5¼ inches, maximum travel of valve, low-pressure cylinders, 7 inches; inside lap of valve, high-pressure cylinders, ¾-inch, inside lap of valve, low-pressare cylinders, ⅞-inch, inside clearance of high-pressure valve, $\frac{3}{16}$-inch, inside clearance of low-pressure valve, ¼-inch, lead of high-pressure valve in full gear, $\frac{1}{16}$-inch; lead of low-pressure valve in full gear, ⅛-inch kind of slide-valve, Morse balanced, diameter of driving-wheels outside tire 56 inches, driving axles, 7 x 8 inches; working pressure, 180 pounds; style of boiler, wagon-top diameter of first ring outside 52 inches, boiler material, steel, thickness of plate, $\frac{7}{16}$, ½ and $\frac{9}{16}$-inch, horizontal seams, quadruple riveted lap joints, circumferential seams, double riveted, size of firebox, 96 x 34 inches; water space, 4 inches front, 3 inches side and back; tubes, diameter, 2 inches, tubes, number, 186, tubes, length over sheet 12 feet; crown supported by crown bars, exhaust nozzle, single, exhaust nozzle, diameter, 4½ inches, smokestack, diameter inside, 13½ inches, feed-water supplied by two No. 8 Monitor injectors, ratio of high to low-pressure cylinders, 1 to 2.81 inches; ratio of high-pressure cylinder to receiver, 1 to 4.05 inches, smallest diameter receiver passage, 7 inches, diameter of intercepting-valve, 7 inches, smallest diameter of reducing-vale, 3 inches, inside diameter of live steam supply pipe to reducing-valve, 2¾ inches.




Details—Brooks Compound.

## Growth Into Favor of the Brick Arch.

No attachment of the American locomotive has risen more rapidly into favor of late years than the brick arch. Yet it is not ten years ago since a committee of the Railway Master Mechanics' Association appointed to investigate the advantage of brick arches presented a report which condemned or underrated the value of this aid to combustion.

Several circumstances have contributed to the popularity of the brick arch and to the deciding of its proper value. When railroad companies began to call for care and economy in fuel consumption a sentiment was cultivated which prepared the way for the general introduction of the brick arch. Anything that would save coal and was not too troublesome to maintain was certain to meet favor. When the municipal authorities of cities began to proclaim ordinances against the smoke nuisance, and railroad companies were forced to direct attention to the smoke raising tendencies of their locomotives, the brick arch was found the most valuable aid in the protection of railroad companies from prosecution. This has quickly led to the brick arch being considered by all well managed railroads an essential part of the locomotive firebox.

The rapid advance of the brick arch into popularity is not stranger than the sentiments which long kept it tabooed as worthless. The opposition offered to this valuable adjunct of combustion was due to the fact that it required some attention, and it was declared a nuisance by people who had no interest in fuel economy and had no patience with anything that they had not always been accustomed to. A brick arch would be applied to one or two fireboxes on a road where none had been used before. Likely enough they were built so that a shovelful of coal could not be thrown into the firebox without striking the arch. It was nobody's business to make the thing a success. The fireman discovered that it interfered with his free and easy fashion of throwing lumps of coal into the firebox and he declared the thing no good. By carelessly throwing a portion of the coal on the top of the arch instead of under it, he choked up part of the flues and the engine did not steam so well as with a plain firebox. When the arch was finally knocked down by being hit in a vital part by a lump of coal, and time lost in getting the fragments removed from the firebox, the master mechanic concluded that the arch was more trouble than it was worth. This was for years the experience of the brick arch on various railroads.

That the arch survived is due to the persistence of a few master mechanics who recognized its great value. They insisted that it should be properly cared for, and where this was done the device soon became popular with the enginemen, for they gained most from the use of a cleaner engine and one that burned less coal. This feeling of favor for the brick arch has grown so much that we lately heard of an engineer who went to the master mechanic and offered to bear the expense of renewing a brick arch since the company did not seem inclined to put a new one in. The cost of a new arch was of small consideration compared with the increase of comfort he found by using it. There are many other novelties that enginemen and others look upon with suspicion that merely need acquaintance to be thoroughly appreciated.

## Fighting by Boycott.

Some time ago the general passenger agents of nearly all railroads formed a compact or conspiracy to boycott the Chicago & Alton. The boycotted road moved along in the even tenor of its way and carried more passengers than it had ever done before. The boycotters became tired of the boycott sooner than the boycotted. When they had properly demonstrated to the world at large what roaring asses they could make of themselves, the general passenger agents decided to raise the boycott. It is hard for some classes to acquire wisdom, for part of the men who favored the Alton with a boycott have now decided to put the same humbug upon the Union Pacific.

That kind of boys' play makes railroad officials appear ridiculous before the reflecting public. The officers of the roads who are taking this boycotting method will yell with protest when striking employés adopt similar fighting tactics. Are the latter not drawing inspirations of this kind of warfare from the railroad companies themselves?

## Southern California Shops.

When I was little more than half way across the continent a master mechanic said, "Be sure to stop off at San Bernardino. You will see one of the neatest shops there is in this country and run as well as anything to be found in the East."

I took this advice, and severed my attention from the novelties of orange groves, peach orchards, luscious vineyards and blooming flowers to search for Mr. G. W. Prescott, the superintendent of motive power. In a country where there is no ice or snow and very little rain, elaborate buildings are not necessary for shops, but those at San Bernardino compare very favorably with buildings to be found East of the Missouri. The shops are small but well arranged for doing the work for about 40 engines, 60 passenger cars and 200 freight cars. Between San Bernardino and Los Angeles the road passes through a series of fruit gardens and villages that supply a large volume of passenger business similar to suburban traffic. On this account the road has a large percentage of passenger cars and engines which make big mileage.

Labor is expensive here and the men in charge of this road have done all in their power to make machines do all the work possible The shops are well provided with tools when compared to other Pacific Coast establishments. The tool room is particularly well equipped and the blacksmith shop would be notable were it in the East for the extent and variety of formers and [illegible]. The shop is also exceptionally well supplied with punches, shears, rolls, bolt-[illegible], steam-hammer and other ma-[illegible] Here there is a novelty in the [illegible] of a flue cutter which has a frame [illegible] from the bolster of an iron truck In the machine shop they make good use

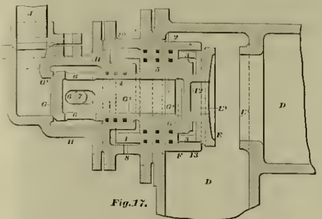


Fig. 17.

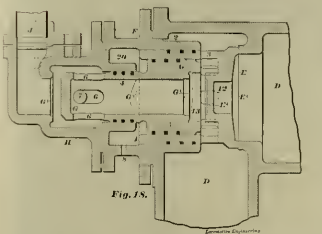


Fig. 18.

Locomotive Engineering

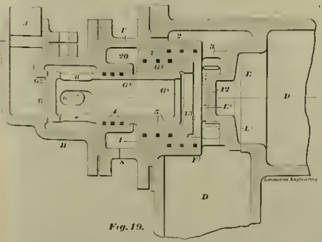


Fig. 19.

Locomotive Engineering

of an air rotary engine which drills, taps, bores cylinders and does a variety of other jobs.

The brass foundry is particularly well run and a small furnace is used for melting brass. A novelty about this furnace is that all the brass scrap from lathes and sweepings of the floor is put into the furnace without having the iron separated. The heats are kept down to the melting temperature of brass and the iron does not melt. When the heat is run off the iron is found in the bottom of the furnace and is dropped out. Mr J B McGill, foreman of the foundry, is an expert in the business

## Sellers Machine Works.

Work is very active in the Wm. Sellers & Co. Works in Philadelphia, but the complaint is heard here as well as in other machine tool works, that railroad companies have ordered very few tools in the last year. The demand for turntables keeps up very well, and the cranes are in demand. The new injector is making satisfactory progress into the favor of railroad companies and is gaining upon the 1876 injector, which has always been very popular. It will be gratifying for those interested in the demand of American articles abroad to learn that the Sellers injector is used largely in France, and that several railway companies in that country have adopted it A commissioner who was in this country lately from Russia examining railway appliances was very much struck with the merits of this injector, and it is likely to be tried on the Russian railroads.

These works have recently completed for the Southwark Foundry & Machine Company a floor boring machine that is operated electrically from a motor placed upon and connected directly with the machine itself. This tool is a special one and is to be used for boring, drilling or milling. It has 7 feet traverse for the vertical lift of head and 30-inch stroke of the spindle. The Ward-Leonard system of electrical transmission is used The direction of motion of all parts can be changed instantly by a reversal of the motor. The Wm. Sellers Company are also building one thirty-ton and one sixty-ton traveling crane for the Carnegie Steel Company, of Pittsburgh, and one fifty-ton crane for the A Garrison Foundry Company, of Pittsburgh The crane that this company is to place in the machinery building of the World's Fair is approaching completion and will be ready for delivery in December.

## An Irish Railway Shop.

The cleanest shops that I visited in all Great Britain were those of the Great Southern & Western of Ireland at Inchacore, in the suburbs of Dublin.

The yards are carefully kept, grass plots abound and not a piece of scrap or material can be found out of its proper place.

The buildings are of stone or brick and very good ones, and the machinery as good as can be found elsewhere

The locomotive superintendent, Mr H. A Ivatt was formerly general foreman of the works and has been in the employ of the road for a good many years

The shops stand on a large plot of ground surrounded by a high stone wall. Inside the inclosure, besides the shops, there are a great many brick cottages which are rented by the company to the employés, these have a sewerage system of their own which is carried to a farm back of the shops, which are cropped to keep the soil in shape.

Like the other Irish roads the gauge is 5 feet 3 inches, yet their locomotives are comparatively small, the largest cylinders being 18 x 24 inches.

A great many suburban engines are used and very neat little engines they are.

They have one compound, 2-cylinder type, a freight engine converted. When I asked how she did the superintendent said he had not run her long enough to tell —only twelve months—said he could tell better after he found out how much extra he would have to put into her repair that would have to be charged to her fuel account. The engineer told me that she could make a round trip on considerably less coal than the other engines.

This road once had a great many kinds of engines but the present locomotive

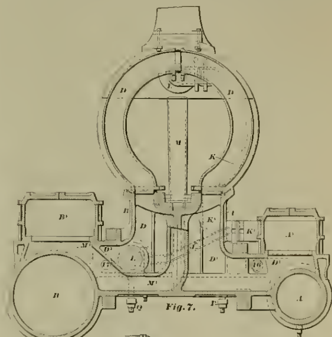


Fig. 7.

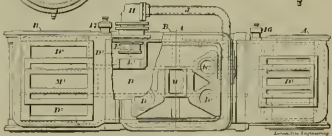


Fig. 8.

Locomotive Engineering

Details—Brooks Compound

superintendent has reduced the classes to three, and rests there.

The engines are fitted up with great care and are very handy for their kind. The vacuum-brake is used and the ejector pipe goes directly through the boiler and empties into an annular opening around the exhaust-nozzle

They use one little trick that seemed to me to be worth imitating. They have a tube made of perforated metal that is just the size of the water hole in the tank and reaching almost to the bottom, this has a flange at the top that prevents it from going entirely down and a pair of handles to lift it out. Coal or other foreign substances are thus kept out of the tank, for no matter if a pail full of coal falls in it makes no difference, anything that will go through the perforation will go through the injectors. This long basket can be lifted out instantly and emptied On suburban engines where coal is piled all over the man-hole as a rule, the device seems particularly useful.

Crown bars are used, and as they never wear out, but are used over and over, that form of boiler is still built

The front ends have a perforated tube the same size as the stack, extending down around the nozzles, the perforations are ⅜ inch or ½ inch by 4 inches long.

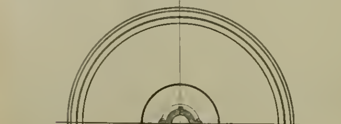
Mr. Ivatt has recently compounded the shop engine

They make their own engines and cars, in fact nearly everything they use, and more progressive ideas prevail than just across the Irish Sea, especially about their cars. Some new coaches just turned out are finished in natural wood and lighted by Pintsch gas. The English idea of beauty seems to be a white painted ceiling with a thin gilt molding. The modern American day coach with its quartered and carved oak finish is as a palace to a hovel when compared with the English carriage. These Irish cars look neat and clean. Their mail cars have an elaborate net for catching mail bags. This has an iron frame and a net of ropes fully four feet wide and twice that long, which folds up beside the car and is operated by a lever on the inside. They also have a cumbersome device for throwing bags off. It is said the bags often break the net, yet our Yankee hook seems to take them in without trouble.

The cars ride better than any compartment cars I rode in, and perhaps this can be accounted for by the system of balancing wheels. Mr. Ivatt does not believe in the knife-edge balance, and uses an ingenious device of his own. This is illustrated by the sketch. A pair of long carriage springs are placed as shown, one end fast to the floor and the other mounted on a guide, or slipper, free to move endwise. At the centers of the springs there are adjustable bronze boxes to take the journal of a pair of wheels. A light split pulley is bolted to the center of the axle, and a small round belt arranged to drive the wheels. When revolved the wheels show at once any unevenness in balance by moving the slippers. This is remedied by screwing weights upon the inside of the wheel-plates until the wheels can be run at the rate of sixty miles per hour without moving the springs. This is done with every pair of wheels, the weights marked in pounds and a record kept. It is claimed that a great saving in wear and tear, heating, etc., has been noticed since this was done, but the great result has been better riding cars.

All wood used for car frames, shops or permanent works is creosoted, a good plant being provided for this work.

Irish railroading is rather deliberate; of course this road runs the Irish mail, hauling the Atlantic mails and passengers from Queenstown to Dublin at a very high rate of speed, but this effort seems to take all the "hustle" of the road. I went down to Cork from Dublin on the engine. The driver was a jolly chap and anxious to know if I knew his two brothers in America, one an engine driver in Canada and one a machinist at Paterson. We ran fast enough between stations, but would loaf from five to ten minutes every time we stopped. There was a third-class carriage next the engine, and at one long stop where the driver took water and told me a five-act story, and the stoker oiled around, I heard an old fellow in the car say: "Tha dhriver has shtopped to bile the wather agin, I wonder phy they don't bile it runnin', like they do in England." J. A. H.




IRISH WHEEL-BALANCING DEVICE.

## Another Outrage.

Railroad companies do not get half the credit they deserve for benevolence. In some parts of the country the greater part of the poor people steal from railroad companies all the coal they use, and the privilege is regarded as almost a right. The Union Pacific Railroad Company put a high fence around one of their principal yards lately, and it nearly caused a riot in the town. People who were in fairly good circumstances complained bitterly about the curtailing of their privileges, and considered it very hard that they could not send their wagon to the coal cars in the yard to be loaded up without charge.

## At the Root of the Evil.

An overworked signalman caused a fatal railroad accident lately by jumping up when half asleep and pulling the wrong lever. The coroner's jury that sat on the accident have returned a verdict which is equivalent to one of manslaughter against the directors of the road. Among the directors are three members of Parliament. It would be a great boon to the managers of certain American railroads if coroners' juries would adopt this practice of going up to the fountain head when accidents occurred that were due to the policy of the company. We would then have more policy in favor of improved safety appliances.

---

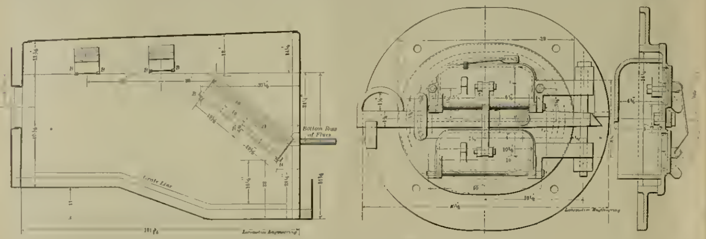
There is considerable friction on some railroads between the transportation and mechanical departments about the car rating of engines. The load and weight of cars is so varied that a number of cars of one kind that will be a light load for an engine will be beyond its capacity with another kind of cars. The only fair way to estimate the capacity of an engine is on a tonnage basis. Even that is not entirely satisfactory, for there is so much underbilling of freight that a ton is much heavier on some roads than on others.

## Illinois Central Fire Door and Brick Arch Arrangement.

Here is a new idea in brick arches now in use on the Illinois Central road. The usual arch and two smaller ones high up in the box and back of the main arch.

The fire-door has a deflector cast on the inside, as shown, and carries two long narrow doors hinged at the bottom and coupled together by a handle; a pull on this opens them both and admits air over the fire; this being deflected down by the shape of the door line, strikes the flames at an angle and rising is thoroughly mixed and ignited before escaping from the box.

The trouble from black smoke in Chicago has led to these devices being introduced, and it is said they prevent in a great measure this nuisance when properly handled.




ILLINOIS CENTRAL FIRE DOOR AND BRICK ARCH.

## Canadian Pacific Water Hose Coupling and Strainer.

The engraving shown herewith will give a very good idea of a new water hose coupling adopted by the C. P. road. As can be seen, the coupling is made something of the form of an air-brake coupling, but held together with a screw-and-lock nut.

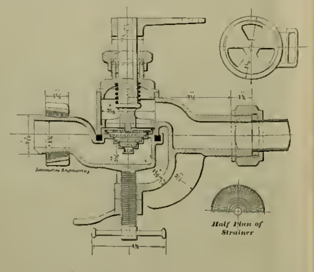
The piece fast on the engine, the right hand one in the cut, carries the valve, a flat one with three openings, as shown in the plan; the handle of this valve extends up into the cab, and is used the same as a lazy cock for pump.

The strainer is a cone-shaped cast-brass piece that merely sets into the tank half of coupling.

The tank, or hose piece of the device is very simple, having a side opening end with a recess for the rubber packing ring.

The lower arm of the main casting carries the screw and jam-nut to hold the device in position.

This coupling can be opened and closed almost instantly without nice adjustment for entering threads, in fact, it can be kicked apart—an advantage in cold climates.




CANADIAN PACIFIC HOSE COUPLING.

## Typical English Freight Engines.

The engraving shown on this page gives a very good idea of the average English freight engine. This machine was the type made by the Midland company until very recently, and the only change now made is to put the frames between the wheels and put the crank pins in the wheels themselves.

Typical English Freight Engine.

This engine has 17 x 24-inch cylinders and 62-inch wheels, with a rigid wheel-base 16 feet 6 inches.

The different locomotive works in the country were building these engines while the writer visited them this summer, an order for 100 having been divided between the principal builders.

The engines have wrought-iron driving-boxes case-hardened; horn blocks each side of them are made of chilled iron, there is no provision for taking up wear, yet they run two years without attention. Every joint in the spring and brake rigging is case-hardened.

All the joints about the cylinder heads, chests, etc., are scraped to a fit, every boiler-cock goes on to a wrought-iron boss riveted to the boiler with a scraped joint, all joints flanged, no screwed-in joints at all.

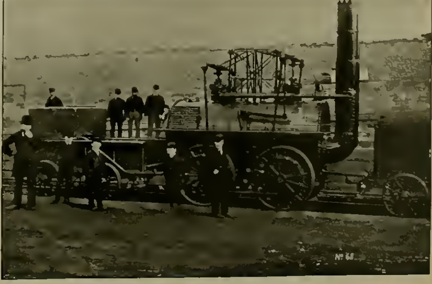
Everything about them is wrought-iron—no castings used worth mentioning. A great deal of the outside pieces are polished, such as the hand-rails, edge of frame and cab, buffers, rods, etc.

The inside cylinder allows the placing of the driving-wheels as shown, and does away with trucks of every kind, as you will see, the spring hangers are fast directly to the frame, no equalizers being employed; this causes them to ride uncomfortably, especially as the crew are obliged to stand up.

In front will be seen the sand-boxes, and between them a trap-door that when raised up exposes the cylinder-heads and chests, there being a lubricator in each cylinder-head.

## In the Oldest Locomotive Works in the World.

The shops of Robert Stephenson & Co., L'td., Newcastle-on-Tyne, England, are the oldest locomotive works in the world. Here George Stephenson constructed his "Billy" in 1825, and later on the "Rocket." One part of the works is the old shop in which this work was done It is a small stone building, in the center of which is a small crane, the jib and arm of wood and geared up with cast gears, just as thousands of its class are made to-day. This crane was made by George Stephenson himself, as was also the stationary engine still driving the tools. This engine is of the old-fashioned beam type. The connecting-rod for crosshead is connected to a walking-beam near its center, one end of which is pivoted to a vertical standard from the frame and the other end carries the connecting rod to the crank The balance wheel is of wood. The plate on the frame reads," Built by Robt. Stephenson & Co., Newcastle, 1823." The only renewal has been a new cylinder For seventy years this old engine has been at work faithfully, but it is now proposed to replace it by a modern high-speeder and let it rest on its past record.



George Stephenson's First-Born.

These shops are far, far behind the age. There are very few new or modern tools to be found in the place and no old ones seem ever to have escaped.

The introduction of cast-steel in Europe has made many special tools for making and finishing wrought-iron wheels obsolete.

The manager of the works, Mr. Crow, is a very ingenious man, and has invented many tools; one, a shaper for cutting out the inside of the wheel rim on a circle is used in many English shops. He also invented a very ingenious drill table, by the use of which it is possible to drill all the holes in a crooked or twisted bar of iron at one setting; this is useful there where so many forged pieces are employed.

Most of the lathes and planers are very old and decrepid. Copper fireboxes are used exclusively, and some special tools are employed to stay the crowns. Crown bars run lengthwise, and, by the way, are now generally made of cast-steel with the thimbles cast on them instead of bolts and nuts; tap-bolts are usually screwed into threads. Great care is taken, however, to make the bolt fit the hole in the sheet. After the box is done and the holes made, a template crown-bar is placed in position and fastened down; this template has long, straight holes in every thimble, this hole is used to guide a reamer, the end of which is plain to go into hole, this reamer cuts out the hole in the sheet on a taper and a cutter faces off the sheet. This insures a tight joint, as all the tap-bolts are taper under the head, and the inside of head is faced true. Copper or brass flues are used, and we noticed one that had a piece broken off the end in expanding was put into a crude old drawing device and drawn out until long enough, this, of course, making it smaller in diameter.

The best tools in the place are the heavy slotters and wheel lathes—the slab-framed engine is made on a slotter, anyway.

They do some metal sawing, mostly thin material. We noticed that these saws were sharpened on an American saw-filer.

One machine planes and bores both cylinders and chests at one setting.

The grinding room is a feature of all English shops, many large grindstones are used to finish bright parts

One thing was noticeable, the elaborate smoke-flue in the erecting shop. Between each track, long pits, there is a smoke tunnel, these being connected to a large stack At intervals along the tunnel there are connections and a pipe running up higher than the stacks of the engines. When they fire up a new engine to test it, they connect an elbow to the stack and draw the products of combustion into the tunnel, this leaves the shop clear for cranes.

They were building ten suburban tank engines during our visit and some small engines for China Work is very dull, not over 20 engines going out in a year, where they used to build 80.

After visiting other modern shops in that country it seems wonderful that this sleepy old place could build a locomotive at all and compete in the open market.

For years the old "Rocket" lay around these shops and was finally given to the South Kensington Museum. On the end of the high level bridge, also built by Stephenson, stands as a monument, Stephenson's "Billy," just like the engine in the picture, this one, "Locomotion," being shown at the Darlington exposition These old engines had extra crank-pin bosses cast in the wheels, so that if a pin was broken off, or had cracked or worn the hole, a new pin could be put in a new hole.

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The people of Illinois are talking of a fast run made on the Chicago & Alton with an engine and single car containing Vice President-elect Stevenson A run of 131 miles was made in 155 minutes with several stops. It was said that during the trip 15.9 miles was run in twelve minutes. The run was no doubt very fast for Illinois.

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They were nearly having a strike of car repairers on the Santa Fé at Raton, lately, under rather peculiar circumstances. A man who was working in the car-repair shop was building a house for himself One day it was found that he came to the shops and checked and then sneaked out and went to work on his house. It was also found that he was using some of the company's lumber in building his house. For the double offense he was discharged He belonged to the Brotherhood of Car Repairers, and the local lodge took up the case and demanded the man's reinstatement. The company stood firm, and the local lodge did not venture to call on the organization at large to make an issue on such a case.

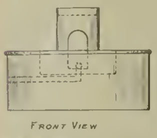
## Railroad Blacksmithing.

By W. G. Lottis

In the last Locomotive Engineering I promised to explain the benefit of the different forge fires as represented.

In the first place a fire as represented in Figs. 1 and 2, effects saving of fuel, the next thing is the rapid and uniform heating, if your work requires it. But for steel and tool-work you generally want a low and uniform heat, and not too rapid.

*Fig. 1*



Front View

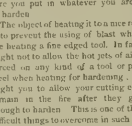
Especially for annealing and hardening you use a fire of this kind after it is coked enough, which will only take one half or three-quarters of an hour, and it gives the best satisfaction of anything I have seen. You have the same heat all around, which is one of the most important things in annealing and hardening steel. If you take and use a keen blast for a few minutes so as to do away with black spots in your fire, and get your coke or charcoal to a nice red heat, then shut off your blast and put in your steel and take a small piece of sheet-iron and set it up against each opening you will find that your steel will heat as quickly as it will in a furnace, and just as uniform if not more so. The center will be as hot as the outside. This is the best way to heat for annealing. I am satisfied, and especially where you have nothing but the forge to do it with. It must be remembered that an uneven heat for annealing has the same effect as it has for tempering, for the higher the heat the greater the expansion, and unequal heat must certainly cause unequal expansion and unequal strain. To convince yourself of this take a circular saw ⅛-inch thick and from 6 to 18 inches in diameter, or any other piece of steel the same size, take and heat it to a perfect uniform heat and put it in dry lime or fine dry charcoal and leave there until cold. When you take it out it is perfectly straight. Then take and heat ¼ of it or ½ to a light-blue heat, then let it cool off slow, and you will find that your piece has warped.

Now, a great many smiths believe that by heating this same piece red-hot and straightening it while it is red-hot, and putting it back in the lime or charcoal and leaving it until it is cold, that the treatment will do away with the unequal strain that was put on by the heating of ¼ or ½ of it, or any uneven heat that may have been put on in the above-stated way. Now this is a mistake. About the only way to do away with this unequal strain is to take the piece after you have warped it, and heat it red-hot, having a perfect uniform and low heat on it, and put it in your lime or charcoal, being careful that your lime or charcoal is perfectly dry, and your piece covered air-tight and left until cold, then taken and filed, planed, turned or ground. If heated right for hardening, it ought to come out straight, at least straight enough, so that it can be trued up by very little grinding, but pains and time must be taken in heating for hardening. Your piece must be heated uniform, it will not do to allow it to heat more rapidly in one place than another. If you do you will cause unequal expansion, which induces unequal strain, and the piece will surely warp in hardening.

There is a large percentage of tools spoiled by allowing them to heat more rapidly in one place than in another, which cannot be prevented in an ordinary open forge fire as represented in Fig. 6, and especially when smiths have not learned enough to build a fire that will give them coke enough in one day to last the next day, and use it in the place of green coal. There is a large percentage of blacksmiths that still burn green coal in the place of coke, especially in agriculture shops. You take a fire, as represented in Fig. 1 and 2, and it can be used for hardening most any kind of a tool, while Fig. 4 is just as good for short taps, milling cutters or any tool that you don't want to be hardened over 8 or 10 inches in length. Fill up with charcoal and let the fire heat to a nice red heat before you put in whatever you are going to harden.

The object of heating it to a nice red heat is to prevent the using of blast while you are heating a fine edged tool. In fact, you ought not to allow the hot jets of air to be forced on any kind of a tool or piece of steel when heating for hardening, neither ought you to allow your cutting edges to remain in the fire after they get hot enough to harden. This is one of the most difficult things to overcome in such articles as large reamers, taps and milling cutters. You take a tap or reamer 2 inches in diameter and if your fire is anyway hot your cutting parts will be red hot when the body is still at black heat, which certainly causes uneven expansion, and has a tendency to shorten your tap, because by heating your cutting parts to red-heat and leaving your body at a black-heat, you expand your cutting parts again as much as your body, but the body being by far the strongest, won't allow the cutting parts to expand more than it does itself, and the result is that your cutting parts must upset when they get any hotter than the body. Now, the question may be asked, will the cutting parts carry the body with them if laid down and let cool slowly? The answer would be no, if the tap is 2 inches in diameter. But if you take a tap 1 inch in diameter and which has been properly annealed before it went to the machine shop, it will generally get shorter by heating in the above stated way and letting it cool slowly because your cutting parts contain about as much material as your body. If, however, you take either one of these pieces and heat them as already explained, having your cutting parts a red heat and your body a black, and quench them instantly after you get them to a refining heat in a solution that will cool quickly enough to refine, you will find that it will shorten nearly as much again as it would by having a perfect uniform heat on it. At least that has been my experience, and that is one of the objections to the lead-bath for hardening, especially such as long stay-bolt taps, for your lead will heat your outside so quick that your center has no chance to get hot unless you soak your tap until the heat runs through, and if you do that you are going to spoil your tap. It will be an open and porous grain.

*Fig. 2.*



Side View.

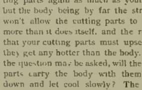


*Fig. 6.*

In order to refine your steel you must quench it as soon as you get it to the lowest heat it will refine at, and especially when you heat it in hot lead. I don't know of any place you can spoil steel quicker than you can in hot lead, for you have got to judge your heat from the looks of your lead pot on the outside which requires considerable practice and good judgment, especially when you have three or four different grades or makes of steel.

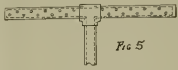


*Fig 5*

One of the necessaries in hardening taps in the above-stated way is seven or eight hours' sleep, and cold water is a very suitable drink the night before.

Another one of the benefits of a fire as represented in Fig. 1 and 2, is the preventing of getting fire blind, because the smith is not looking direct into the bright blazing fire all the time neither has he got the heat in his face and eyes.

Now I know that a great many toolsmiths won't place any confidence in this argument, neither will they believe that the fire has any such effect on their eyes as would cause them to over-heat a piece of steel.

If any smith wants to convince himself of this, let him take a welding heat on a piece of iron, or look into a white-hot fire for a few minutes, and then take a piece of high carbon steel, or an old tap or reamer, and try to get a low uniform heat on it. Take the lowest heat you think your steel will harden at and don't satisfy yourself the first time but try it five or six times and by breaking off your five or six hardened pieces you will find that you won't have three alike in grain.

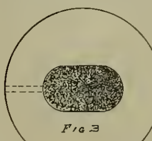


*Fig 3*

Top View.

It is deceiving enough to cause you to quench your steel at such different heats that it can be seen in the grain of your steel. It certainly ought not to puzzle you when you get three good taps and three poor ones that are made of the same bar of steel. If followed up, you will find that it happens quite often, especially in a railroad shop, where every man carries his own tools to the toolsmith and you have five or six men standing around you, all in a hurry for their tools, the tool-room man with a tap, the latheman with a lathe tool, the planer man with a planer tool, the floorman with a chipping chisel or scraper, the boiler-maker with a calking tool or a cape chisel, the carpenter with a plane knife and the roundhouse man with a ratchet drill, not saying anything about the section foreman and car repairers. Now, all of these tools are different in shape and have got to be forged and hardened differently, and the toolsmith is expected to do a good job on all of them. Perhaps he has got two or three of them in an open fire at a time, trying to get them out of his way as quickly as he can. Perhaps he is not thinking or not knowing the result that will come from soaking his tools in an open fire, as represented in Fig. 6, the cold air striking it on one side and the hot jets of air from the other side, and as a rule the cutting edges are down buried with green coal or coke where the smith cannot see it. The result is, the cutting edges are generally overheated, where if you had a fire as represented in Fig. 4 you could plainly see your cutting edges and would not overheat them once where you would five times in an open fire, as represented in Fig. 6.

## American Cars in England.

In a recent railroad collision in England a Pullman car withstood the shock which crushed the carriages ahead of it, and thus saved the rear of the train.

An Englishman writes to the London *Times* to say that similar results have been observed wherever fore-end collisions have occurred to English trains including one of the new Pullmans. The structure of the American car prevents telescoping, and the strength of its frame, together with its peculiar platform and buffer arrangements, makes crushing very difficult.

This Englishman urges the adoption of the American system of construction even to the vestibule, which he regards as a safety device worth copying, apart from the superior convenience and comfort of the American car.

Some progress in overcoming British prejudice in this matter has been already made. On nearly all the great lines our British cousins now run occasional cars which they call Pullmans, and they show a disposition grumblingly to admire them and grudgingly to enjoy their superior comfort.

These cars are not our Pullmans by any means. They are only about one-half as long as ours and less than two-thirds as wide. They have double seats on one side and single seats on the other, with an extremely narrow aisle between. To the American traveler they seem uncomfortably lacking in room and otherwise a poor imitation.

Unfortunately they are the best that our English friends can have, now or hereafter. Their tunnels and masonry road bridges have been solidly built to accommodate cars of the foreign pattern. They are not wide enough to permit ordinary American cars to pass through them. English roads must continue to run narrow cars, and without additional width they cannot make their cars the comfortable, luxurious affairs that ours are. They may get rid of the compartment system however. They may add many conveniences which they now lack. They may take profitable lessons in the matter of strong building, and above all they may step forward forty years by abandoning the old two-wheeled truck which still prevails everywhere in Europe to the great discomfort of passengers.—*New York World*.

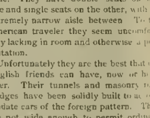


*Fig 4*

Front View

Railroad men may be depended upon to find the most epigrammatic by-name for a railroad. They are calling the Pike's Peak railroad the "Cogwheel Route."

The Rogers Locomotive Works have just finished the building of a two-cylinder compound locomotive.

## A Railroad Man's Paradise.

It was my good fortune to make a very long journey lately, which took me through the grandest and most romantic scenery on this continent. There were so many beautiful places seen, and the attractions and climate were so numerous, that it seems invidious to decide on one region surpassing all others in the charms that please without alloy. We traversed plains and valleys without number that were good to look upon; we passed through defiles where the earth seems to be rent in twain, and mountain, wood and stream combined to form scenes of the wildest grandeur. There were between these extremes many picturesque vales with bluffs and brae sufficient to break the monotony and to lend beauty to retreats that nature had blessed with fertility and bloom. To see all these allurements and to select one scene as attractive beyond others may appear narrow. The restful and subdued grandeur of one cañon enamored me far more than any other scene of the journey.

We had been traveling on the Atchison, Topeka & Santa Fé, through Kansas, Colorado and New Mexico. We had looked upon prairie and plain till we wished that the earth was not quite so flat, we had crossed spurs of the Rocky Mountain range, and while watching the tortuous windings of the train and noting its angle from the perpendicular, were inclined to regret the absence of monotonous levels. But every change had its attractions, every new scene its own beauties. After nightfall our car was detached from the main-line train, and a fiercely puffing little engine dragged us up four or five miles into what seemed to be the heart of the mountains. There was little to be seen but silhouettes of cloud-like mountains and solemn shadows. Then a turn of the track brought us facing the glare of electric lights and the sheen from the numerous windows of a great building.

In the morning we were up with the sun to examine the famous Las Vegas hot springs. These springs have probably been famous ever since human beings with diseases to cure were within reach of the place. This region is the center of what was once a great civilization. The peaceful people whom savage enemies turned into cliff-dwellers no doubt bathed in the waters of these warm springs long before the pioneer robbers from Europe devastated Mexico. It is certain that the savage Indians who roamed here in the period between the two civilizations resorted to the springs to remedy all their ailments.

The hot springs stream up through the limestone rocks all over a small dale at the side of a rapid creek, the water varying in temperature from blood heat to 140 degrees Fahrenheit. The place is in a widened cañon, which in some countries would be called a glen. Bold mountains, whose sides are covered with brush and pine trees, extend upward on each side of the creek, and the folds and furrows which the tumult of their molding and the ravages of storm and flood have put upon these great ridges form scenes that are varied, imposing and interesting.

On a sloping hillside above the springs, in a most commanding position, stands the Montezuma Hotel, the electric-lighted structure which had appeared so conspicuous in the dark cañon. It is an exceedingly handsome building, said to be one of the most comfortable hotels in the country. Our company was shown through the hotel, and it certainly had a most attractive appearance. There were several well-known railroad men staying there for rest and the benefit of the springs, and they all talked enthusiastically about the comfort and health-inspiring features of the place. The hotel is fitted up with all metropolitan luxuries and conveniences. Water as pure as that from the skies is brought from a neighboring mountain, the rooms are warmed by steam, and the house and grounds are lighted by electricity. All that money directed by refined taste can do has been exerted to give artistic finish to nature's striking surroundings.

A novelty in connection with this hotel is the water reservoir, which is a square cistern some 20 feet deep, and 50 feet of a side cut out of the solid limestone rock. This reservoir is on the top of a hill behind the hotel, and is also the source of ice supply. A chute leads from its brink to the ice houses 300 feet below, and the hotel enjoys the use of ice made from perfectly pure water.

The climate is perfect. The average throughout the year is a cool summer temperature. Here the student can rest, with rich inspirations before him for future thought. Here the active man may breathe pure air and bathe in life-giving water, while the energy that will not be stifled may be worked off by rambles over the aspiring mountains. The lover of scenery will find many a memorable view with little exertion, the sportsman may fish or hunt, and the naturalist will find abundant novel fields rich in animal, vegetable and mineral specimens. The invalid finds that the equable climate, the alkaline-saline water and the careful nursing to be health-inspiring, and even the lazy man finds it a good place to rest and escape exertion. The weary editor drinks in the scene—and the water—and exclaims "Wouldn't this be a glorious place to write in, unworried by the man with the new car-coupler and the inventor with the new form of compound engine?" and he hopes some time to come here and work at his book. But we must return to the stern realities of life and only dream of the clear bubbling springs, the rugged cañon, the breezy hillsides glittering in the sunshine, the waving pines, and the creek wimpling over its rocky bed.

A. S.

## In Castle Gate, Utah.

Our engraving, reproduced direct from a photograph, shows a very striking point on the Rio Grande Western, in Price Cañon, the East Portal of Castle Gate.

At every turn of the road—and it's all turns—the tourist sees something grand in nature when he goes over the D. & R. G., on the Rio Grande Western.

The noted scenery of Europe is fine, mostly because of the historic interest and the evidence of man's work for ages there, but for grandeur of natural scenery the Rocky Mountains have more to offer in a single pass than the Alps have in a whole country; the Hudson is finer than the Rhine and the St. Lawrence has more natural beauty per mile than the much advertised and aped-after Dutch stream has from A to Izzard.


In Castle Gate, Utah.

## Railway Notes From Australia.

BY I. VUITAUL.

There is a great deal of discontent among the engine drivers of Victoria, owing to a movement being made to curtail their pay. Some parties, who are evidently looking for an excuse to do the engine drivers injustice, are insisting that the guards have as important duty to perform as the engine drivers, and that the former are paid 40 per cent. less than the latter. That on account of this, pay ought to be equalized, the drivers' reduced and the guards' increased. The highest pay for engine drivers has been the first class, which was 15s. per day. This was made an honorary class, to which six men were admitted yearly on the recommendation of the locomotive superintendent. This has been done away with. At the present time promotion in all classes has been canceled for three years.

As regards the responsibility of the guards, it has been reduced to a minimum through the introduction of the Westinghouse brake, which has done away with the necessity of getting out of the van at night and dropping brakes in the bank. The block system, which has been introduced of late years, has also relieved the guard of the responsibility which he formerly had, so that the guard of the present day has what is commonly called a rosy time of it, especially on night goods trains, which are generally run through.

Having started his train on the journey, the guard coils himself up in his overcoat and sleeps the sleep of one who has done his duty. Should the van begin to rock too much going down a bank for him to rest in comfort, he gets up and screws the brake on to steady the van a bit and returns to his slumbers at once and forgets to release the brake. When the train sticks on the next bank and the driver goes back to see what is the matter, he finds the van brake blocks red hot and the man with the responsibility of the train slumbering peacefully.

I will give you one illustration. About eighteen months ago a train left Melbourne for Woodend with a through load of coal. It is an up-grade all the way. The brake was only partly through the train. When about 22 miles out, the train divided and the van and eight trucks proceeded back to Melbourne. The signalman, seeing the train going back on the wrong road, signaled to the other station, and a following train was shunted just in time to let the runaway pass. At the Melbourne end there is a mile of level road, so by putting gravel along the rails, they succeeded in reducing the speed sufficiently for one of the shunters to get on the van and apply the brake and stop the train. Then they found the guard sleeping soundly and none the worse for his ride.

As to a driver, his responsibility has increased in every way with the improvements introduced, as he has to take responsibilities which were formerly shared by the guard. The rolling stock consists of two classes of old four-wheel or English style of wagon, with the old style of Westinghouse brake, and the new eight-wheeled or American class of wagon, which are fitted with the new quick-action triple-valve. When a driver gets a train of these cars mixed up with a couple of passenger cars at the back, you can imagine the care that must be exercised to handle the brake and keep from knocking the passengers from one car to another.

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Not a few of our readers would do a wise thing by being guided by the advice of "Geo. L. De Witt," who has his say in another page under the heading, "The Mechanical Department." George does not sign the name he is usually known by, but his advice is nevertheless quite wholesome. He is an old master mechanic himself and knows what he is writing about. There are often good excuses for the heads of railroad shops engaging in the manufacture of tools and the doing of other work besides that of repairs, but the practices are generally followed with the belief that the articles can be made cheaper than they can be bought. This idea is nearly always based on misconceptions. The actual cost has not all been counted. But there is something fascinating about being able to point out tools of home manufacture. The man who is tempted, however, is encouraging his own downfall.

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The railroad companies using retaining valves on their freight cars are nearly all making the fittings of cast-iron, because when made of brass the parts are stolen by petty thieves. Even the cheap material does not always prevent the thieves from getting in their work. The entire cars would be stolen in some sections if they were not too heavy to carry away.

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W. Williams, 21 Fink's Building, Melbourne, Australia.

## Rights and Wrongs in Using the M. C. B. Car Coupler.

Railroad men are a remarkably busy class, and it is not surprising that they sometimes forget things which ought to be remembered. There has lately been a lapse of memory among railroad managers and their advisors which is liable to involve serious consequences. In 1888, when the adopting of a standard type of car-coupler by the Master Car Builders Association was under consideration, it was found that certain contour lines must be established for the vertical-plane form of coupler, and the lines patented by the Janney Car Coupler Company were the lines most to be desired. In negotiations with the Executive Committee of the Master Car Builders' Association, the directors of the Janney Car Coupler Company agreed to waive all claims for patent on contour lines of the coupling used on railroads that belonged to the Master Car Builders' Association. The only conditions imposed were that, before applying to cars couplers with the Janney contour lines, railroad companies should apply to the Janney Car Coupler Company for permission to use the lines. An agreement was made between the Master Car Builders' Association and the Janney Car Coupler Company, and the contour lines of the latter company's coupler were adopted as standard of the Master Car Builders' Association.

That was four years ago, and the different railroad companies have been applying the standard coupler in large numbers. Nearly every maker of this type of coupler—and they are already legion—adopted the standard contour lines and made their couplers to conform to the same—an act highly important if the different makes of couplers are to be shaped so that they will couple together and keep coupled. The Janney Company had agreed to permit any maker of car-couplers to follow their contour lines and to apply them to cars on condition that the railroad company asked for the right of application. After the standard lines were adopted, a few railroad companies which used standard couplers other than the Janney, applied for the legal right to use the contour lines, but cases of this kind were the exception rather than the rule. Many railroad companies adopted the M. C. B. standard coupler and began purchasing them from different makers without remembering to go through the formality of asking for the legal right. There is a certain type of railroad manager, with many representatives, who has got into a painfully embarrassing position in this coupler matter. He is the kind of man who is constantly harassed lest the original patentee of an article should build up a monopoly on the rights to the invention. To guard against this danger to society, the railroad manager is always ready to patronize imitations, and he is inclined to wantonly ignore the presumed rights of the original inventor. These men have carefully avoided using the Janney coupler proper, and few of them have applied for legal permission to use the patented lines. We understand that the officers of the Janney coupler company have been looking over their fences lately and taking notes of the trespassers. It will serve more than one manager justly if his company is compelled to pay royalty on all the standard couplers in use, and there is said to be some prospect of the car-coupler people asserting their rights.

## The Traveling Engineers' Association.

The preliminary meeting, held at the Lake Shore roundhouse in Chicago, Nov. 12th, served to confirm the opinion of the projectors that the traveling engineers or road foremen of engines of this country ought to have an association of their own; and a baker's dozen of good men issued a call that's sure to bring a goodly number of traveling engineers together, and men interested in one line of work cannot meet without exchanging views and "talking shop," and they can't talk shop without gaining information themselves, and information to a good traveling engineer means information to all the men who come under his instruction.

Traveling engineers are usually selected from the best runners; they are officials, and are expected to stand between the officers of the company and the men, and, when the right kind of a man is selected, he improves conditions for both.

He is the man consulted to see if actual every-day practice stands in the way of putting into force some plan that seems to the commercial men of the road to be an improvement. It is to the traveling engineer that the officials of the motive power department trust to report condition of power and recommend changes or repairs. He is expected to know and test the qualifications of firemen before they are promoted, and to go out with every new man to see that he gets over the road without trouble.

The road foreman must be able to instruct those who are deficient in knowledge of how to handle the brakes, etc., and ought to be able to *show* a fireman how to fire just as well as to *tell* him.

Few railroad men realize how important the position is and what possibilities for good or ill lay in it.

It is important that the duties and results aimed at by this class of men be as nearly uniform as possible and that they should get together once a year to exchange ideas and report on methods of reaching desired ends. We believe the higher officers of our American roads will be only too glad to encourage this new association, as its only aim will be "How best to improve the engine service of American railroads."

The constitution and by-laws will be as brief as possible, the meetings will be open, and only such subjects as relate to the aims of the association discussed.

The expense to members will be very small—not above $5 per year, if that—and it is hoped that the ship may sail on her maiden trip with a large volunteer crew on January 9th. If you are a traveling engineer or road foreman, see the "call" elsewhere in this paper—see it, and be "one" of the fathers."

## Articles on Blacksmithing.

We would like to direct the attention of men in charge of railroad shops to the valuable articles on blacksmithing which Mr. W. G. Lottes is contributing to our pages. The literature of the blacksmith's art is exceedingly limited, and good articles by a practical blacksmith who is a master of his business ought to be of great value. There are suggestions in Mr. Lottes' articles which would give valuable information to nearly all blacksmiths and would lead to improved work in this important department. How often do we hear complaints about the finest grades of steel being lacking in uniformity. Milling cutters and other expensive tools frequently break immediately after being put in use, and the cause of the breakage is a mystery. The points given in the articles referred to make it plain how unexpected failures may naturally happen.

It would be for the interest of railroad companies for the officers in charge of shops to see that these articles were brought to the notice of their blacksmiths. Complaints are often made that blacksmiths, as a class, display little interest in the literature of their business. We think this is due to the fact that very few men have written on this business whose views are of a practical and reliable character. The articles presented in LOCOMOTIVE ENGINEERING are both practical and reliable.

## Concerning Track Ties.

In the course of a recent extended journey the writer accompanied railroad officers of different lines on tours of inspection. The condition of bridges and track received searching attention, and there was much talk among the railroad men about how the problem of maintaining track in first-class order could be worked out at the least expense. Keep down the expense is everywhere repeated and emphasized, but keep the structure in first-class order is still more emphatically enjoined. The great difficulty everywhere encountered is that of ties for the rails. Ties seem to be scarce everywhere, and the most desirable quality is hardly to be obtained. The next question is how to make the best of the ties to be had. These are mostly of soft wood which has many faults. As heard from the voice of the railroad officer, the leading faults of soft wood ties are the rail rapidly beds itself into the tie and the spikes do not hold tenaciously enough to make soft wood ties safe on curves.

With all due respect to the men who abuse soft wood ties for the shortcomings of the material, we, as onlookers, would soy that the principal mistake made is in treating a soft tie in the same way that a hard wood tie used to be dealt with, and then complaining because it fails to give satisfaction. The material ought to receive treatment adapted to obtain all the strength possible out of its weakness. No link of the railroad structure has been more barbarously used than the hard wood tie. Under the very worst usage it gave fair results in efficiency and durability, and it is natural that men should be impatient when a weaker material fails to come up smiling out of the same hard ordeal. There is a wonderful absence of elasticity in the method of management pursued by some classes of railroad men. This tie question is a good illustration. Instead of treating soft ties as if they were made of the toughest oak, the men responsible for the roadbed ought to consider what kind of treatment would secure the best service from the ties that are now becoming most common. Were this done there would be a general introduction of plates to prevent the rail imbedding itself into the ties, spikes that have greater holding tenacity than the common destructive article would be generally employed, and some simple plan for re-enforcing the fastenings at curves would be used. If this line of treatment was accorded to the soft tie its life and usefulness would be very much increased. This kind of policy must be adopted some time, and it is better that it should begin at once, for there is no possibility of the tough hard-wood tie ever meeting the supply again.

Some railroad officers think that metallic ties will soon take the place of wood, and that the new material will put an end to all the tribulations connected with rail-fastening. It is likely that this change will come eventually, but it is not now in sight. The experiments with metallic ties have not been satisfactory. They are used to a great extent in India, but the traffic is light and slow, and passengers there have no voice in restraining the use of appliances that cause discomfort. People in America would not stand the noise that this fastening introduces, and there are other shortcomings to the metal tie which will cause our railroad companies to cling to wood as long as the material can be had.

If the use of wooden ties is to be continued, it looks as if railroad companies would find it to their interest to introduce processes for preventing the rapid decay of the timber. The annual demand for ties is now said to be about 80,000,000. Any improvement which would prolong the life of a tie for one year will help to provide against the inevitable day of exhaustion of the forests. The most promising aid in this line is in preservative processes. The Southern Pacific Company have an extensive plant at Oakland, Cal., for the preservation of timber, and the officers of the road speak very highly about the economical results obtained. In Europe, where ties are very expensive, the practice of subjecting them to a preserving process before putting them down is general. There are two leading processes followed for the preservation of timber. One is what is known as creosoting, which consists of replacing the juices of the timber by heavy oil of tar. The other process is called burnettizing, and consists of injecting chloride of zinc into the pores of the wood. Those who have had experience with the different processes say that chloride of sodium or common salt is just as good as chloride of zinc, and that both are worthless where the timber gets soaked with water, for then the preserving ingredient gets washed out. When good creosote is used, a hemlock or pine tie will last as long as oak as far as decay is concerned.

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The engineers and firemen of the B. C. R. & N., at Cedar Rapids, Iowa, have organized what they call the "Locomotive Educational Association." They have rented rooms and fixed them up in neat shape, put in a valve-motion model and some good books, and are discussing live subjects relating to their work. All this can have but one result—better posted enginemen. We notice in their plan that members are expected to ask questions and make statements; this is hard to do, men, especially engineers, dislike to ask information on subjects that they are supposed to know about. Some experience of the writer in this line developed a better plan; we had a "question box," a cigar box with a slot in the cover; into this any question about locomotives or rolling stock could be placed; no one knew who asked the question; these were taken out at random and the subject talked over. This plan prevents embarrassment and lets the information sift through the service, a benefit to all. We are glad that the master mechanic, general foreman and traveling engineer, all take an active interest.

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The Southern California Railroad people are changing one of their locomotives to adapt it for the burning of anthracite coal. There are large deposits of this coal on the Santa Fé system, and the intention is to use it on the Pacific slope locomotives.

## Varying Temperature of Passenger Cars.

Winter weather has come upon us rather earlier than usual this year, and with the necessity for heat comes the complaints about the suffering from the varying temperature of cars. A great want in our steam-heated cars is some means of holding the temperature to a range which is some distance away from the freezing and also from the boiling point. Extremes in this thing are much to be avoided, but the average porter and brakeman, to whom the regulation of car temperature is relegated, delights in extremes. There appears to be very loose training among the porters of the Wagner car service in the small details which do so much to influence the comfort of passengers, and attention to the regulation of car temperature seems not yet to be reached. We would respectfully beseech the Wagner Car Company to give this matter their attention before the winter is over. Pullman's people manage to keep their cars endurable, and we cannot understand why the other sleeping-car company cannot do the same thing if they will only try and go about the business in the right way.

While on this subject, we would suggest to division superintendents that they ride in the day cars occasionally and note the manner in which brakemen attend to the regulating of the heat. A thermometer is not a bad thing to use in regulating the temperature of a car. We decidedly prefer it to the sensations of a brakeman, for the latter are not so regular as a discriminating public might be inclined to demand. At one time a brakeman has been out flagging and when called in runs up to the car and reaches it heated and perspiring. The car seems stifling, and he goes through, pulling open the sashes and lets them stay open till a freezing temperature causes complaint. Next time he goes back he gets well chilled and takes his time returning to the train. The cars seem too cool for his frozen limbs, and he closes all the inlets for air and turns the cars into hot ovens. This kind of change may be amusing to some people but it is annoying and distressing to others. If it was the custom to hold conductors responsible for keeping the temperature of the cars fairly equable, and inspection by superintendents or train masters were made occasionally, it would greatly enhance the comfort of the unfortunate beings who have to travel in railroad trains during the winter.

## Vapor Needed in Combustion.

Scientific writers on combustion of fuel have always maintained that any vapor of water present in a fire causes a waste of heat. It is taught that dampness in the fuel or steam admitted to the fire in the process of injecting air all detracts from the heating efficiency of the fuel to the extent of the amount of fuel necessary to raise the water or steam to the temperature of the gases of combustion. In a paper read before the British Association lately, an eminent engineer controverts the old theory, and holds that combustion in a furnace cannot take place properly unless aqueous vapor is present. The experience obtained in laboratories and in blast furnaces with perfectly dry air in the combustion of gas, leads to the belief that the new theory is well founded. The efficiency of the fuel has been increased by admitting steam along with the air.

This thing has been noticed repeatedly in connection with the introduction of the Clark jet for introducing air through the sides of locomotive fireboxes. As the increase of efficiency could not all be due to the increased supply of air, certain patentees of smoke-preventing devices entailing the use of the Clark jet, held that the steam acted as fuel. Science ridiculed the claim, but it looks now as if the claim was partly correct. The act of combustion has always been considered complex, but there appears yet to be mysteries to it which science has not elucidated.

## Pay of Men on Chicago Elevated.

Executive Order No. 1 of the Chicago & South Side (elevated) road defines the hours of duty and rates of pay for all men in the transportation department. We observe that the rate of pay for machinists, blacksmiths, etc., is $3 for ten hours' work. Engineers and firemen work eight hours and fifteen minutes for a day; engineers receive $3.50 per day for the first six months, $3.75 for the second six months, $4 for the second year, $4.25 for the third, and $4.50 thereafter. Firemen get $2.25 for the first six months, $2.50 for the second, and $2.75 thereafter. This is extraordinary good pay and ought to bring to the road an excellent class of men; the work is not hard, there is no danger on the structure except from carelessness, and the hours short and rest regular. The management of this road seem to be inclined to do well by the men; during the recent Columbian celebration in the city there was a rush on the new elevated, but it was carried without mishap, and General Manager Barnard, in writing a letter of thanks and congratulation to the men, added these interesting and important words

"In expressing his warm personal thanks to each officer and employé who, by his energy and devotion contributed to this result, the General Manager has pleasure in announcing that in recognition of their services a day's pay will be added on the October pay-roll to the time of each officer and employé of the operating department."

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We have repeatedly heard the expression used about railroad officers. "He is a good Methodist, a good Catholic, a good Mason, a good Democrat, etc." We venture to say that when a man lets his religion, his clubs or his politics enter into his business, that he is a very unprofitable railroad man. One in charge of men, who selects for promotion or for special positions men whose religion or politics is the recommendation, is certain to serve his employers badly. The influences of church or party should be kept outside of railroad life.

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Among the questions that have come in for answers during the last month, there are several that are too puerile to deserve reply. If those who send in questions would try to do a little thinking for themselves they would not send queries that are silly. Some of them would be ashamed to see their names and addresses put to their questions.

## NEW BOOKS.

MODERN LOCOMOTIVE CONSTRUCTION. By J. G. A. Meyer, associate editor of the *American Machinist*, formerly chief draughtsman Grant Locomotive Works. Published by John Wiley & Sons, New York. Price $10.

Probably no mechanical book has ever been so anxiously awaited as this one has, or will be more welcome to the more advanced locomotive men, those in charge of design, repairs etc., as well as many who simply want a ready reference to keep them straight on rules and formulæ needed in their work. Mr. Meyer contributed the first chapters of this work to the columns of his paper, and the subject-matter of the book has become well known. Any student who wants to know the why and wherefore, who wants to know how the size, proportion and strength are figured for every piece in a locomotive, needs this work. It has all the best rules for figuring out valve motion, adhesion or any other point necessary to determine in a locomotive. It gives proportions and strength of every part of the boiler, the values of different materials, and how to figure all the strains a boiler is subject to. There are more than 1,000 illustrations in the book, every detail of a locomotive being shown and proportions given. This is the book needed by all the young men who have written us for something to guide them in building a small locomotive and the many more who write weekly for a book "naming every part of a locomotive and showing a picture of it." The book will become a standard and remain so until the form of the modern locomotive shall have been radically changed.

THE LOCOMOTIVE ENGINE AND ITS DEVELOPMENT. By Clement E. Stretton C. E., author of "Safe Railway Working." Crosby, Lockwood & Son. London. Price 3*s*. 6*d*.

This is an 8vo of 154 pages, on the early history of the locomotive in England. It is profusely illustrated and is very interesting to one who likes to read up on the development of the modern locomotive. The author is one of the best posted men in England and being disinterested his reports on various practices are better than a biased judge; for instance, in his preface we note the following paragraph

> The question of railway speed is one which constantly engages the attention of passengers, and we often *hear* of 90 and 100 miles an hour. During the past twenty-five years the author has ridden upon many engines, and has traveled in in all the fastest trains on all the railways of this country, for the special purpose of ascertaining their rate of speed. Upon a few occasions, and under favorable circumstances, he has recorded the very high rate of speed of 79.9 miles an hour, but he has never been able to time a train or engine at actually 80 miles an hour. As long ago as 1853, 81 miles an hour was run by engines on the Bristol and Exeter Railway, but these have now been changed and their speed reduced. It is not wise to predict what *may* be done in the future but at present 80 miles an hour is the maximum pace.

The author does not seem to think that "facts" as he calls them, have proven that the modern compound locomotive is a better or more economical machine than the simple engines, and says: "Whatever the compounds can do the simples can do, and often with more efficiency." The book is a valuable addition to any engineer's library.

SPON'S ENGINEER'S TABLES. A new edition. By J. T. Hurst. Spon & Chamberlain, New York. Price, 40 cents; in a cloth case, 50 cents.

This little book is 1½ inches wide by 2½ inches long, and contains a great deal of information in small space. It is an English work and many of its teachings would mislead an American who did not know there was a difference between the English and American standards. Their bolt and nut proportions, wire gauges, etc., are entirely different from ours. We notice that under "farm labor," they allow a man eighteen days to dig one acre of stubble land (1 spit, whatever that means to an engineer) and that 2½ days would be the proper time in which to pull one acre of mangel-wurzels. For all this, there are many little things in the book that are nice to know. It is one of those little collections of facts and figures that are very attractive at sight, but that an engineer would seldom consult.

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It is not wise for train men to be too exacting in holding the company they serve to the last letter of the contract of employment. On a road which we know of the train men have a contract in which the agreement is made that all passenger trains shall have a conductor and two brakemen. On that system there is a branch five miles long which has a passenger train that makes three trips a day. The company's officers thought that one brakeman might perform the duty of riding thirty miles a day on this train, which generally consists of one baggage and one passenger car, but the grievance committee made such a vigorous protest that the two brakemen were left on. The company are now arranging to operate the branch by electric cars. In a case of this kind it is possible for the pay of one man to turn the balance that exists between the expense of operating a railroad by steam or by electricity.

## PERSONALS.

Mr. H. B. Hodges has been appointed engineer of tests of the Baltimore & Ohio, in the place of Mr. Randolph.

The B. & O. have ordered sixty new engines from Baldwin's. They propose to be ready for the Fair business.

Mr. J. H. Sheldon has become agent for the Taylor Iron and Steel Company. His headquarters are in the Central building, New York.

Mr. George N. Terry has been appointed agent for the Safety Car-Heating and Lighting Company, with charge of the office at Chicago.

Mr. John Ortton, for several years superintendent of motive power of the Toledo, St. Louis & Kansas City, has resigned, owing to ill health.

Mr. Henry James has again connected himself with the Parrott Varnish Company, as sales agent. His office is at 29 Broadway, New York.

Mr Peter Clark, for many years assistant mechanical superintendent of the N. & N. W. division of the Grand Trunk, at Toronto, Ont., has retired.

Mr David Mackenzie, for some time purchasing agent of the Central Vermont, has been made superintendent of the New London division of the road.

Mr. T. W. Ranson, master mechanic of the Erie at Hornellsville, has resigned. He has been succeeded by Mr. Isaac Bond, with the title of general foreman.

Mr. E. A. Gilbert has been appointed general foreman of the Harvey Steel Car Works at Chicago. Mr. Gilbert was formerly master car-builder of the Boston & Maine.

Mr J. C. Blackwood, a son of General Foreman Jas. P. Blackwood, of the S. C. road, at Charleston, S. C., has entered the Rogers Locomotive Works to complete his trade.

Mr. W S. Hughes, for many years in the service of the Long Island road, has been appointed general foreman of the New York and New England shops at Providence, R. I.

Mr H. A. Childs, general foreman of the Erie shops at Jersey City, has been appointed acting master mechanic in place of Mr. C. E. Fuller, who has gone to the Central Vermont.

Mr. A. Leofred, mining engineer, Quebec, reports that he is kept as busy as he can be all the year around, making assays or preparing reports on American and Canadian mines.

Mr. George James has been appointed master mechanic of the western divisions of the New York, Chicago & St. Louis, with charge of the road's repair shops at Stoney Island, Chicago.

Mr. W. F. Strong has been appointed general foreman of the car shops of the South Carolina, at Charleston, S. C. The office of master car builder has been abolished, and Mr. E. M. Roberts takes general charge of that department.

Mr. T. B. Hindel, formerly master mechanic, and Mr L. C. Leach, at one time master car builder, of the New York, Chicago & St. Louis, have formed a partnership for engaging in the manufacture of a car-wheel patented by the latter.

Mr. John Hawthorn, master mechanic of the Chicago & Erie at Huntington, Ind. has been very sick and it was feared for a time that he would not recover. We are pleased to learn that he is getting better now and expects to be able to resume work soon.

Mr. W. F. Johnstone, superintendent of motive power of the Mexican Central, was visiting Providence, R. I., lately, looking over the big compound locomotives his road is getting built there. He reports that the compounds in use are doing remarkably good work.

Mr. C. R. Fitch, for some time superintendent of the eastern division of the Erie, has been made general superintendent. He came from the Long Island to the Erie and made a very decided success in the way he performed the difficult duties of the position.

Mr. J. S. Porter has resigned his position as master mechanic of the Cleveland, Cincinnati, Chicago & St. Louis, at Sandusky. Mr. Porter has been long in charge there, and was general master mechanic of the Indianapolis, Bloomington & Western before it was absorbed by the Big Four.

Mr. J. G. Hubbard has been promoted to the position of master mechanic of the New York, Lake Erie & Western at Buffalo, in place of Mr. Geo. B. Ross, resigned. Mr. Hubbard has been foreman of the car repair shops and was formerly master mechanic of the Buffalo Southwestern.

Mr. Robert M. Dixon, mechanical engineer of the New York Car Heating and Lighting Company, has been appointed manager of the Pintsch light department of the same company. His brother, who has been agent for the company at Boston, takes the position of mechanical engineer.

The directors of the Western New York & Pennsylvania have presented a testimonial to Mr. Richard Connolley a passenger conductor. This was done in recognition of his courage, coolness and good judgment in getting his train to a place of safety at the time of the great fire in Oil City.

Mr. C. S. Mellen, who went from the Union Pacific to be general manager of the New York & New England, has become second vice-president of the New York, New Haven & Hartford. It is understood that he will be in immediate charge of the transportation department of the road.

Mr. W. T. Reed, superintendent of motive power of the Chicago, St. Paul & Kansas City road, is said to be a recognized expert on boilers. When any accident happens to a boiler in the neighborhood of St. Paul, Mr. Reed's views on the cause of the accident are said to be considered conclusive. He is often employed by insurance companies to inspect boilers.

Mr. F. R. F. Brown, for several years mechanical superintendent of the Canadian Pacific, has been appointed mechanical superintendent of the Intercolonial Railway in place of Mr. H. A. Whitney, who has been placed upon the retired list. Mr. Brown is a particularly able mechanical engineer and railroad officer. He has been engaged in private enterprises since he left the Canadian Pacific.

Mr. George E. Sampson, road foreman of engines of the Chesapeake & Ohio, having been assigned to other duties, Mr. J. R. Belton has been appointed road foreman of engines, Cincinnati, Lexington and Big Sandy divisions, effective November 1. He will report to and receive his instructions from the superintendents and master mechanics. The jurisdiction of R. W. Harris, road foreman of engines, has been extended over Kanawha district, Huntington division.

Mr. M. M. Reid, for some time general foreman of the New York Southern shops at Berkley, Va., has been appointed master mechanic of the Savannah, Americus & Montgomery, with headquarters at Americus, Ga. Mr. Reid is an energetic and studious mechanic whose upward progress we have been watching with interest. He went from the Baltimore & Ohio to Virginia, and before that worked in New England. If energy and good management can achieve success on the same road, Mr. Reid will give satisfaction.

Mr. T. B. Purves, Jr., has been appointed master mechanic of the Boston & Albany Railroad at East Albany in place of his father, who becomes his son's assistant, reversing the old arrangement. This was a change made with the consent of the father. The young Mr. Purves has been a particularly successful shop manager, which has commended him to the attention of others looking for good men. This has brought him several offers by other roads and by private firms. The Boston & Albany people appreciate his worth, and the superintendent of motive power proposed the new arrangement that would keep Mr. Purves with the company.

Mr. H. A. Gillis, master mechanic of the New York, Lake Erie & Western, has enjoyed a more varied experience than most of our younger mechanical officers. He was educated as a naval engineer and graduated from Annapolis. Finding that the prospects of success in life were far from brilliant in the navy, he retired to private life and went to work as a mechanical engineer. He was with the New York Safety Car Heating and Lighting Company for a long time, and from there he drifted into railroad life. He was general foreman at Meadville for a time, and there earned his promotion to the position of master mechanic.

Mr. Jacob Johann, for several years agent for the New York Safety Heating and Lighting Company, at Chicago, has accepted the position of superintendent of motive power of the Chicago & Alton, in place of Mr. Quackenbush. Mr. Johann is one of the best known of our master mechanics, and was noted as an excellent mechanic and good executive officer. He was long superintendent of motive power of the Wabash. He has been a leading member of the Railway Master Mechanics' Association, and was president one term. He was the prime mover in the action taken by the association to convert the Boston Fund into scientific scholarships.

One of the most impressive men we met with during a long journey was Mr. P. A. Reynolds, an engineer on the Southern California Railway. He is a big man of striking appearance, strong personality, and a natural leader of men. He is chief of the Brotherhood division, and is generally appointed to represent the order at the annual conventions. Mr. Reynolds was originally from the New York, New Haven & Hartford, and is well acquainted with the many engineers who passed from that road into good railroad positions. He drifted out to the Atlantic & Pacific when that road was new and passed through the severe ordeal that all successful men had to endure on that road. Here none but the fittest survived, and the methods of selection were savagely severe—often succeed or die. In some regions the feed-water used was so heavily charged with solids that gauge-cocks could not be kept open an hour, and the smokestacks were habitually used as gauge-cocks. The engineer who could keep the crown-sheet wet under these circumstances had a turn for the business. While on construction Mr. Reynolds was once overtaken in a cañon by a flood and escaped by climbing up the cliffs. The engine was not reached for two months.

Chiropodists and corn-doctors will, with difficulty, choke down a leer of contented glee when they get a glimpse of the Illinois Central's new cars for the World's Fair traffic—for if those seats don't put corns and bunions on other parts of the riders' anatomy than the feet, we miss our guess. These cars are a cross between a country school-house and a palace stock-car, and, while they might do for sheep they are not fit for human beings, and especially to show to the world as the representative American suburban car. These are freight cars with diamond trucks, air-brakes and vertical hook couplers, the bodies are box car, except that there are openings on each side of the car and wooden seats running across on each side of the door-ways—like an open street car—the victims sit facing each other, the same as in the English compartment car. There are curtains in case it rains, and a sort of a muskrat trap in the shape of an iron bar over each runway that are all handled from one end of the car. The spring planks of the trucks are 15 inches wide and provisions made for three elliptic springs side-and-side, the center one has been kindly left out to provide for easier riding until the cars go into the dead-freight business where they belong. The World's Fair has been located on ground that practically gives the I. C. road the bulk of the enormous business of hauling the people back and forth between the Fair and the city, and they can well afford to buy real, made-a-purpose, suburban cars that would at least be comfortable and let foreigners go home with the conviction that, while we do not have as many classes of travel as they do, we at least make a distinction between man and beast. It was just such seats as these, in a Western Sunday school, that made the junior philosopher often wonder if they had the same kind in that eternal-damnation place, and fixed the belief forever in his mind that it would be about as slow and lingering a penance as fire and hot coal tar.

The Thatcher Car & Construction Co. of this city have recently built for exhibition two of their dumping cars and tested them in the presence of a large number of railroad men. They already have a couple of trains in service on the Canadian Pacific. The cars hold ten cubic yards of earth, and are dumped by an air cylinder under the car, the whole train being dumped and replaced in upright position and locked there by the simple movement of a valve on the locomotive. This device was first designed by Thatcher & Gearhart, at Leadville, Col., and was illustrated in the L. E. for December, 1891. The present device, however, is an improvement on that.

## Traveling Engineers' Call.

At a preliminary meeting held at Chicago, Ill., Saturday, November 12th, the following call was decided upon and is hereby issued:

We, the undersigned road foremen of engines, or traveling engineers, deeming that an association of men in our calling would be beneficial in that an exchange of ideas would tend to uniformity in our work, and to widening our information and usefulness, and, if properly conducted, would make the position of traveling engineer recognized as one of great usefulness to railroads and to enginemen. It would prevent friction by promptly rectifying small abuses; prevent waste by conducting a practical education and the encouragement of economical practices.

We ask all traveling engineers and road foremen of engines to meet for the purpose of organizing an association similar to the Master Mechanics' Association; said meeting to be held at 2 P. M. Monday, January 9, 1893, at room 912, No. 5 Beekman street, New York City, office of LOCOMOTIVE ENGINEERING. If this meets with your approval, will you kindly correspond with John A. Hill, at above address, at your earliest convenience, stating if you will be present, or if not, if you will join the association.

C. B. Conger (chairman), C. & W. M.; W. O. Thompson (secretary), L. S. & M. S.; J. S. Boder, L. S. & M. S., W. A. Pitcher, P. & L. E.; T. J. Hennesy, Mich. C., M. Mast, C. & E.; W. T. Simpson, C. & G. T.; A. H. Polhamus, P. R. R.; John King, P. R. R.; A. S. Work, N. Y. C. & St. L.; N. S. Mora, C. & N. W.; W. A. Murdock, C. & N. W., W. A. Anthony, C. & N. W.

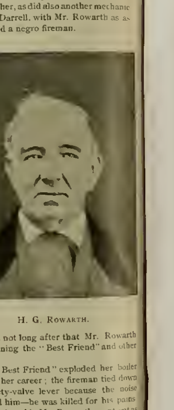
## H. G. Rowarth, Engineer of the First Locomotive Built in America.

The locomotive "Best Friend" was the first one built in the United States for actual work. She was made by E. L. Miller at the West Point Foundry in New York City, and sent to the then biggest road in the country, the South Carolina.

This engine had a vertical boiler at one end and inclined cylinders at the other, the cylinders being over the tank, the whole resting on four coupled wheels.

Mr. Rowarth was born in Charleston, S. C., in 1810, and when twenty years of age was an apprentice in the machine shop of a Mr. Dotterer.

The "Best Friend" came to Charleston in 1830, but there being yellow fever there, Northern mechanics would not go down to set her up. Mr. Dotterer sent machinist Julius Petch to set up the engine, with H. G. Rowarth as helper. When the engine went into service, January 15, 1831, Mr. Petch ran her, as did also another mechanic Nicholas Darrell, with Mr. Rowarth as assistant and a negro fireman.



H. G. ROWARTH.

It was not long after that Mr. Rowarth was running the "Best Friend" and other engines.

The "Best Friend" exploded her boiler early in her career; the fireman tied down her safety-valve lever because the noise annoyed him—he was killed for his pains.

Soon after this Mr. Rowarth went out as engineer of a river steamer and let railroading alone for a few years, but came back to the road in 1838, and was running the engine, "Reading."

He remained in the service as engineer until 1885, nearly fifty years; thirty-one of this was put in on the pusher on Aiken Hill. He is at present living with his son, T. S. Rowarth, at Augusta, Ga.; his health is good but his eyesight and memory are failing.

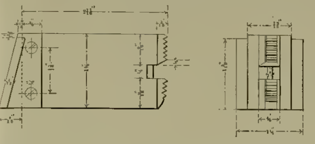
It seems remarkable that the man who ran the very first locomotive built in America should live to see more than fifty thousand locomotives constructed in the land. It shows what hustlers we are in this age, anyway.

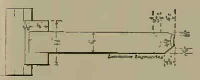
While visiting a Scotch locomotive shop last summer, our conductor said "Come into the erecting shop and I will show you some engines with all your American tricks on them, they are awful trappy." These engines had headlights, bells, extension fronts, cabs and pilots—all extras over the European engine.

Saddle-tank switches are as common in Great Britain as in this country, but in all we saw there the saddle tank extended over the front end, the stack going through it. This plan admits of a shallower tank and a less top-heavy engine.

## Slotted Machine Screw Thread Dies.

The annexed engraving illustrates a form of die used by the Atchison, Topeka & Santa Fé people for their screw thread cutting machines. It is well known that the ordinary form of die used in such machines is greatly given to choking up with the cuttings, and breakage is often caused by this when the work is pushed. In the improved dies shown a slot is made in the middle of the die which lets the cuttings





out. In practice it is found that this can be forced to any extent without fear of breakage. It is a small invention that greatly facilitates the cutting of screw threads, and is well worthy of general application to screw machines.

## Progress of the Vestibule.

The vestibule for passenger cars is becoming one of the recognized features of a first-class train. The indications are that within a very few years all the passenger equipment in the country will have vestibules. The vestibule is a luxurious addition to a train which might have been easily dispensed with had it never been applied. The use of a vestibule appears to make a train harder to pull, and therefore slightly increases the cost of train service. Platform gates might have been put on that would have made the cars as safe for passengers moving from car to car. But the vestibule is much more comfortable, especially in bad weather, and it keeps the cars cleaner than having the doors exposed to the entrance of smoke and cinders. The traveling public having been made familiar with the comforts of the vestibule, there is getting to be a sentiment that a train that does not have vestibules on the cars provides inferior accommodation for first-class passengers. This is creating a demand for vestibules which is urging railroad managers to adopt this improvement where some of them are not ready to incur the great expense involved.

Among the railroad companies that expect soon to apply vestibules to their passenger equipment is the Southern Pacific. This company has about 200 passenger train cars, a large proportion of them being employed on long distance trains. The equipping of all these with vestibules will be a costly operation.

The few vestibuled cars that are in use in Great Britain have been rapidly gaining friends for this style of car among the traveling public, and there is a likelihood that this improvement will exercise great influence in overcoming the prejudice against Yankee innovations, a form of prejudice that has stood in the way of the rapid introduction of open-seated cars to displace compartment cars. In several accidents the vestibuled Pullman cars have exhibited great resisting power to destructive shocks, and John Bull is inclined to take the safe place in traveling. This will, no doubt, accelerate the popularity of the improvement to cars.

There are several vestibuled trains running in Germany, and they are reported to be highly popular. The cars are short and of the four-wheel type which are greatly given to pitching and lurching at high speed. It is found that the vestibules tend to steady the cars, and this, no doubt, continues to make them appreciated.

## Urgent Demand for New Cars.

In spite of the great promise of business that a bountiful harvest in all sections of this continent conveys, the railroad companies held off from placing orders till they were embarrassed for want of cars to carry the freight offered. This is a phrase of railroad management that has grown familiar by repetition. The railroad companies now want cars very badly, and they want immediate delivery. After a few months of semi-stagnation, all car-building establishments are rushed with orders and all are turning out cars as fast as they can be thrown together. This is the time when cars are built which help to keep the car-building business active, and which tends to cripple the finances of the purchasers. It is no use preaching at railroad companies for the sins which have become recognized practices; but the owners of this kind of property follow a very expensive policy in habitually delaying the ordering of rolling stock until they can no longer do business without the forced filling of orders.

## New York Railroad Club Meeting.

The annual meeting of the New York Railroad Club was held in the rooms of the American Society of Mechanical Engineers, New York, on November 17th. President R. C. Blackall was in the chair. A large number of members and visitors were present. Among them were the following railroad men R. C. Blackall, Delaware & Hudson; A. E. Mitchell, H. A. Childs and H. A Gillis, New York, Lake Erie & Western; Wm. Lewis and T. Muir, Delaware, Lackawanna & Western, W. C Ennis, New York, Susquehanna & Western; H. H. Vreeland and Thos. Millen, New York & Northern; Geo. W. West, New York, Ontario & Western; A E. Benson, Ulster & Delaware, E. M Hedley, Brooklyn Elevated; F. Hedley, Kings County Elevated; L. Ames, Beech Creek, S W Huston, Chicago Elevated, —Mendenhall, Pennsylvania; R B. Reading, Manhattan Elevated; C Mayeau, New York, New Haven & Hartford.

The first business was the election of officers, with the following choice President, R C. Blackall; first vice-president, Geo. W West, second vice-president, A E. Mitchell, third vice-president, W. H Lewis; secretary, John A Hill, treasurer, C. A. Smith; executive committee, Thos Millen, W. C. Ennis, H. H Vreeland, W. W Snow, W. G. Wattson; finance committee, Thos. Prosser, E H. Andress, F. M. Patrick.

A paper on "Location of Tools in Railroad Shops" was read by Mr. W S. Rogers. The paper will be found on another page of this issue.

The question of satisfactory car lubrication does not yet appear to be settled to the satisfaction of people who travel on some of our railroads. It is a very bad advertisement for a railroad company to have a train stop for twenty minutes at a station while all the trainmen are exerting themselves to cool a hot box, and all the passengers are out looking on and sneering at the company. On some roads you never hear of a hot box on a passenger train, while others are constantly meeting with delays from this cause. On the train, we were riding on lately, stopping for the second time to cool off a hot box, we jumped down and watched things. The waste in the box had dropped away below the journal. Common kind of cotton waste was used. Woolen waste would have prevented the delays.

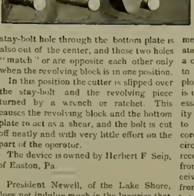
The far Western roads are not taking very readily to the standard Master Car Builders' car-coupler. They say that the vertical hooks make too rigid a connection for passing around the sharp curves, and that it is frequently necessary to put links between the hook couplers. Those who are opposed to this form of coupler think that this objection will ultimately result in the abandoning of the present standard. At the same time we noticed that the long passenger cars on the Denver & Rio Grande, and other excessively crooked roads, went around the worst of the curves without the Miller hooks causing any disturbance.

## A Simple Stay-Bolt Cutter.

The illustration on this page shows the construction of a stay-bolt cutter, the invention of Ellwood Hay, a machinist in the L. V shops at South Easton, Pa.

As will be seen, the body of the cutter has a projection on one side that prevents it from turning by bracing against another bolt, the length of stay left outside the sheet is determined by the thickness of the back plate, which is part of the shear, this plate is removable. The revolving block is prevented from coming out of the body by the top plate, the outer end terminates in a hexagonal head.

Through this revolving piece is drilled a hole large enough to slip over the stay-bolt, this hole being out of the center The



stay-bolt hole through the bottom plate is also out of the center, and these two holes "match" or are opposite each other only when the revolving block is in one position.

In this position the cutter is slipped over the stay-bolt and the revolving piece turned by a wrench or ratchet. This causes the revolving block and the bottom plate to act as a shear, and the bolt is cut off neatly and with very little effort on the part of the operator.

The device is owned by Herbert F Seip, of Easton, Pa.

President Newell, of the Lake Shore, does not indulge much in the luxuries that might be called for by his position, but he is getting a private car built in the Wagner car shops that will hold its own among the finest private cars on wheels. It is finished in mahogany and contains elaborate hand-carving. The fittings and furniture are in the latest style of car furnishings Particular attention has been bestowed upon the framing, which at the ends is a combination of wood and iron that gives an extremely strong structure.

## An English Way of Running Trains on a Single Track. Webb & Thompson Electric Staff System.

This consists of a magazine formed of a cast-iron pillar, 3 feet 6 inches in height, having a slot, *A*, about 1¾ inches wide down the center of the pillar, and capable of holding eighteen staffs. Where it is necessary to have a larger number of staffs, a pillar is used having a double slot capable of holding twice the number of staffs. On the top of the column is fixed what is termed the head of the pillar, which contains the whole of the mechanical and electrical parts of the instrument. On the face of this there are two indicating disks, *B* and *C*, and underneath the right-hand indicating disk, *C*, is fixed a tapper key, *F*. In the center of the face there is an ordinary galvanometer, or current indicator needle, *D*. *E* is the continuation of the slot through which the staffs must be withdrawn or deposited. An ordinary single-stroke bell is fixed between the cabins of a section.

In the interior of each magazine are the electrical and mechanical parts, which are as follows

Turning on a center pin are five metal disks secured together. Each disk has four notches at equal distances apart cut out of its periphery, of such a width as to admit the shank of a staff, and when a staff is being withdrawn from the magazine it carries the whole set of disks round with it as it follows the curved portion of the slot until it reaches the enlargement, through which it is withdrawn. At this moment the disks will have made exactly one-quarter of a revolution, and another set of notches will be exactly over the slot in the column. In replacing the staff the disks will be rotated in the opposite direction.

To lock the disks in position three of them are provided with pawls which fit into the notches, but each staff is fitted with lifting pieces which disengage these pawls, and allow the disk to move whenever a staff is being replaced or withdrawn. So far it will be seen that any number of staffs can be withdrawn one after the other, and the arrangement will now be described by which the magazines are electrically controlled to prevent more than one staff from the two apparatuses being out at a time. One of the disks is locked in position by means of an electric lock, which is conjointly energized by a local current and a current sent from the station to which the staff is to be sent. This lock is an important feature of the apparatus. The bolt being very heavy, a magnet and current of great power would be involved to lift it through the space necessary, and to avoid this the poles of a comparatively small magnet are placed normally in contact with the bolt which forms an armature, and the magnet is lifted mechanically by a tail piece which is actuated by a projection on the staff. Thus a comparatively small current is required to lift the heavy bolt. The magnet employed is interesting As a single wire is used for working the system, it is necessary that magnetism of a certain polarity should be induced in the cores, and to do this a magnet was adopted, the cores of which form a closed magnetic circuit energized by four coils, two coils receiving a current of a fixed polarity from a local battery and two coils receiving the current alternating in polarity from the line wire, the poles being placed between the two sets of coils. The magnetic circuit being closed, no magnetism is induced at the poles by a local current alone, or by the line current alone, or by both if in opposition, but a powerful magnetic attraction is induced if both currents are in unison.

On the right side of the drumhead are placed five electric switches. Two are automatically worked by the turning of the disks, and alternately change the polarity and direction of the current in the line wire, and three are worked by the right-hand dial and tapper key

Assuming now that a single line railway has four stations, A, B, C, D One apparatus is fixed at A two at B, two at C, and one at D As a rule, each apparatus is provided with ten staffs, but double or treble this number can be provided for. The staffs for the section A B are so constructed that they cannot be used for the section B C, and similarly those for B C [illegible] not be used for C D, thus a staff sent from A cannot be used by B for the apparatus between B C

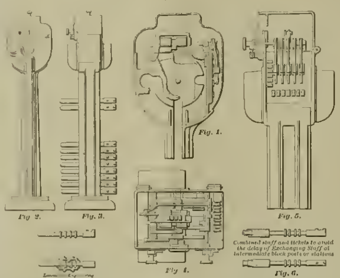
We will now describe the operation of signaling a train from A to B The signalman at A rings to B by depressing the tapper key B acknowledges the signal. A then rings to B the description of the train he is sending in accordance with a prearranged code B acknowledges the [illegible], and A then rings that he wants to [illegible] a staff and at once turns his [illegible] hand dial to "For staff," this operation switching on the current from the local battery to the local coils. On receipt of the last signal B depresses the plunger [illegible] which sends a current through the galvanometer of both apparatuses, the needles of which are deflected to the [illegible] the electric lock of A's apparatus A, seeing his galvanometer needle deflected, lifts a staff from the slot in the column and through the curved slot in the column head, withdrawing the staff at the enlarged portion of the slot

Having withdrawn the staff, A turns [illegible] left-hand indicator, which registers the fact that a train has been despatched from A to B the turning of this indicator [illegible] the line wire circuit, and the galvanometer needle of B's apparatus falls to zero informing him that a staff has been withdrawn and the direction of the train registered

It must now be explained how the withdrawal of a staff makes it impossible for a second staff to be taken from the apparatus at A or B When B sent a current to A each apparatus, so to speak, was in unison, or in other words the current flowed through the line coils of A's electro-magnet in a direction non-opposed to the current in the local coils and a strong magnetism was induced at the poles, and similarly a current sent from A would energize the magnet at B When A withdrew the staff, the disks were turned a quarter of a circle, and the automatic switches reversed, if B now sent a current, which, of course, would be of the same polarity as before, it would be changed in direction through the coils, and would consequently be opposed to the current in the local coils, and if A sent a current to B, it would also be opposed to the current in the local coils of B' apparatus, as the reversal of the automatic switches in A's apparatus not only reversed the direction of the current from B, but changes the polarity of a current sent from A If the staff withdrawn from A's apparatus is replaced, the disks would be turned back and the working restored as before, but if the staff is taken to B, and placed in the apparatus, the disks of B's apparatus would be turned back and the automatic switches reversed, which would have the effect of reversing the polarity of the current sent from B and altering the direction of the current in the line coils sent from A Thus both apparatuses would be again in unison, and a staff could be signaled for and obtained at either end of the section

To work single lines on the time system, or where it is desired to have intermediate block posts which are not staff stations, tickets can be used in connection with the electric staff apparatus on the principle of the old staff and ticket system, but retaining all the advantages of the electric staff system. In this case a ticket-box is secured to the side of the apparatus and a ticket staff provided, which is retained in an independent slot in the column When it is desired to send say three trains from A to B, the signalman at A obtains permission from B in the usual way, and instead of taking an ordinary staff he withdraws the ticket staff He is then able with this staff to unlock the ticket box and withdraw a ticket, the withdrawal of the ticket prevents the ticket staff from being replaced in the column, and thus no other staff can be obtained either at A or B. The first train is then sent away with a ticket, and at a stated interval of time, in case the line is worked on the time system, or when the train has been signaled as having passed the intermediate block post, the second train is dispatched with a second ticket, the third train is then dispatched with the ticket staff. When the two tickets and staff have arrived at Station B, the signalman at B places the tickets in his box, and only when this is done can he place the ticket staff in his instrument and restore the working Complete arrangements are also made in connection with this system for switching out intermediate staff stations, for picking up and depositing the staffs at intermediate posts when the train is running at speed, and for the locking of siding points by means of keys combined with the staffs

*Fig. 2.*




The Crescent Steel Company, 480 Pearl Street, New York, report a growing demand for their steel in railroad shops. The fine crucible steel made by this company is admirably adapted for the construction of tools of all kinds. In railroad shops it is largely used for taps, dies, milling cutters and all kinds of cutting tools.

A large order for hydraulic projectile drawing presses has been awarded to Messrs. Watson & Stillman, of New York, by the United States Projectile Company, of Brooklyn. Orders for hydraulic presses, pumps and accumulators have been so abundant during the past year that it has been found necessary to operate their plant both day and night, notwithstanding increased facilities in the several departments. This firm is getting out a hydraulic weighing machine which will be a highly valuable apparatus for railroad companies. It will weigh cars accurately when they are run over the machine at ordinary freight train speed, an electric register being employed to record the weight. The machine can also be made to weigh different pairs of wheels separately

The Buffalo, Rochester & Pittsburgh have just received from the Brooks Locomotive Works six freight and two passenger engines. The freights are consolidations, weighing about 106,000 pounds, with cylinders $17\frac{1}{2} \times 26$ inches, and carrying 160 pounds of steam on the boilers. They are an improvement in minor details of an engine that has given remarkably good service on the road. The passenger engines have cylinders $18 \times 24$ inches, wheel centers 66 inches. They have the most modern attachments, including Boies steel-tired wheels for tender and truck.

The Swain Lubricator Company, of Chicago, have sent us an illustrated pamphlet showing the "Permanent" metallic rod packing which they are now making. The packing looks to be very simple, and it is said to have shown a record of sixteen months' service in valve-stem glands without indications of wear. Beveled rings of a soft metal are used which obviate the necessity for springs. This packing can be used in an ordinary gland stuffing-box

During one week last month the Baldwin Locomotive Works received orders for 130 engines. There were forty compounds among them. There were thirty-five of the engines for the Brazilian state railways.

## Santa Fe Passenger Locomotive.

The accompanying engraving shows an eight-wheel engine built in the Atchison, Topeka & Santa Fé at Topeka, Kan., which is doing remarkably good work, and is, withal, an excellent specimen of a well-designed locomotive. The engine has


PASSENGER ENGINE BUILT IN TOPEKA SHOPS

cylinders 17 x 24 inches, driving wheels, ...ters, 56 inches, and a boiler 56 inches diameter at the smallest ring. The boiler carries steam of 160 pounds pressure With a train of seven cars this engine makes fifty miles to the ton of coal, and does the work with remarkable ease The working parts are very strong and the bearings large, and the engine promises to be remarkably economical on repairs.

## Fast Express Engine, London, Brighton & South Coast Road.

Of all the English locomotive designers of recent years, perhaps the late Mr. Wm. Stroudey was most original and the quickest to try a new idea

As long ago as 1882 he decided to make something new to handle the heavy express trains between London Bridge and Brighton, a distance of 50½ miles. This line is crooked for an English road, and has several stiff grades.

The express trains often contained twenty-five carriages—very heavy trains—and the public demanded a schedule of one hour.

The big engine, with 7-foot "single," shown on page 439, could not perform this work every day with certainty, and Mr. Stroudley built the first of his coupled engines, like the "Jonas Levy," and named it "Gladstone."

By using inside cylinders he was enabled to place his driving-wheels in front, and the small trailing-wheel admitted of a fire-box as big as he wanted,—an important feature.

These engines have cylinders 18¼ x 26 inches, have 6-foot 6-inch drivers, 1,485 square feet of heating surface, and weigh, ready for the road, 85,000 pounds.

This road uses air-brakes, and these engines have an ingenious reversing device operated by air

To avoid cutting the leading flanges, a pipe is brought from the exhaust passages to the flange of the wheel, and a small jet of wet and greasy steam is thrown against the flange, this lubricates well and cut flanges are avoided

The engines are painted a light orange and striped with a broad black band, and the bright work is extra-well finished.

They get the big trains over the road on time, making over a mile a minute every day.


A FAST ENGLISH EXPRESS ENGINE.

## High Speed Trains.

At the New England Club meeting last month, Mr C. A. McAlpine, superintendent of the Old Colony Railroad, read a paper, "Higher Speed of Railroad Trains; System and Appliances Necessary to Accomplish It." He discussed the higher grades of train speed that are practicable, which is what the public are ready to pay for. When the public are ready to pay for a three hours' ride between New York and Boston, it is likely to be provided even though the train speed required should be very great. Locomotives might be built to run 80 or 90 miles an hour, but the public are not yet ready to pay for the outlay involved to make that speed safe If trains were called for to be run so that an average speed of 70 or 80 miles was made between terminals, special tracks of a very substantial character would be necessary, provided with perfect means of preventing collisions.

One of the most important things to be considered when we start a train is our ability to stop it. Mr. Westinghouse tells us that with a perfect brake acting upon all the wheels of an express train running at a speed of 90 miles an hour, at the end of ten seconds after the application of the brake the train would still be moving at 60 miles an hour, and would have traveled 1,130 feet, and it would be brought to a stand in about 1,200 feet more, or 2,330 feet in all; while under the best actual conditions now existing, at the end of sixteen seconds the train would be moving at 60 miles an hour and would have traveled about 1,800 feet. With this fact staring us in the face it seems a waste of time to talk of running at such speed on our present tracks and in connection with the ordinary passenger and freight traffic. It is possible to put our present roads in condition to meet the requirements, but there is no reasonable probability that it would result in a sufficiently increased revenue to warrant the outlay.

The difficulty of maintaining an average speed of fifty or sixty miles an hour was discussed. Seventy-miles-an-hour speed is often reached by trains that do not average forty-five miles an hour. This would indicate that by making a more uniform speed a greater average could be obtained without faster running For trains making a running time of fifty or sixty miles an hour, he considered better means of stopping promptly should be provided. He favored having all switches interlocked and a satisfactory system of signals for protecting trains. A source of danger apprehended to fast express trains was the freight trains running on the adjoining track. The breaking down and wrecking of freight trains from the use of defective material or car apparatus was considered a danger to be dealt with.

In counting the cost of high speed it was estimated that the train resistance to a train running sixty miles an hour was twice as much as it was when the train was running half the speed. Every well informed railroad man knows this to be a mistake, but the cost of high speed is no doubt made greater than that of low speed.

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A notice appeared lately in the press dispatches of a heroic action performed by Engineer James Butler on the Lake Shore & Michigan Southern. On reading this account of how this man readily risked his life to save his train, Mr. Eberhardt, of the firm of Gould & Eberhardt, Newark, N. J., sent us ten dollars as a present to the heroic engineer.

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We have received from the Congdon Brake Shoe Co., of Chicago, a handsomely prepared catalogue giving particulars of the various forms and qualities of castings made by the company. They comprise all varieties of iron and steel. The high reputation of the makers, which has been growing for years, guarantees a first-class article. The Congdon Works are making first-class steel castings for all kinds of rolling stock and track work. This is a line of industry that has been greatly needed in the West, and railroad men would do well to give the enterprise all the encouragement in their power. The brake shoes made by the company are of national reputation. They make the Ross, Meehan, corundum and steel shoes for locomotives. For cars they make the Ross, Meehan, Congdon and plain cast iron shoes.

## Work at Baldwin's.

Baldwin's people have lately built for the Chicago North Side Railway some motors with air-condensing engines, the condenser being coils of pipe exposed on the roof of the car. The motors are closed in and look like a small street car. Among engines which we noticed in the erecting shop of the Baldwin Works during a recent visit, were two compounds for the Sandusky & Columbus, and eight simple engines for the same road. A number of the compounds for the Chicago South Side Elevated were nearly ready for delivery. There were a variety of engines for different countries in South America, and some curious specimens for working round steel works. The boilers for some of the engines belonging to the large Pennsylvania order were in the boiler shop nearly ready for moving to the erecting shops the World's Fair. There was a warm contest for the seats of these cars. The Hale & Kilburn Co. got the entire order.

The Duluth & Iron Range Railroad has just sent out specifications for a number of ore cars to be built to the recently established ore car standard of the road. The order, when placed, will be for from 450 to 500 cars; these cars will be 22 feet long and 8 feet wide, they will be fitted with the Safford draw-bar, the Butler draw-bar attachment, and the Schoen pressed steel center plate, the National hollow brake beams, Hewitt box lids, Westinghouse automatic quick action brakes. Brakes will be applied to both trucks and will be hung inside.—*Railway Age.*

The following railroad companies are reported to be in the market for cars The Long Island, for passenger cars, Central Railroad of New Jersey, for passenger cars; the Great Northern, for passenger cars, New Jersey & New York, for six passenger cars; the Wilkes-Barre & Hudson River, for general equipment.

The Bridgeport Machine and Tool Company have made additions to their shops lately. There is an extension of the machine shop 96 x 80 feet. There is a Yale & Towne's 10-ton traveling crane in one side of this building and the other side is two story with light tools in the upper floor. The tool room, 20 x 40 feet, has been placed at the end of the new building, which puts it near the middle of the works. These works have lately gone into the manufacture of Fox lathes and are meeting with good demand for this useful tool. Mr. C. L. Libby is superintendent

The Lukens Iron & Steel Company report a steady and satisfactory business. Among recent roads added to the list are the C., M. & St. P., Fitchburg, Grand Rapids & Indiana, Chicago & W. Michigan and Buffalo, Rochester & Pittsburgh railroads.

The Cambria Iron Company report that their business among railroads is rapidly increasing Recently they have received orders from the Beech Creek, the Southern Pacific, Delaware & Hudson, Nickel Plate, and Nashville, Chattanooga & St. Louis. The steel toughened by the Coffin process is becoming popular.

We are very much gratified to learn that the *Railway Age* is about to publish a new edition of their Biographical Directory of railroad men. The last directory was got out in 1887, and it is getting very far behind the age. We have used the book till it is in totters, and every time we open it to search for original information of a personal character, we breathe a long-ing for a new edition. We strongly advise all who are asked to contribute biographical notices to send them in without delay and make the particulars full enough. When we are writing an obituary of a man or a notice of his rise in the world, we like to have reliable information, and on that account we are interested in the new Biographical Directory.

SEVEN-FOOT WHEEL "SINGLE," LONDON, BRIGHTON AND SOUTH COAST. (SEE PAGE 437.)

Two engines were on the floor for Sweden. The railways of that country get locomotives regularly from these shops.

They have lately delivered two compounds to the Chicago & Northwestern, and others for the Missouri, Kansas & Texas. The latter was the second order, the compounds in use working so satisfactorily that others were ordered. They are building one two-cylinder compound for the Chicago South Side Elevated Railroad

Among the orders for cars placed during the last month are: Erie, 1,000 freight cars; Delaware, Lackawanna & Western, 500 freight cars; Baltimore & Ohio, 2,000 box cars and 500 gondolas, Green Bay, Winona & St. Paul, 1,000 box cars; Huntington & Broad Top, 250 coal cars. The The New York Central has let 130 passenger cars in preparation for the business of

The Chicago & Western Indiana have ordered 4 locomotives from Cooke's The Chicago, Rock Island & Pacific have ordered from Baldwin's 6 ten-wheel engines and 6 Forney suburban engines, with three pairs of drivers connected and three pairs of tender wheels. The Baltimore & Ohio have ordered 50 engines from Baldwin's.

The general offices of the Congdon Brake Shoe Co. have been removed from the Monadnock Block, Chicago, to the works at 59 Wallace Street, where all communications should be addressed.

The compound built by the Pittsburgh Locomotive Works, which we illustrated last month, is giving high satisfaction in service. She went to work pulling trains without a single change. The engine has been running on the Pittsburgh & Lake Erie, the Columbus, Hocking Valley & Toledo, and the Cincinnati, Hamilton & Dayton. All the men in connection with these roads admit that the compound has badly beaten the simple engines in fuel economy.

The Pennsylvania Railroad compound, built at Altoona, has been pulling trains for about two months, and has given entire satisfaction in every respect The engine steams so freely and uses so little fuel that the intention is to use oil as fuel, and they are now putting on the necessary apparatus.

A sanding device for railway cars has been patented by W B. Leitch, Allerton. Ia. It is worked in connection with the air-brakes and is intended to prevent the sliding of wheels when the brakes are applied.

At the car shops of the Delaware, Lackawanna & Western, at Dover, N J., a new style of car has been built for the transportation of horses and cattle. Accommodations have been provided for twelve horses, and the car is so constructed that it can be hauled on first-class trains.

## B. & O.'S NEW THROUGH LINE.

### Preparing for the Immense Traffic Incident to the World's Fair.

The management of the Baltimore and Ohio Railroad is preparing for an immense business in 1893 while the World's Fair is open in Chicago. The terminals at Chicago are capable of accommodating a much heavier traffic than is now being done, and important changes are being arranged for the handling of very heavy freight and passenger business to the West from New York, Philadelphia and Baltimore. New equipment for largely increased passenger business and an extensive stock of freight cars have been ordered. The various roads of the system will be improved by straightened lines, reduced grades, extra side-tracks and interlocking switches. The new line between Chicago Junction and Akron has shortened the distance between Chicago and tide water twenty five miles, and between Pittsburgh and Chicago fifty-eight miles.

The distance between Chicago and Pittsburgh and Chicago and Cleveland by the construction of the Akron line and the acquisition of the Pittsburgh and Western line and the Valley Railroad of Ohio, is about the same as via the Lake Shore from Cleveland to Chicago, and by the Pennsylvania from Pittsburgh to Chicago. The alignment is to be changed and grades reduced to a maximum of twenty-six feet. It is expected that within twelve months the old Baltimore and Ohio through line between Chicago and the Atlantic Ocean will have passed away and the new line via Pittsburgh be established, with no greater grades or curvature than on any of the trunk lines.

Work has already begun east of Pittsburgh to meet improvements making west of Pittsburgh. These improvements will consist of additional second and third tracks, a general correction of the alignment and completion of the double track on the Metropolitan branch. It is expected that the new through line will be ready simultaneously with the completion of the Belt line through the city of Baltimore, which is intended to unite the Washington branch with the Philadelphia division and do away with the present line via Locust Point. Forty new and powerful locomotive engines were added to the equipment during the last two months, and others are in process of construction. The permanent improvements now under way and in contemplation involve the expenditure of some five millions of dollars.—*Baltimore American.*


### Dear Cheapness.

*Editors:*

I have read with a great deal of interest your article in the LOCOMOTIVE ENGINEERING, subject, "Dear Cheapness," and I think if ever there was a truthful article presented to the railroad fraternity it was that headed as above.

If such matters were brought to the notice of railway managers oftener, in the fearless manner as quoted in your article, it would, in my opinion, have a tendency in bringing those who consider only the first cost to a sense of duty in regard to safety, and make it much more pleasant for those that are trying to get that which in their judgment is the best material to save life and property.

I am pleased to say for the management of the Chesapeake & Ohio Railroad that their policy has always been, first, to purchase that which will insure them safety to life and rolling stock, the price of same being a secondary consideration, especially so on all material where human life is involved.

W. GARSTANG,
S. M. P., Chesapeake & Ohio Railway.
*Richmond, Va.*

### A Lame Exhaust Puzzle.

*Editors:*

The different puzzles about air pumps, and other mechanical questions presented to the readers of LOCOMOTIVE ENGINEERING appear to excite much attention and set the men a-thinking. So I shall submit notes about a defect which caused me great difficulty:

A locomotive on a passenger train came in and the engineer reported that she had lost an exhaust. I naturally expected that an eccentric or blade had slipped, and examined the engine carefully, but the motion was all right. To make sure, I put the engine on different centers and trammed the valves in full gear, and found them set correctly. Thinking that the trouble must be in the nozzles, I opened the smoke-box and found that they were all right. Then I was puzzled. What do your readers think was wrong?

TRAVELING ENGINEER.
*San Francisco, Cal.*

### Guaranteeing Steel for Fire-boxes.

*Editors:*

It has been suggested for years that fire-box steel be guaranteed to run a certain number of miles, the same as cast car wheels, varnish etc. And there is no good reason why this should not be done. Some steel-makers refuse absolutely to make a guarantee, on the ground that having once delivered the steel their responsibility ends. There is as much ground for this claim as there is for the car-wheel maker to urge a similar one. It is claimed also that the steel-maker cannot guarantee the workmanship or use of the steel by the railroad company, which is quite true, but as in case of failure of a sheet in use it is easy to determine whether the failure was due to the quality of the steel or wrong use by the railroad company, this objection disappears. I am aware that this assertion is disputed, but the writer has made such guarantees to the full satisfaction of the steel manufacturer and the user.

When a manufacturer fears from past experience the good performance of his steel, he does well, probably, to fight making a guarantee; but as it is both rational and right that steel should be guaranteed, it follows that the manufacturers who do first make a guarantee will first take the lead in supplying railroads.

The car-wheel maker is no more apt to suffer from bad use of his wheel than the steel-maker of his firebox steel, and the wheel is just as apt to be injured by the lathe hand fitting the axle as the side sheet by the boiler-maker, or by maltreatment when in service; but as these features leave their tracks, it is not difficult to ascertain *why* a wheel fails, nor is it any more difficult to determine the cause of failure of a side sheet.

*Cincinnati, O.* FRANK CORBETT.

### Defense of Richmond & Danville Drawings.

*Editors:*

I read a piece in your paper this month. It was signed, An Old Man. He said that while in the pattern shop at Manchester, Va., he saw a print of a cab bracket, and that it had dotted lines running everywhere and that it showed more labor than brains.

To show you that the gentleman did not know what he was talking about, I herewith inclose blue print of the bracket, which you will see is a very simple and inexpensive drawing. It would make an awkward section, as you can readily see. I wonder what the gentleman would say if he saw the drawing I made of a 20 x 24-inch cylinder in which I showed six views, as follows: Plan, inverted plan, transverse section, longitudinal section through center of cylinder, section where fastened to frame, and face view at center of bedplate. I think the dotted line in that drawing would rather confuse the old gentleman.

I desire to say here, that by maneuvering I saved two good weeks' work on the elevation of the new 20 x 24-inch ten-wheel passenger engines which the Richmond & Danville Railroad are having built at the Baldwin Locomotive Works. I am the only draughtsman in the superintendent motive power department now, since returning to Washington from Atlanta, Ga., so you can see that I have no time to loaf.

I have to make anything that comes to hand. Besides drawing, I have to get the tracings out of the case for blue printing, and afterward to put them back again. The 20 x 24-inch ten-wheel passenger engine and tender together have about *160* drawings, and are formed into two books 24 x 36 inches. I had been with the Richmond & Danville Railroad three years and seven months, when I took hold of the drawing department. It was in a very poor condition and no system. Now we have system and drawings which we are not ashamed of.

At the age of eighteen I entered the shops of the Baltimore & Ohio Railroad at Mount Clare, Baltimore, Md.; that was January 3, 1873, as an apprentice in the machine shop. Nearly one year after finishing my trade I took up drawing at the Maryland Institute night school, and graduated June 4, 1877, with the highest honor in the mechanical grade. One year later I was transferred to the drawing-room and, after being there over four years, I accepted a position with the Richmond Locomotive Works, and after being there over two years I received a call to the Richmond & Danville Railroad, where I now am. While in Richmond I taught mechanical design at the Virginia Mechanical Institute night school.

H. K. GRIFFITH.
*Richmond, Va.*

[We have examined the drawings of the bracket referred to and see nothing the matter with it.—EDS.]

### Using Emergency After Service Application — Some Exoerience — Some Everyday Trouble to Think About.

*Editors:*

The November number of your paper contains an article by W. F. Relyea, on the New York Central air-brake instruction car. He says, among the many things that this car proves to, or convinces the unbeliever of, are the following. First, "If you have made a light application and placed the handle of brake-valve on lap, then throw it around to the emergency notch, you don't get the benefit of the emergency-brake, or, in other words, the emergency-valve don't open because there is not enough pressure in train-pipe to open it." I beg leave to differ with the gentleman on that point.

I have fitted up an instruction-room in roundhouse, with pump, main reservoir, brake-valve, auxiliary reservoirs, brake-cylinders, signal-whistle, all complete, and representing a seven-car train, and at the same time showing every style of equipment on our engines, and freight cars; duplex gauges are connected to each brake-cylinder and auxiliary reservoir, giving us every facility for making tests that the Westinghouse instruction car has. I have just concluded a series of twenty tests, which the following table will show the result of, there was a slight variation in the pressures, owing to the inability to draw exactly the same amount of pressure from the train-pipe every time, but they show the general average. All tests were made with a pressure of 50 pounds in auxiliary reservoirs, and a piston travel of seven inches. Under these conditions a full application of brakes (in service notch) required a train-pipe reduction of 17 pounds, and reservoir and brake-cylinder pressure equalized at 35 pounds. A full emergency application gave 42 pounds in brake-cylinder.

The first column shows the reduction of train-pipe pressure, the second the auxiliary reservoir pressure, the third the brake-cylinder pressure (in service), the fourth the brake-cylinder pressure after using the emergency, after the light reduction.

| Train pipe reduction service. | Auxiliary reservoir service. | Brake cylinder service. | Brake cylinder after emergency. |
|---|---|---|---|
| 5 | 45 | 0 | 39 |
| 7 | 43 | 5 | 38 |
| 8 | 42 | 9 | 37 |
| 10 | 40 | 15 | 36 |
| 12 | 39 | 20 | 35 |

Thus it will be seen that there is a gain up to and including a ten-pound reduction of train-pipe pressure before the emergency is used. If the New York Central car does not give like results, it is because there is something wrong with the equipment, or the men in charge are following the instructions that a young man gave in the Westinghouse car on its last visit here. He says, throw the handle to the extreme left and let it stay there until the train comes to a full stop. That kind of an application only gives thirty-seven pounds in brake cylinder, a loss of five pounds over a proper emergency application, and necessarily a tardy release by having to replace the air in train-pipe uselessly wasted.

I have three problems in air-brake practice to submit to your readers. While they may not be new to all, yet if a discussion of them results in helping one air-brake man out of trouble I will feel that my experience has accomplished some good.

1st. When the pump is started all the air flows out the exhaust-pipe fitting of brake-valve. On lap and in the emergency notch air can be held in main reservoir, but in full release or running position it *all* flows out as fast as pumped. What is the matter?

2d. At the slightest touch of handle in service notch the brakes all go on emergency. Where is the trouble?

3d. A pump running a steady and regular stroke suddenly makes several quick strokes, sometimes up and sometimes down. To all appearance a suction-valve has stuck up, allowing the pump to discharge back through suction instead of in main reservoir. The most careful examination failed to find any air blowing back. Three or four quick strokes and the pump resumed its regular stroke again. This occurred at intervals of four or five minutes while the pump was in use. There was not the slightest difficulty in keeping up seventy pounds of air with five coaches down a grade of 120 feet to the mile. Where does the trouble lie?

H. W. KELLOGG.
A. B. Inspector G. P. Div. of R. & D. R. R.
*Birmingham, Ala.*

### Brake Trouble in an Awful Cold Country.

*Editors:*

In this country during the winter the coupling next to main drum freezes and air-pump stops working; in order to start pump again have to apply lighted waste to thaw this out; in many cases this has to be done several times while running over division; would say there is a governor attached to air-pump; before governor was attached this trouble of freezing up did not often occur—in fact, it was very rare to find pump stop on account of above trouble. This summer the whistle signal has been attached. The weather during our winter months has been very severe, averaging from 25 to 55 below zero, with heavy winds, so that it's not a very pleasant job to be getting down at every other stop or so to thaw out this coupling, and again, I have seen cases where pumps would be working all O. K. while at station, and after pulling out have known pump to stop before getting over main line switch, thereby causing extra stop. Can you throw any light on this subject?

F. S. THORNE.
*Brandon, Manitoba.*

[The trouble mentioned by our correspondent is a serious one on mountain grades in such extremely cold countries as the Northwest Territory of Canada. The pump governor may aid the elements in freezing up the pipe by temporarily shutting off the flow of air and giving the moisture time to congeal. The best cure is provision against moisture in the air as much as possible and in locating the air drum on the engine in such a way as to make the pipes the most direct and where they are liable to keep warm. Drip pockets help in collecting the moisture before it gets to a point liable to freeze, it is almost impossible to keep air pipes from freezing up in such a cold country when the drum is located at the rear of the tender.]

### The Mechanical Department.

*Editors:*

It has often occurred to the writer that the frequent changes in the heads of mechanical departments must be largely due to other causes than simply change of management, and he has quietly tried to find the cause. The old idea was that a man, in order to be a master mechanic, must be all the name applies, *i. e.*, a man who can do everything, and, therefore, supposedly competent to supervise others.

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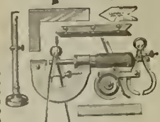

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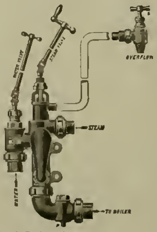


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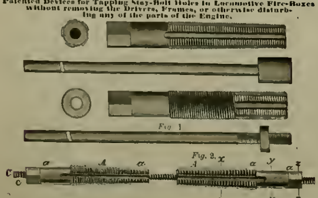


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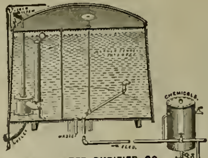


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☞ WRITE FOR OUR CATALOGUE. ☜

That idea has now gone out of date, and the man with the executive ability to properly organize his department and systematize his labor is the man for the position, although he may not have had the diversity of experience in actual work that the old-time master mechanic has had. The *Safety Valve* puts it thus: "The man with the pencil and drawing-board is driving out the man who carries a foot rule in his pocket. The man with the trained mind is usurping the place of him with the trained hand, and the artisan of the future, if looking for promotion, must needs be a student." It does not follow, however, that because a man has a trained hand that he cannot also have a trained mind, for he will be far more efficient if he have both; but if we must choose between them both, give us the well-trained mind, for it must be evident to all thinking men that the man with a business education, including, of course, mechanical draughting and an experience in shop-work sufficient to give him an intelligent understanding of practical methods, is far superior to the man who is simply educated in shop practices alone. In the one case, theory is reduced to practice on a basis of scientific principles, whereas the other has no theory and whose practices are fast becoming obsolete in the light of mechanical improvement.

We do not want to be understood as intimating that a master mechanic must be a graduate of a college, but he must be trained on broad-gauge principles, either in practical mechanical schools or in technical colleges; and the day is coming, and we believe it is not far distant, when every position in our railroad mechanical departments, from fireman to superintendent of motive power, will be filled with men especially educated for their positions. The position at the head of any railroad mechanical department is one of honor, trust and grave responsibility, and it takes a very little difference in material application for a man to save or lose ten times his salary.

There is hardly a shop in the country where the shop methods could not be materially improved, and yet, if you tell the master mechanic so, he pities you because you know so little about his ability to beat anybody in the world for economy. A short time ago the writer was visiting a master mechanic who was bitterly denouncing the general manager who had just sent him a most positive order to reduce his force and cut down expense. He said, "See the work I have to do, and only this handful of men to do it. It is shameful, and I cannot keep my engines up with so little force." The writer went through the shop with him, and was pointed out in detail the work being done, and it is not in the least exaggerating to say that at least one-third of his labor was employed in making specialties that could have been purchased from the manufacturers cheaper, and saved him his labor for far more important work. Our master mechanics are trying to do too much. The great expense of the shop is not only costly material, but costly labor to work it, and it can be summed up very easily if they will only use a little business common sense. Make your shops what they should be—repair shops, and not try to convert them into manufacturing establishments. It is all very easy to show how cheaply you can do your own work, but if ever the general manager goes carefully over the auditor's report, he will soon discover your mistakes, and call on some one else to conduct your department.

Don't cheat yourself by underestimating your cost. Keep up with the procession. Read the railroad papers. Think how it would be if you had to pay the bills yourself. Educate yourself up to your requirements, and become a practical business man as well as a practical mechanic. Our railroad papers have some of the brightest mechanical minds in the country upon their staff, and if you have been deprived of scholastic advantages, take advantage of their learning and practical experience. Read the papers. Don't say you haven't the time. Take time, for it will save your company more than your time will cost them, and make you a more competent man in every respect, for the man who reads and thinks and acts is the coming man. GEO. L. DE WITT.

*Milwaukee, Wis.*

## Young Small's Locomotive.

*Editors:*

In looking over LOCOMOTIVE ENGINEERING I saw a cut of a small engine called the "Little Maryland," and noted her sizes. I have one as a competer, and one that has a record which I will give you in detail. She ran by engagement at Elitch's garden, Denver, Col., four months of last summer every day except one day and a half, which was caused by a washout. The distance made was 1,320 miles. She hauled from five to seven cars. Each car was weighted down 50 pounds to keep from jumping the track while going around the short curves. The track was in a circle of 400 feet. This little wonder was reviewed by from 1,000 to 10,000 people a day during her engagement. The principal dimensions are as follows:

Gauge of track $8\frac{3}{4}$ inches, cylinders $1\frac{1}{4}$ x 2 inches, diameter of drivers 6 inches, total wheel base 28 inches, top of rail to top of stack 20 inches, total length of engine and tender 67 inches; diameter of boiler $7\frac{1}{2}$ inches, fire-box $5\frac{1}{2}$ x $6\frac{1}{2}$ inches; five tubes: three $1\frac{1}{2}$ inches, two 1 inch. Tender holds 4 gallons of water, and boiler 3 gallons. Total weight of engine and tender ready for the road 260 pounds.

I built this little wonder in Jamestown, New York, commenced it 1888 and completed it 1889. I worked on it by odd spells. I made my own patterns, built my own boiler, made of the best steel. Boiler carries 125 pounds steam, tested, when built, at 300 pounds per square inch. My workshop was in our kitchen, my bench a stove box. I borrowed tools to work with. I never served at any trade in a shop. I am now firing on the Union Pacific Railroad. I presented their road with this little wonder at the gardens last summer.

I claim that I have the smallest successful coal burning engine in the United States. This engine hauled five cars with five grown persons. Each car weighing without its passengers 125 pounds, each person averaged 125 pounds, which makes 2,250 pounds the little wonder hauled around this circle of 400 feet.

C. T. SMALL.

*Denver, Col.*

YOUNG SMALL'S LOCOMOTIVE.

## A Reminder from the Drawing-Room.

*Editors:*

I have always noticed that the mechanical papers are forever showing up new designs of locomotives and giving the superintendent of M. P. credit for them. Now I should like to know if the mechanical draughtsmen are not entitled to some credit? As a rule they make all the drawings, and many a useful suggestion here and there, pile on figures and lines and all to scale, and all must be right.

I never hear of them in the way of credit, and it's mighty seldom one gets appointed to the position of master mechanic.

Couldn't you put your pen under and give us a lift out of the mire of obscurity?

ONE OF 'EM.

*Washington, D. C.*

## About Lining Up Guides—Wear on Same.

*Editors:*

On page 283 of your August (1892) issue Mr. C. F. Smith, of St. Paul, "picks me up" on two statements made in my article contributed to your February (1892) issue. The first of these is his exception to there being any rock to a crosshead when first laid on the bottom guides after they have been lined and leveled as closely as possible before the line is removed from the cylinder. Mr. Smith says that after setting guides for fifteen years he has never found this rock. I am very glad for his sake that such is the case, for I have known quite a number of persons (ye humble writer being no exception) who *have* found the rock, and who have spent a few anxious moments endeavoring to unfind (?) it. The other statement to which he takes exception is: More wear being from top guides and top crossheads when an engine is running forward. And after more closely observing this point I believe him to be right when he says "The greater wear is on the bottom guides," under these circumstances, and I take pleasure in thus publicly acknowledging my belief that upon this point he is right and I was wrong, and I wish to thank Mr. Smith for pointing out my error. His is the sort of criticism I like to see.

It is the *truth* and the correct ways we are after more than fame or glory.

L. C. HITCHCOCK.

*Minneapolis, Minn.*

## What Made These Brakes Apply?

*Editors:*

We had a little trouble with our air-brake, and I have no doubt many of the readers of your paper have had the same experience, but for the benefit of those who have not, I will give the symptoms and let them determine what it was, and send the answer for publication next month.

It was nothing serious but very annoying, as the brakes commenced to go on as soon as the brake-valve was placed "on lap." At first I thought there was a leak in the train-pipe, so I got down and looked, but found it O. K. I then placed the valve "on lap," and found that air escaped through the equalizing valve—not enough to make much noise, but enough to apply the brakes. Thinking that there must be a leak in the brake-valve reservoir, I examined it and the pipe and joints between it and the brake-valve, but found no leak. Not having time for further investigation, I postponed the matter a while and afterward found the difficulty, which was soon remedied. What was it?

M. E. WATTS.

*West Nanticoke, Pa.*

## Good Work with Brakes.

*Editors:*

In replying to our Wisconsin friend, would say that I did not wish to be understood as saying that the engineers in question habitually used 12 lbs. of air to stop with, but my idea was to give the maximum, showing what is used in emergency stops, and as a rule such applications are made when there is something on the track or where a very quick stop is required, and I thought this was understood in friend Synnestvedt's statement in the August issue.

I will, however, say that an occasional station stop is made with 3 lbs., and rises accordingly, until, as I have said, it gets to about 12 lbs. for an emergency, and as for telling these engineers they are using too much air to stop with, I believe they

would give lessons on that subject, and that such information to them would be superfluous. For instance, their run is 103 miles and there are four trains handled by three men, and the wheels under coaches are inspected after each trip, and the general foreman of car inspectors has informed me there has not been found a single slid-flat wheel caused by these engineers handling air-brakes for over twelve months and there has been no complaint about their trains jerking. As to pressure equalizing at 12 lbs. reduction, I have found some coaches with 10-inch brake cylinder and 12 x 33-inch reservoir that would equalize with 9 lbs. reduction and others that took as high as 14 lbs., difference I suppose caused by temperature and strength of graduating springs, and I find the average pressure in 10-inch brake cylinders to be 56 or 57 lbs. when equalized through service application and at 4-inch piston travel with 70 lbs. in auxiliary reservoir to start with. Now take a 10-inch brake cylinder in this condition and make a 12-lb. reduction; there would still be greater pressure in the train pipe, namely, 58 lbs., while the equalized pressure, 56 lbs., in the brake cylinder, applied to the wheels as a service stop, would, I believe, stop the train in less distance than a quick-action or emergency stop with the same quantity of air in the brake cylinder.

I have made some experiments on coach, tender and driving brakes to determine what were the average pressures in them while in service, and they give some idea of what a man does when he stops a train without jerking. The American driving-brakes had 12 x 33-inch reservoirs and 12-inch brake cylinders with 5-inch piston travel, equalized at 35 to 38 pounds. Tender with 10 x 24-inch reservoir and 8-inch brake cylinders gave 50 pounds at 7-inch piston travel, while the 10-inch cylinder on coaches with 12 x 33-inch reservoir gave at 4-inch piston travel 56 to 57 pounds on service stop, 59 on emergency and 61 on quick action, and at 8-inch piston travel equalized at 50 pounds service stop, 54 emergency and 57 quick-action, but graduated much better on longer travel.

What is the opinion of others as to a 12 x 33-inch reservoir being a proper size in this case. Does it seem to supply too great a volume of air and take too long to fill on this account, or not?

Now, as for that love-feast, would say I am partial to such things and do not see why, as that one was missed, we could not get up a small crowd and have one of our own, and after some others have been heard will tell what explanation I gave to the engineers.

GEORGE HOLMES.

*Roanoke, Va.*

## Oiling Air Pumps.

*Editors:*

One of the most interesting articles I have read for some time was the one signed "A Fireman" in the November number of your paper, treating of the equalizing discharge valve. It is refreshing to read anything as candidly and tersely put, even if the writer be in error in the position taken. As stated in the editorial note at the end of the article, most of the trouble was undoubtedly the result of intoxicating the pump with such a cocktail.

That it is bad to mix drinks or to drink too much is well known, and the same thing may be very aptly said about the treatment of the air-pump. Give it only one kind of oil (the right kind), and very little of that. One of the most difficult things to teach engineers is the proper care of the pump, and particularly in the matter of oil.

Some men pour in a few drops or more every time they go around the engine to oil up. Some men use black oil, some valve oil, some signal oil, and some a mixture of every oil they can find.

And what seems peculiar, a man who thus doses the lower cylinder is generally very anxious to save oil in the upper cylinder, and will run it almost perfectly dry until it is in a horrible condition, packing-rings all loose, bushings worn hollow, and every stroke blowing like a porpoise. The upper cylinder under the action of the steam requires much more oil than men imagine, and should never be allowed to run, even for an hour, entirely without oil.

Any man who does not give the upper cylinder sufficient oil will find out that before very long he will have to assist the action of the pump with a hammer, until finally even the hammer will not start it, and he will be required to give up his train or run to the end of his division without brakes.

As before stated, the great majority of men give the lower cylinder altogether too much oil, and it is a habit of which it is very hard to break them, largely because the pump seems to be like a toper who suffers when the quantity of his grog is reduced. A pump which has been in the habit of receiving large doses of oil regularly and often, will groan dreadfully if the allowance is cut down very suddenly, so the best way is generally to reduce the quantity gradually and at constantly lengthening intervals. If this does not secure the desired result the pump must be overhauled, after which the proper allowance of oil may be given.

The evils directly traceable in many cases to the use of the wrong kind of oil in the pump or in too generous doses, may be summarized as follows: Heating, pounding, sticking of valves and consequent intermittent or uneven stroke, failure of brakes to set with proper force in graduation, difficulty of moving the engineer's valve handle, gumming up of the train signal valves, especially the pressure-reducing valve, and other troubles too numerous to mention.

The writer is familiar with a case where, for the sake of experiment, several pumps were run for a number of months without any oil in the air cylinder except such as would be sucked down with the piston rod from the upper cylinder in the downward stroke, and a small quantity put at frequent intervals on a swab around the piston rod. When these engines came into the shop for repairs the pumps were carefully examined and found to be in first-class condition, better in fact than many which had been generously fed with oil, and showing less wear.

*Chicago, Ill.* PAUL SYNNESTVEDT.

## Passes in New South Wales.

The question of free passes on railways appears to be exciting the people of New South Wales not a little. Politicians there, as elsewhere, consider themselves entitled to ride free, and they are a little more exacting in their demands than the average assemblyman of America. The members of Parliament obtain a gold badge which serves as a pass on the railways. This badge they consider a perpetual legacy, and ex-members of Parliament are accused of using it after they are no longer members. A movement has been started to deprive ex-members of the badge which entitles them to ride on railways, and there is a feeling of indignation among those concerned at the attempt to curtail their privileges. Meanwhile the government railways are a heavy tax upon the colonist, and hot words are passing between those who think that all citizens should pay their railroad fares and those whom custom has made spungers upon expense. The holding of a pass entitles a man to free transportation over 12,000 miles of railways. The abuse of this privilege is said to have a marked effect upon the earnings of the railways.

In a lecture on ancient railway history by our correspondent, Mr. Clement E. Stretton, of Leicester, England, and reported in the London *Railway World*, the claim is made that George Stephenson was the inventor of the steam whistle. We believe this to be a mistake, and we are under the impression that the steam whistle was invented in this country. Can any of our readers give us information on this question?

## Some Blacksmith Shop Tools.

BY GEO. F. HINKENS.

I am glad to note that your paper is taking up railroad blacksmithing; it is an important branch and one that has been neglected.

I believe one of the troubles has been that blacksmiths were afraid of being criticised if they ventured into print. I am the opposite; I am afraid they won't criticise; let them come, be fair, tell the truth and all will learn something.

Please remember, however, that I am a blacksmith and not a draughtsman, and that I make all my own sketches.

A comprehensive view of blacksmithing is impossible without a knowledge of the different parts for which the work is intended, knowledge that can only be acquired by close and studied observation. Therefore, the first in order and importance to know of iron is, "What service must it render, what special purpose is it best adapted for?"

Mr. Lottes puts the question, "How often do we hear of a side-rod breaking in the welds?" and says nine times out of ten you could blame the material or man that did the forging. Please, Mr. Lottes, what is the cause of the tenth mishap? Possibly the tenth break is the result of a bad weld or poor iron, but the other nine were due to crystallization; now I never saw a side-rod broken in the weld.

However good the weld, it is always the weakest point. At least tests have demonstrated such to be a fact. Consequently, it is a matter of vital significance to locate your weld, keep the weld from the terminus of vibration lest the rod will break before the proper time, and that time will arrive when the constituent particles at the end of shock or vibration become crystallized, due to the molecules of metal becoming intact or in a measure independent of each other.

The question then suggests itself, how are we to avoid crystallization in side rods?

Select suitable material which should be fibrous and hard; fibrous so as to sustain shocks, and capable of yielding to force or pressure without breaking. Hard, because soft iron will crystallize quicker than hard, and after all this precaution is taken don't allow side-rod to be in service long enough for internal disintegration to take place, and when it does take place there is only one remedy—"fusion."

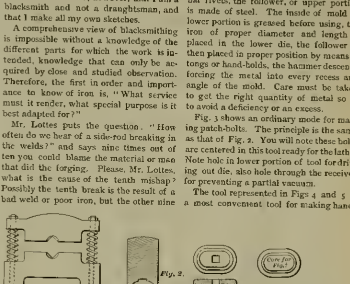
In regard to welding I have reference to welds taken in a smith's fire, in an oxidizing atmosphere. As a matter of course, "if temperature is increased to fusion in a non-oxidizing furnace welding is practically perfect," but I am speaking of welding in its general acceptation.

As to forging there are various methods and for those of your readers that may be interested I will endeavor to generalize a few tools that can be utilized with efficiency under a steam hammer.

Fig. 1 shows a device for squaring stay-bolts cold. A pair of coil springs lift the top die to allow for turning on each quarter. With this process we square 2,240 bolts in ten hours; all heads are central and uniform, and it is without question a valuable tool in a shop not provided with an automatic or belt-power bolt machine. The hole in die is drilled half across the face, the balance is squared for the head. In connection with this tool, we use gauge tongs.

Fig. 2 represents a tool for making crown bar rivets, the follower, or upper portion is made of steel. The inside of mold or lower portion is greased before using, the iron of proper diameter and length is placed in the lower die, the follower is then placed in proper position by means of tongs or hand-holds, the hammer descends forcing the metal into every recess and angle of the mold. Care must be taken to get the right quantity of metal so as to avoid a deficiency or an excess.

Fig. 3 shows an ordinary mode for making patch-bolts. The principle is the same as that of Fig. 2. You will note these bolts are centered in this tool ready for the lathe. Note hole in lower portion of tool for driving out die, also hole through the receiver for preventing a partial vacuum.




The tool represented in Figs 4 and 5 is a most convenient tool for making hand-hole plates, an article extensively used about locomotive boilers. A solid mold or core, exactly a copy of the work to be produced, is made of steel by hand forging and then finished in the machine shop to the required form as shown in Fig. 7. The bottom or receiving portion of the tool, Fig. 5, is then forged to the general form and core, Fig. 7, is indented into it. In making the top or shearing part as shown in Fig. 4 care must be exercised in giving the proper clearance lest it will bind or drag the metal. The tool now being ready for use the inside of mold, Fig. 5, is oiled with greasy waste, the white-hot iron is placed thereon, the hammer descends upon it, forcing the metal into the mold, thus forming the rib or flange. The next process is shearing it to the required form, which is done by placing the cutter, Fig. 4, over the mold, Fig. 5, thus cutting off all surplus. The last operation is placing punch, Fig. 6, in square hole of Fig. 4, driving it through and making hole for the bolt.

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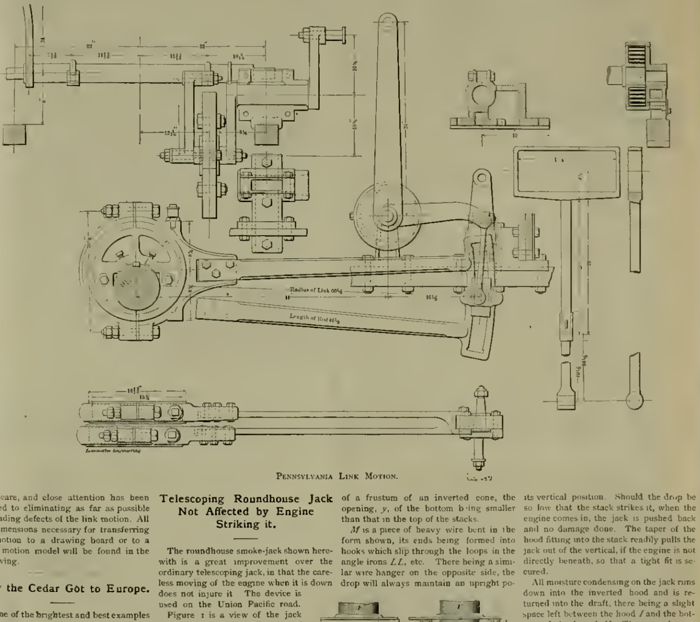
A thing about car construction that strikes us as strange is the practice of making short pockets for the stakes of gondola cars and cutting the stake flush with the bottom of the pocket. Why not extend the stake to the bottom of the sill and give the lower part fulcrum hold to resist the leverage of the long end? It is no wonder that there is difficulty in keeping the sides of gondola cars from bulging out.

### Pennsylvania Link Motion.

The numerous class of our readers who concern themselves in the study of valve motion will find in the annexed engravings a valve motion well worthy of close attention. It is the standard link motion for all the locomotives belonging to the Pennsylvania Railroad to which it can be applied. It has been worked out with great care, and close attention has been devoted to eliminating as far as possible the leading defects of the link motion. All the dimensions necessary for transferring the motion to a drawing board or to a valve motion model will be found in the engraving.



PENNSYLVANIA LINK MOTION.

### How the Cedar Got to Europe.

"One of the brightest and best examples of perseverance and genuine love of plants was exhibited by the man who first introduced this species of tree into Europe," again began Jack, pointing to a large cedar growing on the other side of the road behind a lodge gate. "I was only a youth when I first read the story of that French man who, when traveling in Palestine found a little seedling among the cedars of Lebanon. He carefully took it up, with all the soil about its roots, and, for want of a better flower-pot, placed it in his hat. The ship in which he sailed, on its voyage home, met with many contrary winds, and was much delayed in consequence, so much so that the provisions fell short, and all on board were put on short allowance. The captain received only two glasses of water daily, the crew one glass, and the passengers only half a glass. Our traveler, undismayed by its scarcity, gladly shared his half glass with his little seedling, stinting himself so much in that respect that, when the ship arrived at last in port, he was almost dying, and, behold, the little cedar was a fresh young tree six inches high! It required all his persuasive eloquence to convince the Custom House officers that the hat contained nothing more valuable than its tiny roots. He had it conveyed to Paris, and planted in one of the gardens there, where it grew and grew, until it became the largest and noblest tree in all the gardens. When it had attained its hundredth year it was cut down, doomed to make room for a railway, and now, the most potent factor in the civilization of the nineteenth century, 'the god of fire and steam,' shrieks daily over its withered roots."

### Telescoping Roundhouse Jack Not Affected by Engine Striking it.

The roundhouse smoke-jack shown herewith is a great improvement over the ordinary telescoping jack, in that the careless moving of the engine when it is down does not injure it. The device is used on the Union Pacific road.

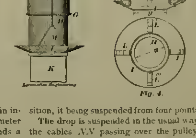
Figure 1 is a view of the jack at right angles to the direction of the track beneath. Fig. 2 is a view of the upper portion of Fig. 1 taken at right angles to it or parallel to the track. Fig. 3 is a section of the drop part of the jack. Fig. 4 is a plan of Fig 3. *FF* are the roof beams of the roundhouse. *E* is that part of the jack which extends above the roof. It also extends down into the roundhouse to a point slightly below the lower edge of the beams *FF*.

The pipe or barrel *O* is made of sheet-iron stiffened at the lower end by the ring *G*, and at the top by the ring *D*. On the opposite side of this ring *D*, are trunnions *AA*, which pass through suitable holes in the straps *CC*, which are fastened with lag bolts to the inner face of the beams *FF*.

The pipe *O* is made slightly larger in internal diameter than the outside diameter of *E*, the lower end of which extends a short distance into it. It will be seen that the pipe *O* swings freely on the trunnions *AA*, in a vertical plane parallel to the track.

In the lower holes of the straps *CC*, are hung the pulleys *BB*. The barrel *H* of the drop on lower part of the jack is made of sheet-metal, its outside diameter being slightly smaller than the inside diameter of *O*, so it will slip inside easily. To the bottom of *H* are riveted the angle irons *LL*, etc. The arms of *LL*, etc., form an acute angle, *x*, with each other. To the other arms of *LL*, etc., is riveted the hood *I*, also of sheet-iron; its form being that of a frustum of an inverted cone, the opening, *y*, of the bottom being smaller than that in the top of the stacks.

*M* is a piece of heavy wire bent in the form shown, its ends being formed into hooks which slip through the loops in the angle irons *LL*, etc. There being a similar wire hanger on the opposite side, the drop will always maintain an upright position, it being suspended from four points.




The drop is suspended in the usual way the cables *NN* passing over the pulleys *BB* and running back horizontally for some distance where they come together and are continued in one cable. This passes over another pulley and comes down the face of one of the posts of the roundhouse. To the lower end is attached a counter weight of the same weight as the drop. The motion of this counter weight is fixed to keep the drop in proper limits.

Figure 1 shows the drop resting on a stack *K*. Should the engine start with the drop in this position the jack swings on the trunnions till it is free from the stack, when it swings back and finally resumes its vertical position. Should the drop be so low that the stack strikes it, when the engine comes in, the jack is pushed back and no damage done. The taper of the hood fitting into the stack readily pulls the jack out of the vertical, if the engine is not directly beneath, so that a tight fit is secured.

All moisture condensing on the jack runs down into the inverted hood and is returned into the draft, there being a slight space left between the hood *I* and the bottom of the barrel *H*. This entirely prevents the water that condenses on the jacks from running on to the engine.

### Inferior Firebox Steel.

I believe that instead of the price of steel for fireboxes of locomotives dropping all the time, it would be for the interest of railroads if it were increased and the increase meant a better article.

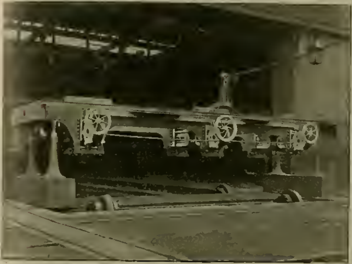
A new boiler costing from $1,500 to $2,000 is put into service, and in ten months is torn apart because plates of an improper quality have been put in which require renewal, while another engine doing similar work has caused no expense to the owners. The steelmakers and the railroad companies ought to agree on a quality of steel that will stand the bad water and not call for the expensive repairs that renewing fireboxes or side-sheets involves. Facts regarding good and bad steel and the comparative results of using them ought to be strongly urged upon the attention of railroad managers.—*J. N. Lauder*.

## The Crewe Shops of the London & Northwestern, the Largest in Great Britain.

[*Editorial Correspondence.*]

The shops of the London & Northwestern road have a peculiar attraction for an American, being, as they are, the largest shops in the country. The road operates 1,700 miles of road and owns 2,620 locomotives—the largest number owned by one road in the world. These engines were built at Crewe.

I had the misfortune to get to Crewe during the August "bank holidays," and found the works shut down, but this was more than compensated for by the kindness and courtesy shown me by Mr. F. W. Webb, the locomotive and carriage superintendent, who personally conducted me about the works and added greatly to the interest of my visit by answering a thousand questions and allowing me to pry into everything that caught my eye.



JAW FACING MACHINE.

The shops at Crewe are strictly locomotive and permanent way shops—the "carriages" and "waggons" are maintained by the shops at Wolverton.

Crewe is all railroad. In 1841 the population of the village was 203, but the next year the shops of the combined roads that make up the London & Northwestern were moved to Crewe, and the census of 1851 showed 4,571 inhabitants. Now, or in 1891, there were over 30,000. There are two small factories here employing female labor, otherwise there is nothing of the town except the railroad shops and the homes of the workmen. The public buildings are good and there are plenty of them, but everything has the L. & N. W. brand on it in some way or another.

### PERSONNEL OF MANAGEMENT.

The first superintendent of these works was F. Trevithick, a son of the noted engineer who did so much toward the development of the steam engine, he was succeeded in 1857 by Mr. Ramsbottom, inventor of the water scoop and the double safety-valves that bear his name, who was in turn succeeded in 1871 by the present efficient officer,—only three men at the head of these great works in half a century.

### EQUIPMENT OF THE CORPORATION.

Some idea of the magnitude of the business done by this corporation may be had when I tell you that last year their earnings were $58,400,000 and the expenses $31,045,000. They employ 60,000 hands, 18,000 being in the locomotive department. They own 2,620 locomotives, 6,000 passenger carriages and 57,000 goods wagons, besides twenty steamships and 3,000 horses and carts.

### BUSINESS DONE.

They carried 63,000,000 passengers and hauled over 40,000,000 tons of goods. There are 800 stations on the line, 1,500 signal cabins or towers and 32,000 signal levers to handle; 17,000 lamps are lighted every night. They burned over one and a quarter million tons of coal last year, and ran 211,000 special trains—or that many in excess of those on the time card.

### THE SHOPS.

The offices of the department are in a very long brick building, probably 800 feet long; this contains the drawing rooms, photo studio, the stores, accountants', running and signal offices, complete suits of rooms for the head of each department. This building is surrounded by green sward and shrubs, and near the end and inside the works is the residence of Mr. Webb.

The shops I shall not attempt to describe; they are substantial brick and stone buildings extending for a mile and a half, and being located in a Y where the different lines converge to form the main stem to London, the works extend over 116 acres of ground, there being thirty-six acres of roof.

The company roll their own rails. I believe this is the only company that does this in Great Britain, although most of them make everything they use. This is a noticeable feature of all English shops; they are manufacturers of everything they want—a hard place for supply men if it was not for the export trade of the country. The rails now used are of the bull's-head variety, being 30 feet long and weighing 90 pounds per yard. The forge shop is unique and a very extensive one. Here I saw my first Ramsbottom duplex hammer. I had heard of these for years. There is a 30-ton machine here and it is said to be very efficient. There are two 30-ton blocks driven horizontally to and from each other by steam. The usual vibration noticed in the ordinary vertical hammer is absent to a large degree in this big machine. There are quite a number of vertical hammers here ranging from 2,000 pounds up to 20 tons.

Mr. Webb's metal sleeper is rolled here, and there is something like 100,000 of them in use on the line, but I must say I don't like them, they are so noisy. It is plainly discernible when the train drops off the wood on to the steel.

Not only are the rails rolled here, but the steel is made on the ground, they have both the Bessemer and Siemens-Martin processes, and besides this make their own crucible steel for edge tools.

Like all the other European roads, they are making many parts formerly made of wrought iron of cast steel, and a large plant is employed.

One of the nicest things about these shops is the power, gas engines are used and each shop and department has its own. No boilers are needed and the space occupied by them and the coal bunkers is entirely saved, besides the room required to handle the coal, etc., the large Otto gas engine in the erecting shop has been in use since 1884, giving the best of satisfaction. One good man can keep up a number of them, and they are easily cared for and are always ready to go to work on a moment's notice without waiting to get up steam. In America we are just beginning to see the advantages of divided power, how much lighter shafting we can use, and how much we can save by transmitting power from one shop to another, the work of Westinghouse, Church, Kerr & Co. is doing much to show the utility and practicability of this plan of having a dozen engines instead of risking everything on one big one.

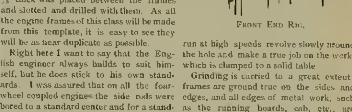
At Crewe the gas works are large, there being forty-nine producers and are located where the least in the way, the gas coming to the works for furnaces and engines in underground pipes.

There are only two parts of a locomotive that Mr. Webb buys, the brass flues and copper fireboxes, they use a half a million flues a year.

The flat plate frames seem awful easy to make, just slabs of 1⅛ steel slotted, they put ten on a three-headed slotter at once, and do the slotting for $1.25 per frame. I noticed they were making the first frames of a heavy eight-coupled mineral engine, and in order to get a template of the frames for future use, a steel plate ½ thick was placed between the frames and slotted and drilled with them. As all the engine frames of this class will be made from this template, it is easy to see they will be as near duplicate as possible.

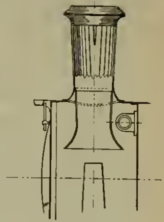
Right here I want to say that the English engineer always builds to suit himself, but he does stick to his own standards. I was assured that on all the four-wheel coupled engines the side rods were bored to a standard center and for a standard pin, and that the side rods on nearly a thousand engines were interchangeable, although the engines varied much in general design.

One of the interesting tools to be seen is the rotary device for squaring up the jaws of frames. Three of these are shown at work on the frame of a six-wheel goods engine. These machines are very simple, the cutting heads being driven by a worm on the shaft, and carrying tools on each side, they are centered by special devices on their frames as shown, and one feed through the jaws cuts both sides. At some places these tools are mounted on wheels and are shoved under engines in repair shops by putting planks across the pit, they are then centered and the jaws turned up. Many roads there do not use shoes or wedges, simply turning up the horn-blocks when worn, it is no great job to replace these blocks on the frame, an American frame is an expensive thing to change much.



EIGHTEEN-INCH GAUGE "DICKIE."

I should like to call attention to the capstan in front of the "Charles Dickens." Many of these power devices are around the works, and are most convenient when it is desired to pull dead engines in or out of the shops, or in moving or loading anything heavy; they can be set in motion any time and cost little or nothing to maintain; they save lots of "pushing." They have a great many special tools that we don't need and some that we might use to advantage. There are a number of sizes of vertical spindle grinding machines, with which they grind out all holes in hardened work. Emery wheels of small diameter



FRONT END RIG.

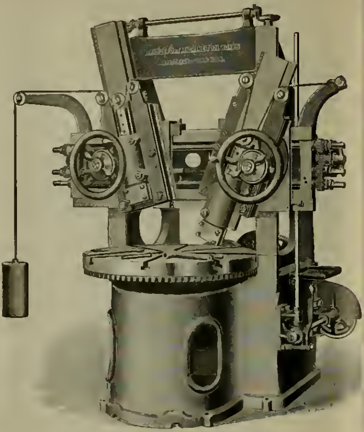
run at high speeds revolve slowly around the hole and make a true job on the work, which is clamped to a solid table.

Grinding is carried to a great extent; frames are ground true on the sides and edges, and all edges of metal work, such as the running boards, cab, etc., are ground and polished. A large room is fitted up with grindstones, where all kinds of work is finished.

Milling is done extensively, and some very ingenious machines are employed to do special work, such as milling around the hubs and between the spokes of wrought-iron driving wheels. They finish a great deal of work that is afterward painted.

I expected to see sawing machines used extensively, but there are not many, and the fabled band-saws that "cut out the throws of crank shaft forgings" were not to be found, band-saws are used on thin sheet metal. Hot saws are used in the forge; one of them seven feet in diameter, running with a periphery speed of 13,000 feet a minute, cuts off the end of a nine-inch axle in thirty seconds.

They have a rotary milling device for cutting out the throw of the cranks. This has two cutting tools in a revolving wheel while the centers turn the axle, forging so







as to feed it to the cutters, making a complete turn around the center of the pins, thus roughing out the throw and forming the pin itself. This is called a "nibbling machine."

All wrought-iron work is annealed and every five years all wrought-iron work such as rods, crossheads, pistons, valve motion, etc., are annealed and rehardened. This prevents crystallization and takes out any strains that service may have put into the parts.

In the erecting shops they have well-made frames so constructed that the engine frames, cross frame braces, horn blocks, etc., are simply put in place without measuring and riveted up.

One of these shops is devoted to the manufacture of signal apparatus, which is very intricate, and there is lots of it. The European roads are run by signals, the engineers rarely or never receiving orders to move their trains; double track lines are controlled by manual, inter-locking signals; single track lines are operated by the staff system—a staff being the scepter of between the trucks and only some 18 inches above the ground; it has seats in the end and is used to hurry pieces for repair, tools and men from any of the shops to the running sheds or any place else.

As so much of the work is manufacturing, there is always large orders of stock going through the works; injectors and brake apparatus are made in lots and special tools provided for them.

Around the works everywhere there is an 18-inch-gauge track, and numerous little locomotives like the one shown herewith are employed in handling material, and wonderfully powerful and handy little helpers they are. The boilers are straight, round shells, the firebox being a tube in the end about as big as a pail; they have a throttle and lever at each end so that the runner can see where he is going; they carry 165 pounds of steam on these. There are five miles of 18-inch track.

In the shops most of the work is done by the piece and "piece work detectives" are employed to keep track of results and cut down the price of work.

brake blocks are used. These were once discarded for iron, but the men petitioned to have them back, and as they cost less than iron, back they went.

Everywhere is the evidence that cast-steel is taking the place of wrought-iron, but it is especially noticeable in the case of wheels for cars and engines. Cast-iron wheels are not looked upon as safe, still their rough-and-ready mineral and coal engines have cast drivers with the old-fashioned I-section spoke.

On the front of the stacks or top of the arch there is a little bracket on which different devices are placed to denote the character of the train; these are pieces of sheet iron cut in oval, diamond, heart or other shape and painted white. These are used to show the signalmen in the towers what trains are important and should not be delayed, and should be run around others, etc. Fish and meat trains are run at a high rate of speed and given the preference over other trains.

On some of these engines a real novelty is to be seen in the shape of solid-ended to get her back. The crew number is fifteen.

Driving axle journals are, as a rule, very much longer than ours and hot-boxes correspondingly less; 12 inches is not an uncommon length, the springs being inside the frame; the boxes bear directly upon the "horn-blocks," and few of them have any provision for taking up wear.

Little attention seems to be paid to making an engine easy to repair; they are made to run. For instance, the front ends are riveted on the arch and all the rivets filed down smooth and flat; nice pieces of work, but expensive to get into shape when once disfigured.

The front flue-sheet is, as on all British engines, larger than the boiler; it is always fastened to the barrel of the boiler by an angle iron; its lower edge is extended down and fastened to the cylinders on the frame; the edge is flanged ahead and the arch fastened to it. This is why all their engines have a smokebox larger in diameter than the boiler.

As every joint about the average Eng-

"Charles Dickens"—A Million-Mile Record in Less than Ten Years.

authority to occupy the line from one station to another. This called for grievous delays where more than one train wanted to move in the same direction, and this brought out the ticket-and-staff system, the most complete system of this kind being an electrically controlled system known as the Webb-Thompson. This device is made in the Crewe shops and is illustrated and described in another column.

Some idea of the size of inter-locking and switch-towers used can be seen from the number of levers in the towers at Crewe and London, the latter having 280 levers and the former 155. One thing I noticed particularly was the use of a ⊓ section of rolled iron for rods instead of pipe; these are very stiff and rigid; the lengths are coupled by a strip inside the recess, bolted through, guide rollers run under and are covered by the flanges of the strip. It is claimed that they are cheaper than pipe, occupy less space and cannot change their length by turning.

The shops are strung out for something over a mile, and to facilitate the handling of men and material they have a couple of locomotives with a long covered car where tender should be; the floor of this car is

THE ENGINES.

A pair of cylinders are usually cast in one piece, with the steam chest between them. This only has a cover on the front end, and the back has two valve-stem holes and stuffing-boxes. The back cylinder-heads are also cast in. This casting is bored in one machine, and at one setting both cylinders and their stuffing-boxes are bored, the front flanges faced, while a small pair of bars are boring the valve-stem holes in the chest.

They are using cast-steel driving-boxes with a shell brass. They babbitt the sides to prevent cutting of hubs of the wheels. These boxes are put on a machine that planes the top sides and rounds out the crown for the brass at one setting. The inside tool is something like the planer tool for this purpose made by Pedrick & Ayer.

They have a number of electric cranes of their own make and use the Thompson electric welder in some of the work.

The fire doors open inside the box, swinging from the top. These are unfinished castings. They make them of steel and chill them. They burn out in from three to four months.

On engines, tenders and cars wooden rods; instead of a brass bush fast in the rod they have a bronze bush *fast on the pin*; this runs in a hardened and lapped hole in the end of the rod; they go two years without serious wear, and the pin is never worn out of true. A new bush restores it to its proper size and keeps the centers the same.

The extension front is unknown. A short front with a straight, open stack is used. All the fronts have holes to let the cinders run out. They have abandoned the torpedo in the nozzle and now extend a pipe from the stack well down into the arch, as shown in the sketch. The nozzle is on a level with the top row of flues and is larger than the old ones. These improved fronts have made the engines steam freer and throw less fire.

In freight engines they use steel packing rings, steel rod bent-up. Three are used on each piston. They are only about one-quarter of an inch wide, but are three-eighths of an inch deep.

On what ought to be the cab roof, and facing back into the tender, there is a small plate with the number of the "shed" or roundhouse to which the engine belongs, so if an engine is sent off her regular beat all know where she belongs and can figure

lish engine is a flange joint, there are lots of flanges to make. I noticed some flanges that were to have four square holes through the flange; these holes were being finished to a standard size by shoving a square piece of steel with teeth cut on each side of it, in a sort of spiral, a smaller size being used to rough out the hole than that used to finish it; this seemed a quick, cheap and accurate way to do the work.

Such parts of the engine as are liable to rust are galvanized; the inside of the tank is thoroughly galvanized as is also the coal space; this requires no paint and lasts three times the life of bare plates.

Slab frames are particularly easy to fit work to, being true and square all over and extending from buffer to back of engine in one straight piece, the frame going outside the cylinders. It would be almost impossible to fasten a slab frame to an outside cylinder of our style and preserve its "get-at-ableness." Their entire frame is made without a forging.

Mr Webb is now using three boxes on

the main driving axle. The center box is fitted between the cranks, and slides up and down in a pair of heavy jaws that are supported by a heavy brace to the cylinders and across the frame; this box bears no load, but it prevents undue bending strains on the axle and will admit of an inside engine being run home on one side with a broken axle.

The oil pipes from cab to chests are run through the exhaust pipe from the large vacuum-brake ejector which extends from the boiler head to the smoke arch on the right hand side. These oil pipes are cased in wood to prevent them from wearing.

The tenders have six large steel-tired wheels set in solid jaws, no trucks; there are extra good steps and hand-holds. The tanks for express engines only hold 1,300 gallons as the road has numerous scooping troughs; even suburban engines with very small tanks will strike bravely out with a big train; they can scoop water almost anywhere.

All the steam-chests are cast on the cylinders, and in most of them the cover to the chest is cast on, the end having another cover through which a machine is introduced to mill out the ports and face the seat.

Some of these inside engines have as big as 19½-inch cylinders, the two cast together, one steam-chest for both and the whole thing weighing less than one of our cylinders and saddles; but when one cracks the whole thing has to be thrown away.

The road uses automatic vacuum brakes, but have an improvement of Mr. Webb's. This is a separate steam valve, connected with the engineer's valve, which can be handled from either side of the cab, that applies the brake on the engine. This steam brake is so arranged that should the vacuum in the auxiliary cylinders under the cars run down below a safe amount, the steam brake is applied and informs. I understand this was done to prevent accidents to the brake from freezing up. It is not an unmixed blessing, for if steam runs down in making a hard run, the jet that keeps up the vacuum will let up a little, and the first thing you know on goes your engine brake, and the only way to get it off is to restore the vacuum, and this takes steam when needed; it may keep things safe, but it prevents a man from "getting there" sometimes when he otherwise would.

Mr. Webb believes that there should be a "breaking piece" in all mechanism; that is, a piece that is sure to break first when a crash occurs from any possible cause. He makes his tenders the breaking piece in passenger engines, so that they can crush with the least loss of life and property. The tank frames are made of creosoted pine.

The company used to give coal premiums and do yet, but the men say the amount has been cut so close that there isn't "baccy" money in it for the best of them.

HISTORICAL LOCOMOTIVES.

The "Charles Dickens" is one of a large class of engines in use, and until the invention of Mr. Webb's compound the standard passenger locomotive of the road. This engine has 6 feet 6 inch drivers, and was turned out of the shop in February, 1882; since then she has run between Manchester and London, doubling the road daily, and on the 12th of September, 1891, completed her 2,651st trip, running 1,000,000 miles in nine years 219 days, in this time she also ran ninety-two extra trips. In making the million miles she burned 14,016½ tons of coal. She is still doing yeoman service.

The "Cornwall" is also a noted engine at Crewe. She was originally built in 1847, by Trevithick, with the boiler under the axle and a wheel 8 feet 6 inches in diameter. She was changed in 1862 by Mr. Ramsbottom and a new boiler placed above the axle; this engine is still pulling express, having been on duty more than 45 years; she has the largest wheel in the world.

Mr. Webb recently constructed a full size model of the "Rocket" just as she was when she won at the Rainhill trial in 1829. The picture of the builder, George Stephenson, was obtained by photographing his statue, while the driver on the foot plate is Mr. Jas Hitchens, the runner who brought the Webb compound out to the United States a few years ago.

THE RUNNING SHEDS.

At all of the running sheds there is to be found a bundle of soft iron wire, about as large as broom straws, and a big "hunk" of wool yarn, this is used as feeders for all oil cups, driving boxes, etc. "Trimmings" the men call them; men get fined for neglecting "trimmings."

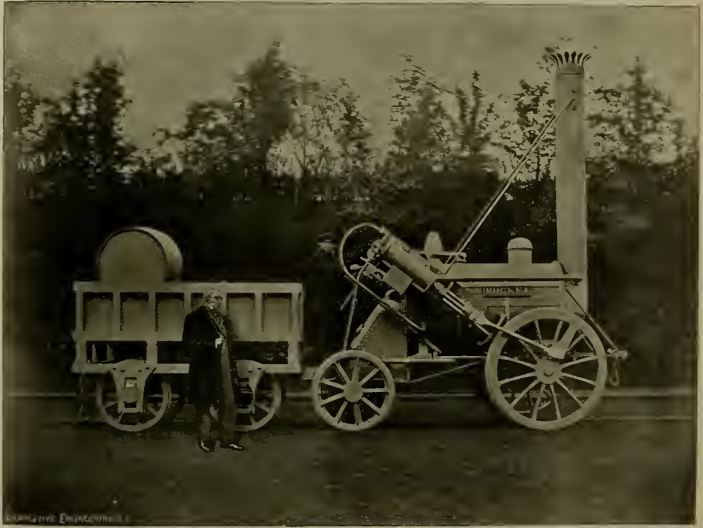
In the running sheds the engines stand on long tracks, one ahead of another; over them extends an inverted trough of light wood; from this, openings are made at every engine or two to the air above, the stacks are very close to these jacks and when the pops go off it blows the boards off the rig, but they have the best of dampers and take care so that a case of popping in the shed is rare, and the man who is responsible for it hears from it.

In these running sheds they have great iron furnaces in which coal is burning; this is used to fire up dead engines, no wood being needed. When a new fire is to be kindled the man who fires up takes his men, about six and each man has a long iron-handled scoop, holding more than the ordinary firing scoop; these they fill with live fire, put the crooked handles over their shoulders and march to the engine, where one mounts the deck and receives the fire, spreads it and covers it lightly with coal. This plan is clean, uses no push-cars for wood and removes the danger of fire in a large pile of kindling. The heat of the furnaces is utilized in drying sand.

THE COMPOUNDS.

Of the compounds I am loth to speak, comparatively, because I know so little about their simple engines; a comparison of their compounds with our simple engines, or *vice versa*, is no comparison at all. Mr. Webb has ninety compounds of his three-cylinder type; all of these are on express trains and the most important ones on the road. Whatever may be said, their inventor does not hesitate to put them on heavy fast trains. I have before me a list of the ninety engines, names, numbers, size of wheel, date turned out, miles they have run and coal they have consumed. The first one, named "Experiment," was sent out April 3, 1882, and has run 440,933 miles and burned coal at the rate of 30.8 pounds per mile, and it is a remarkable fact, that this is the very best record of all the class. The "Alchymist" has been running four years with a coal record of 41.2 pounds per mile—the poorest record—while the average for the class, for a mileage of 21,181,250, is 35.1 pounds per mile. These engines keep well on time and often handle 20 English carriages—very heavy trains.

The latest and largest engine of the class is the "Greater Britain," shown herewith. This engine has a pair of trailing wheels, and a combustion chamber in the barrel of her boiler, using two sets of flues. This engine has 7-feet 1-inch wheels, two 15-inch cylinders and one 30-inch, all of 24-inch stroke. She has 1,505.7 feet of heating furnace. Weighing 116,704




GEORGE STEPHENSON AND THE ROCKET, AS ORIGINALLY BUILT.

pounds, she is a very finely finished engine, and doing fairly good work. She has the latest loose eccentric plan of valve-gear for her low-pressure cylinder, the runner having no control of it; the high pressure cylinders move the axle until it strikes a stop in the loose eccentric, and this drives it for that gear; when the engine is reversed the small cylinders have to move the engine before the valve for the big cylinder changes, this is hard to do under some circumstances. I was riding behind one of the engines when the runner had to get down and shift the loose eccentric by hand before he could start his train; couldn't get slack enough to move it.

## Confession.

I have failed in lots of things which some other fellow working alongside of me would do with ease. I always considered myself the best machinist that ever lived, and when I heard of big wages being paid in some distant shop I assumed, as a matter of course, that all I had to do was to go to that shop and get a job. When I got the job I didn't always get the big pay, but I was too smart to kick much about it. My career as a journeyman machinist was rendered much smoother and more pleasant than usual by my having come to a knowledge one day that I could find better mechanics than myself in every shop I went into. This was a bitter pill, but I swallowed it and it did me good.

I could tell some interesting things regarding my own experience and the experience of others who, like myself, were troubled with the big head for some time before discovering the proper remedy. I know one man to-day who never got more than a dollar and a half a day in his life, and he never was worth more, either, and still that man will tramp from the Atlantic to the Pacific ocean if he hears that good machinists out there are getting two or three dollars a day. He can tell of the many times he has been humbugged by shop-owners, and can tell of many a poor shop-owner who has been humbugged by him. He has tramped this country over expecting to find a man foolish enough to pay him the wages of a good machinist, and I never knew him to work a day for less than he was actually worth as compared with other men.—*Chordal's Letters.*

## The Mertsheimer Variable Nozzle.

The Mertsheimer variable exhaust nozzle is working with remarkable success on the Union Pacific, and has been applied to 150 locomotives. A highly promising feature about this variable nozzle is, that it is remarkably easy to operate and does not get gummed up or corroded. It is formed by two serrated or notched circular plates, the one sliding on the other. When the notches of the upper or sliding plate coincide with those of the lower one the greatest amount of opening is obtained. If it is necessary to reduce the area of nozzle opening, the sliding plate is turned till the projections partly or entirely cover the notches of the lower plate. It is a remarkably ingenious contrivance and possesses the saving merit of simplicity. There is nothing to get out of order and therefore the nozzle is likely to be a permanent success.

The engineers in charge of locomotives having this nozzle speak very warmly about it and they operate it to save coal. When pulling out of a station or on a hard pull they open the nozzle and find it a decided improvement to the working of the engine. They say that the pulling open of the nozzle frequently saves doubling heavy grades.

During a recent extended ramble, in which numerous shops were visited, we noticed a variety of methods employed for transmitting power at an angle from the line of shafting. Some of the methods employed were rather ingenious, but none of them approached in simplicity or efficiency the Almond coupling, which can be seen in the Watson & Stillman shops, East Forty-third street, New York, near the Grand Central station. Parties who wish to transmit power at right angles ought to look into this device before scheming costly substitutes. It is made by the T. K. Almond Mfg. Co., Brooklyn, N. Y.

Where railroads are built into sparsely settled districts it is a fine thing to have a rich government to stand behind any lack of earnings. The people of New South Wales who indulge in the expensive luxury of government ownership of railways, are receiving practical illustrations of the advantages not to say the disadvantages of the system. Out of a total mileage of 12,000 they have ten sections, comprising 765 miles, which are operated at a loss. The roads cost $47,500,000, or $62,000 a mile, and they are operated at an annual loss of $1,555,000. Instead of presidents and general managers the railways are operated by a railway commissioner who is not responsible to the people who pay the bills for shortness of receipts. The railways of South Australia were operated for a time under the commissioner system, but the colony has lately decided to abolish the office.

Almost every large railroad shop in England has one or more small switchers with a crane either swung around the dome or stack, the latter plan gets the crane at the front of the engine but requires the arch and stack to be made immensely heavy. These cranes are operated by steam, handled from the cab and are very handy, as they will go out into the yard and pick up anything weighing less than two tons and place it where wanted, particularly useful in loading pieces on cars.

A subscriber to Locomotive Engineering, who writes on the business paper of a bank, writes us: "I am not now, nor never have been a railroad man, but take your paper because I appreciate the valuable reading matter contained therein." It does not require a railroad man to enjoy reading the paper. Anyone who is conversant with engineering affairs can find interesting and profitable employment in the perusal of its columns.

We understand that the Chicago, Milwaukee & St. Paul have ordered the Walker smoke consumer for twenty-five locomotives.


Webb's Last and Largest Compound.

Some one has patented an invention which consists of deepening the needle beams of cars and making that a seat for the truss rods instead of the usual queen post. The patentee is already after some railroad companies for infringement. He ought to have some difficulty collecting the royalties. It is one of the most impudent patents we ever heard of being applied for. The practice of using the needle-beam as a queen post is nearly as old as car building. We are only surprised that some one does not get a patent on the diamond truck. Some combination could doubtless be devised that would be patentable, and superlative assurance on the part of an agent might lead some railroad managers to pay royalty for the sake of peace and quietness.

The best trains of the Great Northern of Ireland are lighted by electricity, there are four incandescent lights in each compartment. A storage battery system is used.

## Metropolitan Double Tube Injector.

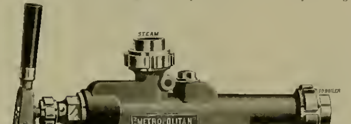
We hereby present to our readers a perspective and a sectional view of the Metropolitan double tube injector. This injector, as the name implies, is a double tube apparatus provided with an independent lifting appliance which, when the injector is working, constantly lifts the water and supplies the forcing apparatus. The benefits of this arrangement are numerous. It enables the makers to provide an injector that will always lift the water, no matter how hot the injector or the suction-pipe becomes, and they have found by experimenting that it never requires over thirty seconds to one minute to bring the water under the hardest conditions. It also enables the injector to start readily at 25 pounds steam pressure and work up to 250 pounds steam pressure without any regulation of the water or steam supply, and no matter how much the steam may vary, the injector cannot drop the water at the overflow. This injector will work hot water, and from experiments made, they find that with a steam pressure of 25 to [illegible] pounds the injector will take feed water at a temperature of 145 degrees Fahrenheit; with 125 pounds steam pressure it will take feed water at 140 degrees Fahrenheit, with 150 pounds steam pressure it will take feed water at about 135 degrees Fahrenheit, and with 200 pounds steam pressure it will take feed water at [illegible] degrees Fahrenheit. These results are wonderful and go to show the great range of this injector. Owing to this great range and the device employed to regulate the capacity, the capacity can be reduced nearly as much at 180 pounds as at [illegible] pounds steam pressure. Another curious feature is that the maximum capacity steadily increases as the steam pressure increases. In other makes of injectors the capacity is regulated by increasing or decreasing the water opening. This is not done in this injector, but instead, they increase or decrease the steam to the lifting apparatus. If it is necessary to decrease the capacity they throttle the steam to the lifting apparatus by means of the regulating valve (part 21; see sectional cut). The result is that less water is lifted, and consequently less water is forced. By employing this means of regulation, the injector will work as steadily when discharging its minimum as when discharging its maximum capacity. There is a stop in the regulating valve which is so set that the operator cannot break the feed by regulating too close.

The operation of the machine is very simple. The lever is drawn back slightly to lift the water, then pulled back as far as it will go. The construction is well designed. There are no outside attachments to break, wear or interfere with the numerous small attachments found in every locomotive cab. By referring to the sectional drawing it will be seen that the tubes are all removable from the back of the machine and can be removed without taking the injector off the locomotive. It will also be noticed that all the *valve seats* are removable and can be taken out for regrinding or replacing, thus doing away with placing the body of the injector in a lathe to turn up the seats. When the injector is working the overflow is closed and the valve is held to its seat by a pressure equal to the boiler pressure, and under no circumstances can the water run out of the overflow, and the engineer is not required to run his head out of the cab to determine whether the injector is feeding the boiler or the water is running out of the overflow.

This injector is manufactured solely by the Hayden & Derby Manufacturing Company, 111 Liberty street, New York.

The makers of this injector write:

"We placed the first one of these locomotive double tube injectors on an engine of the Central Railroad of New Jersey about a year ago, and when they placed the compounds of the "385" class on that road they were equipped with this style injector. These engines have been in constant service, and, as you well know, the service is a severe one for an injector. We are pleased to say that the injectors have given perfect satisfaction and the engineers are highly pleased with them, owing to their reliability and to the fact that at high steam pressure, as well as the lowest working pressure, the capacity can be regulated to suit the requirements of the locomotive for a light or heavy service. We now have about one hundred of these injectors in use."




## Proper Location of Machinery in Shops.

By W. S. Rogers.

The following paper was read at the November meeting of the New York Railroad Club:

Properly locating and arranging the buildings for a locomotive machine shop, where general running repairs and the usual overhauling may be done, and where, if need be, the completed engines may be built, is, beyond question, a work of utmost importance, requiring great care and study. But following the correct construction of the plant comes the proper location and arrangement of the machines and tools necessary in equipment an item of engineering requiring intricate and tiresome planning, tedious in its many small details, and, as a rule, to the progressive mechanic seeking perfection in shop practice and lowest shop expenses annually, very unsatisfactory.

The rearranging of an old plant to cheapen and shorten the production is also a work requiring no small amount of skill and display of mechanical wisdom, and can only be successfully carried out to perfect completion by one who is perfectly familiar with the strength and use of each and every machine and tool in the works, but he must be also acquainted with all the requirements demanded from the nature of the work, studying the methods in vogue and making all alterations and changes with only one object in view, that of cutting down the cost and time of producing finished results.

A battery of planers so placed that their frosted cross-rails and heads appear in perfect alignment from some central point of view in the shop is very pleasing to the eyes of an enthusiast for beauty, and they are also quite an advertisement for their builders, but to the man with practical ideas all harmony of operation is destroyed; he sees no such thing as beauty, for he knows the requirements of those tools in daily output of work, and he calculates the added expense of manual (or brute) labor needed in transportation of materials to and from other machines variously located and involved in finishing the product. Would it not be far better to have those planers distributed about the shop, whereby the heavy work would all be concentrated near machines adapted to it, and make as much saving as possible out of the annual allowance for shop expenses that the motive power and equipment might be the gainer thereby?

The lathes all standing in long lines by the windows or double lines with their backs together make a very imposing array of tools. We see them so arranged at expositions, etc.; but is it not better to disperse them about the shop? A large one in convenient proximity to a heavy planer or slotter, and the smaller ones grouped together in pairs in such manner that their carriages will face each other, thereby making it an easy matter for one man to run two machines without doubling the burdens already on him? Experience has taught the writer that a man can operate a heavy lathe and a planer or slotter satisfactorily and to advantage if the machines are conveniently located, and he also discovered that such combinations bring about the piece-work system in a very desirable manner.

Milling machines are usually grouped together—the idea being that most anyone can run a milling machine and attend to half-a-dozen others at the same time. All of which is about half true, but it takes so long to get the work to and from them, and so much time is lost in changing the machine to all the demands, that it takes really more time getting ready and getting there than it does to do the work. Consequently, much work that should be done on this class of shop equipment goes to other machines.

In some lines of manufacture, such as sewing-machine and gun work, these tools are kept in constant service and on one class of work—thus it is an easy matter for one simple, cheap man to operate several of them. In locomotive work it is different. I know of one machine in a locomotive-building plant that stands idle three days a week, while enough goes to other tools to keep it busy fourteen days a week. The reason being, simply, that it is located in the wrong part of the works. The same line of thought will lead to the proper distribution of the drilling machinery about the shop, also the axle lathe, wheel lathe and wheel press, whereby the materials will all concentrate at the right place and go on to their destination without clash, confusion or useless cost. No machine should be located in any part of a shop simply to fill a vacant space on the floor, or because it is as good a place as any. There is such a spot as the best place for it, and I would say, find that place and put it there if it requires the moving of half a dozen others to make room for it.

Another important adjunct and absolutely necessary evil to all first-class plants is the tool-room. Its importance demands that it should be convenient and easy of access to the employés at all times. The space it requires alone makes it the hardest to locate, and as a general rule it is the creator of more dissatisfaction than any item connected with the whole plant. A friend of mine once asked my opinion about the best place to locate the tool-room in the new plant he had established. I advised putting it in the northeast corner, and he did. Three years later I met him, and in the course of our conversation I inquired regarding the convenience of the tool-room's location. His reply fully illustrated the uncertainty always existing in the mind of a practical mechanic when this department of the shop's equipment demands attention. His answer was: "I have moved it to all four corners of the shop since I saw you, and now have it in the center of the place, and still it don't fit. My general manager suggested recently that I jack it up and run a set of trucks under it and take it out doors next."

I have seriously thought that when it falls to my lot to again locate a tool-room, to divide it up and put four or more smaller ones in as many parts of the plant with the small hand-tools in each necessary for the machines in their vicinity.

Taking, for example, the work on cylinders, planing, boring and drilling are the three distinct operations to be performed. If the planer is located near the boring lathe and in proper position, and the radial drill is also within convenient range, very little transient labor will be required to perform the three operations. We also will find that the man on the boring tool can also push along the planing and oversee the drilling, thus keeping all the machines in operation with the minimum of labor and in equally rapid time as if it was done the old way, with one man to each machine and one third of them waiting for work to reach them, as would be the case if they were isolated.

The important gains made by such methods are almost wholly in time, and if nothing else is earned this alone is money saved. If a piece of work (a set of guides, for example, of four driving-boxes) can be finished in six hours, it is the height of false economy to allow the time to be lengthened out an hour or two longer because the labor element is too busy elsewhere to take it from the machine. Far better will it be to move the machine to a more convenient location.

Following the work on the various machines closely, and having them so placed in positions with reference to the travels of the many parts of work through the shop toward finish and erection, thus avoiding all back-lash, confusion, delays and clashing among employés, means low cost of production, harmony throughout the plant, fewer names on the pay-roll, and large decrease in operating expenses with increased amount of work performed every year.

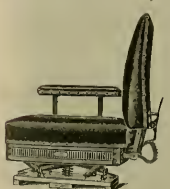
## The New Cab Seat, with Arm-Rest.

Now the boys have got it right! A long time ago the junior philosopher said that ... or any other seat would never be just right until the arm-rest was fast to it, so that when the seat made a sudden dive while the rider's elbow was on the arm-... it wouldn't tear him in two just where the fifth rib is spliced on the main frame

The Brotherhood seat has always been a good one—now it's simply perfect. No matter how one-sided you alight on it, the seat goes down and comes up "square"—no tilt in it.

The adjustable back is nice when you want it, and gets out of sight when you don't want it.

Anyone who cares for an engineer or ...man—and we suppose there are quite a ... who have certain ones they do care for—could not do them a better turn than to drop one of these seats into the lucky fel-



New Cab Seat.

low's Christmas sock, it's something they'd all appreciate, and then the makers, Stannard & White, of Appleton, Wis., are giving a year's subscription to Locomotive Engineering to every one who orders a seat before January 1st.

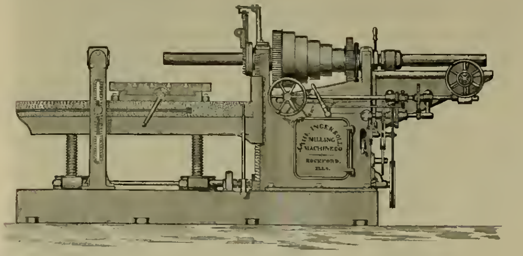
This seat is not expensive, is durable, and one that will save a man's bones many a hard jar

## Sixty-inch Horizontal Boring and Milling Machine.

This type of machine, so well and favorably known to most mechanics, is here shown in a much improved form.

As heretofore built, it was almost indispensable in any shops having accurate boring and drilling to do, the builders aim to make it quite so by excellence of proportion, workmanship and convenience of handling.

The driving cone has five steps for 4-inch belt, range, 8½ inches to 20 inches in diameter. The back gear ratio is 9½ to 1, giving much more power than has heretofore been the custom for this size machine. The spindle is 4½ inches diameter, of high carbon hammered steel. The socket is 3½ inches in diameter and tapered $\frac{1}{16}$ inch per inch. Traverse, 60 inches at two strokes, and is guided through a sleeve 46 inches long; usual quick return is provided. Cross table is three feet wide by four feet long, can be lowered to swing 46 inches, hand and power cross-feed is applied to this table in both directions and hand motion longitudinally, 4 feet 6 inches. The main table is 8 feet long 26 inches wide, provided with bolt slots for use when cross table is removed, cross table is movable by hand and power, and has vertically all the feeds common to the spindle and cross table. Elevating screws 4 inches in diameter. Feed motion of this machine will bear very close investigation. By use of the friction disk a very wide range of feed is obtained; this, we believe, has never been equaled before. The lever shown near the front hand-wheel gives the hand cross feed, hand elevating, hand spindle feed, or power spindle feed in its various positions The clutch lever, which is easily operated from the same position in which a man will stand in operating the lever near the front hand-wheel, controls the power to raise and lower feeds; these two levers being within the reach of the operator at one time control conveniently all the operations of the machine. Feed mechanism commands both table motion and the spindle feed in two directions, and when any one is in use there are no surplus parts revolving idly. The machine is especially adapted for end milling, or slab milling, or rack cutting within its range, and the hand-wheel is graduated to move the spindle by thousandths of an inch for this purpose.



New Horizontal Boring and Milling Machine.

The set of cutters illustrated show one of the many intricate forms in which our patent cutters have been made for milling special work. The slab milling machines are especially adapted for railroad work Any one interested in milling can obtain from the manufacturers of these machines, The Ingersoll Milling Machine Co., of Rockford, Ill., some very interesting data in regard to the time in which they will guarantee machines to mill a certain number of such pieces as crossheads, driving-boxes, truck-boxes, shoes, wedges, valves, etc.

They make a milling machine 36 inches wide to mill 8, 10 or 12 feet long, and are glad at any time to give any information which is within their power about this machine and appertaining to milling

## The Standard Electrical Dictionary.

A popular dictionary of words and terms used in the practice of electric engineering. By T. O'Connor Sloane; published by Norman W. Henley, 150 Nassau Street, New York. Price, $3.00.

The most progressive science of modern times is that of electricity. Every man connected with the operations of applied mechanics is every day being more and more brought into practical contact with electrical appliances. The discoveries and inventions relating to electricity are so numerous that it requires a diligent student to keep informed on electrical progress, and ambitious mechanics and engineers with other duties to attend to cannot burden their memories with the immense mass of details. But they can keep books of reference that will supply, when needed, all the information required

Among the numerous books offered to keep people informed on electrical matters we have rarely seen anything that equals in value the Standard Electrical Dictionary. The name does not describe the book properly, for it is more of an encyclopædia than a dictionary, since it gives detailed information about nearly every phrase and device connected with electricity

Professor Sloane, author of the book, is one of the most accomplished teachers of electricity in Europe, and his explanations are always reliable, besides being expressed in plain language that ordinary people can understand. The telegraph operator who interests himself in his business will find in this book facts well worth knowing about batteries, instruments, and all apparatus connected with transmission, the electroplater will find information relating to his art, the man with electric bells in his house can, by a little study, learn to detect the cause of failure to ring, and the man in charge of an electric lighting plant will find the dictionary the most valuable kind of a hand-book. Railroad men who are ambitious to post themselves on the science which is now operating so many railroad appliances will find the book a most valuable source of reference.

## Horizontal Radial Car Borer.

This machine is the latest in the line of boring machines. It will bore all kinds of straight or angle holes for car and bridge work, with the greatest rapidity and ease for the operator.

The column is one single column with the main roller frame resting on and bolted to the same. The vertical part of the column is made to revolve, the center of which is the center of the mandrel. It is also made to move in and out on the main column and also carries the spindle and slide moving up and down.

The rolls are 6 inches in diameter, all driven by gearing and friction operated by foot power. These rolls can also be driven by hand at the will of the operator.

The mandrel is of the best quality of steel, of large diameter, and has a vertical stroke of 26 inches, and a horizontal stroke of 24 inches.

New Horizontal Radial Car Borer.

The countershaft is placed above and provided with a new device, to allow the spindle to be driven at any position without any changes being made

For further information address the builders, The Egan Company, Cincinnati, Ohio.

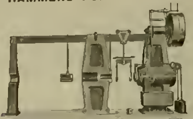
# BEMENT, MILES & CO., PHILADELPHIA, PA.

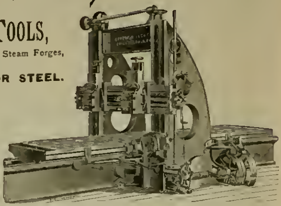
BUILDERS OF

## METAL-WORKING MACHINE TOOLS,

For Railroad Shops, Locomotive and Car Builders, Machine Shops, Steam Forges, Ship Yards, Boiler Shops, Bridge Works.

**STEAM HAMMERS FOR WORKING IRON OR STEEL.**



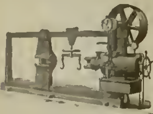


NEW YORK OFFICE: EQUITABLE BUILDING. GEORGE PLACE, Agent.

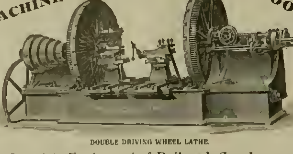
# NILES TOOL WORKS,

HAMILTON, OHIO.

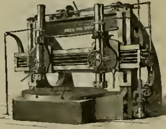
MACHINE TOOLS.



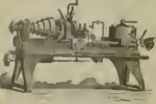
HYDROSTATIC WHEEL PRESS.



DOUBLE DRIVING WHEEL LATHE.



BORING AND TURNING MILL.



SCREW MACHINE.

HORIZONTAL BORING AND DRILLING MACHINE.

The Complete Equipment of Railroad, Car, Locomotive, and Machine Shops a Specialty.

New York, 136 & 138 Liberty St. | Branch Offices { CHICAGO, Phenix Bldg. PITTSBURGH, Lewis Block.

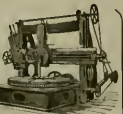
# WM. SELLERS & CO.,

INCORPORATED,

PHILADELPHIA, PA.,

## Manufacturers of MACHINE TOOLS,

Lathes, Planers, Drill Presses, Steam Hammers, Steam and Hydraulic Riveters, Punches and Shears, Bolt Cutters, Wheel Presses, Car Wheel Borers, etc., etc.



High Speed, Power, Traveling and Swing Cranes; Turn Tables for Locomotives; Testing Machines; Shafting, Pulleys, Hangers, Couplings, etc.

**THE SELF-ADJUSTING INJECTOR OF 1876 —AND— THE SELF-ACTING INJECTOR OF 1887**

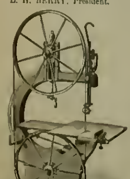
L. H. BERRY, President. L. O. ORTON, General Manager.

# BERRY & ORTON CO.,

ATLANTIC WORKS, { 23d and Arch Streets, Phila., Pa. 136 & 138 Liberty Street, N. Y.

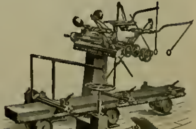
## WOOD WORKING TOOLS,

For Locomotive, Car Builders and Railroad Repair Shops. Let us send you catalogues, drawings or specifications before you order.



No. 0 BAND SAW.

Our Capacity has lately been more than Trebled.



VERTICAL RADIAL BORING MACHINE.


## A New Tire Remover.

Hank Colvin sat down behind the president the last time he called at the Ananias Corner, and listened attentively to the liar who was telling how he ran an old Hinkley 400,000 miles without turning the [illegible] and to the secretary as he related how he used to weld up broken tire, etc., at country blacksmith shops, but Hank can't listen long without saying something.

"Reminds me," said he, "in '56, when I was on the Lackawanna, we had a continual circus with the old wrought-iron tires, breaking, getting loose and being shimmed. They fixed up all kinds of schemes to heat tires, and at last one of the shop men thought of putting clay all around the 'fire pan' to keep from burning the nice red paint on the wheels, and also to make the fire 'draw.' The first rig of this kind was in full operation on the old 'Secaucus,' when in stumbled Sandy McPherson with about three gauges of sheep-dip in him. Sandy stopped beside his engine and looked at the clay for a minute, then he called up to his fireman in the cab: 'Hey, Jock, lad, coom doon 'ere, I'm a coo if they 'aint got to drawin' em off wi' poultices.'"

## Didn't Know Where He Lived.

On one of the Western lines Terrence Cunerty got on as engine house crew caller with the idea of some day running the engine of the day express.

Terrence wasn't much on the read, and it often took him a long time to spell out the names on the board and get his list made out.

One night train, 29, was marked up for 1.30, with Ames engineer and Stuart fireman. In the evening an order came to abandon the train. The foreman was in a hurry. He made a swipe at the names on 29's line, got only the fireman, and hurriedly wrote "Aband"—a common abbreviation.

Terrence came in here and scrawled "29 Ames" in his book, and then slowly spelled out the "Aband." several times. Terrence had got his job upon his oath that he knew where every railroad man in town lived, but "Aband" was a new one on him, so he went to the boiler washer and complained.

"Say, Bill, this ain't no fair show, some one is tryin' to down me; here's a new smoke shoveler put on and nothin' said to me about where he lives, but I'll fix him, blast his skin, I'll call the extra man, that's what I'll do. When they git the best of me they'll git up early in the mornin'. See?"

## A Satisfactory Excuse.

Superintendent Vreeland of the New York & Northern has a hard time keeping the cranks among his commuters in good humor when delays happen to Elevated trains that lead to the missing of connections. One day the express trains on the Elevated were late and some of the cranks who expected to meet trains from the city were indignant because the orders were given to start New York & Northern trains without waiting for the express.

"Why don't you hold your train?" exclaimed one of them to Mr. Vreeland. "I have friends on the city train, and it is shameful not to wait for them."

"Didn't you hear of the big children's parade at 145th street?" asked Vreeland. "You would not want the express train to run through that crowd and mash up the youngsters, would you?"

"O, I forgot about that," said the faultfinder, and he walked away satisfied, without reflecting that the children were in the street twenty feet below the express train.

## Novel Way of Keeping the Ports Closed.

"Speaking about the way of fixing up broken down engines," remarked Brother Casey, "there was a plan tried by Hiram Jones on the Michigan Southern & Northern Indiana that made some talk at the time.

"It was away back in—Oh, well, when the big strike happened on that road. Hiram just squeezed through as an engineer of a saw-mill engine, and when the strike happened he made up his mind that it was time to bloom out as a locomotive engineer. He got a trial easy enough and started out with an old Rogers engine. He did not go far when the crosshead on one side broke. He looked the engine over leisurely and decided that he could fix her to run on one side. The main rod was taken down all right. Next operation was to close the ports. This he did by pinching the engine till the rocker-arm stood in the right position. How to keep in that position was a mystery at first. Reflection brought forth a bright idea. He got a chain and with it secured the rocker-arm to the pump, taking care that it was firmly enough fastened not to move. Then he was ready to start the train.

"When Hiram got back to his saw-mill he spent a long time considering how it was that the rocker came to break off that pump. After years of thought he came to the conclusion that it was because the pump was too weak."

## A Railroad Men's Fishing Party.

When flowers were still in their bloom, you or one of your correspondents suggested that an article on deep-sea fishing would be seasonable. About the same time you gave particulars of a convention of master car builders and master mechanics that was held at Galveston, Tex., for the purpose of settling questions of interest in the movement of cars. There may not appear to be any intimate relation between the discussion of interchange of cars and deep-sea fishing, but things are not always as they seem, and it does not appear that your correspondents told all there was to be said about what was done when the M. C. B. and M. M. of the Sunny South met to settle their differences.

After the business session was over some evil-minded person persuaded the railroad men to enjoy the questionable pleasure of spending an afternoon in a deep-sea fishing expedition. With light hearts and jocund faces the whole party boarded a yacht of much sail and small beam and were soon scudding down the bay before a spanking breeze. Joy reigned supreme till the party got clear of the jetties, and then the tumultuous waves that smiled with the sunshine glitter, but tossed the craft with merry bounds, took the sense of fun and pleasure out of the thorough landsmen comprising the party.

A burst of laughter that rose from a group listening to one of Colonel Meehan's stories was checked by Frank Rearden suddenly jumping up and thrusting the upper portion of his person over the rail. "Smoked that strong cigar of McGee's a little too long," was the explanation given. Talk was scarcely resumed when Hancock nearly threw Siddons overboard in his mad rush to the rail. While he gazed in distress at the deep blue waters of the gulf he protested that Galveston oysters did not set well on his stomach. Mirth was now no more. The rail was quickly crowded with anxious faces poring into the briny deep and groans loud were uttered and many sighs that expressed a longing for the dusty shore.

Leeds, the big-hearted man whom everyone knows him to be, was leaning in sympathy over Player, who was trying to turn himself inside out.

"Do you feel bad, John?" asked Leeds. Player looked around with an injured air and asked: "Do you think I am doing this for fun, Pulaski?"

By this time Campbell was lying in the scuppers with Burke for a pillow, and Groves was urging Galbraith to try a swallow of salt water. The only difference in the condition of the company was that some were a little worse afflicted than the others.

While the captain of the yacht was roving about to give his cargo a full taste of the pleasures of "A Life on the Ocean Wave," the tide turned and the wind fell away. In vain he tacked and beat against the breeze. The more he tried to get back the further he drifted away from land, and there were good prospects of the party remaining all night "Rocked in the Cradle of the Deep." This was more than flesh and blood were equal to, and a steam-tug was engaged to put the party ashore on the extreme end of the jetty. The jetty is composed of rough stones with a narrow rail on top. It was now dark, and the shades of night covered the stumblings of this sad band as the party crawled along amidst many pitfalls in the three miles' journey to the city. None of the party carried home a single fish story.

M. C. B.

## Disposition of the Cow.

Mr. W. P. Brady, who is superintendent and general agent of the Mississippi Racine road, is very particular about having full reports of all stock killed, so that settlement may be made with the owners. A rule of the company requires that the section foreman shall report all stock found killed or wounded on his section and calls for detailed particulars. A cow was killed at Morse some time ago and the section foreman's report was very meagre. Mr. Brady wired:

"Patrick Dugan, section foreman, your report gives no particulars about the disposition of the Morse cow killed."

In reply to this Mr. Dugan answered: "The disposition of the Morse cow was very kind."

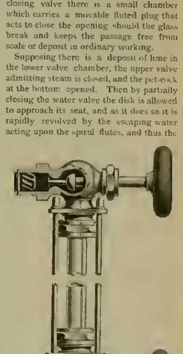
An improved form of safety-valve has been patented by Amos P. Kinney, Boston, and assigned to the American Steam Gauge Company. It is a combination of safety-valve with a valve-seat provided with an annular groove in its under side. Means are provided for pressing the valve to its seat against the pressure of steam beneath. A ring surrounds the valve and a pair of vertical rods extend upward through the casing and are connected on top by a yoke making a very compact and strong form of safety-valve.

## Ashley's Automatic Water-Gauge.

The annexed engraving illustrates a new form of water-gauge which possesses several features that commend it for use on locomotives. It will be found particularly adapted for the numerous roads that use feed water heavily charged with solid impurities, for it is designed to automatically clean out the lime deposits which so quickly choke up gauge-cocks. It also closes in case of the glass breaking, an arrangement that is very useful for locomotives.

In appearance the fittings are not unlike those generally in use, but behind each closing valve there is a small chamber which carries a movable fluted plug that acts to close the opening should the glass break and keeps the passage free from scale or deposit in ordinary working.

Supposing there is a deposit of lime in the lower valve chamber, the upper valve admitting steam is closed, and the pet-cock at the bottom opened. Then by partially closing the water valve the disk is allowed to approach its seat, and as it does so it is rapidly revolved by the escaping water acting upon the spiral flutes, and thus the



deposit is cut out all the way to the seat by gradually opening the valve. The gauges are highly spoken of by engineers who have used them. They are made in various sizes by the Ashley Engineering Company, 136 Liberty street, New York City, a full stock being carried.

A full edition of the Martha Washington Cook Book, 320 pages, well bound and illustrated, has been published by the Cincinnati, Hamilton & Dayton Railroad and is given away for 10 cents a copy. Send that sum in stamps to E. O. McCormack general passenger agent C., H. & D., Cincinnati and you will receive the cheapest book of the season. There are some new recipes in it for dishes that will make the Christmas dinner a memorable event.

A patent has been granted to D. H. Nichols, Boston, for a method of lighting cars by electricity. Two electric lights are set opposite to each other, at opposite ends, but at the same side of the car. There is a circuit for the lamps and two switches in the circuit. Reflectors are employed to distribute the light where it is wanted.

If you want a first-class watch of the best make and can't afford to spend the money, we will supply it for overtime. See the rear pages of this paper.

The Pennsylvania have started the Baldwins at work on forty-five new class "R" engines, consolidation.

## DAILY SALES OF WESTINGHOUSE ENGINES

DURING THE MONTH OF OCTOBER, 1892.

| Date | | | | H. P. |
|---|---|---|---|---|
| 1 | Phil. and Reading Terminal R. R., | 12th order, | Philadelphia, Pa., | 85-Comp. |
| " | " " | 13th " | " " | 85 " |
| " | " " | 14th " | " " | 85 " |
| " | " " | 15th " | " " | 85 " |
| " | " " | 16th " | " " | 85 " |
| " | Pittsburgh Chronicle Telegraph, | 3d " | Pittsburgh, Pa., | 60-Stan. |
| 3 | West Mich. Furniture Co., | | Holland, Mich., | 25-Jun. |
| " | H. Mueller Plumbing Co., | | Decatur, Ill., | 35 " |
| 4. | F. J. Parsons & Co., | | NinevehJunc., N.Y. | 15 " |
| " | Cochrane Chem. Co., | 3d " | Boston, Mass., | 35-Stan. |
| 5. | Crescent Steel Co., | 6th " | Pittsburgh, Pa., | 75-Jun. |
| " | Pennsylvania Tube Works, | | " " | 75 " |
| " | Dawson El. Lt. and P. Co., | 1st " | Dawson, Pa., | 75 " |
| " | " " | 2d " | " " | 75 " |
| " | " " | 3d " | " " | 35 " |
| " | Nicaragua Eng'g Co., | | Managua, Nic., | 10 " |
| " | Adam Blumer, | | Monroe, Wis., | 25-Stan |
| " | Bridgeport Copper Co., | 6th (kodak) | Bridgeport, Conn., | 100-Comp. |
| " | Westinghouse, El. & Mfg. Co., | 35th order, | Pittsburgh, Pa., | 330 " |
| " | " " | 36th " | " " | 130 " |
| 7 | Wm Clark Thread Co., | | Westerly, R. I., | 10-Stan. |
| " | United Gas Imp. Co., | 25th " | Philadelphia, Pa., | 75 " |
| " | H. J. Russell, | | Tekoa, Wash., | 50-Jun. |
| " | Evanston El. Il. Co., | 5th " | Evanston, Ill., | 100-Comp. |
| " | J. E. Reinecker, | | Chemnitz, Ger., | 85 " |
| " | Yuan Boyer, | | Ygualada, Spain, | 45 " |
| " | Yg. Y. Bertran, | | San Feliue, | 65 " |
| " | Jose Solderila Casas | | Balsareny, | 85 " |
| " | Jose Tubra, | | Castellar, | 200 " |
| 8 | Rourke, Strauh & Co., | | Knoxville, Tenn., | 35 Jun. |
| 10. | Pittsburgh Reduction Co., | 5th " | Kensington, Pa., | 330-Comp. |
| " | " " | 6th " | " " | 330 " |
| " | Detroit Citizens St. Railway Co., | | Detroit, Mich., | 260 " |
| 11. | Montgomery St. R'y, | | Montgomery, Ala., | 130 " |
| " | Columbian Exposition, | 5th " | Chicago, Ill., | 130 " |
| " | " " | 6th " | " " | 130 " |
| " | Odd Fellows' Hall, | 1st " | Philadelphia, Pa., | 85 " |
| " | " " " | 2d " | " " | 85 " |
| " | " " " | 3d " | " " | 85 " |
| " | First Nat. Bk. Bldg., | 1st " | Pittsburgh, Pa., | 45-Stan. |
| " | " " " | 2d " | " " | 45 " |
| 13. | Tacony Iron and Metal Co., | 1st " | Tacony, Pa., | 25 " |
| 14. | S. D. Warren & Co., | 26th " | Yarmouthville, Me., | 85-Comp. |
| " | W. O. Wildermuth, | | Pomeroy, Ohio, | 5-Jun. |
| " | F. Glazier & Son, | 2d " | So. Glastonbury, Ct., | 25 " |
| 15. | Union Hardw'e Co., | | Torrington, Ct., | 100-Comp. |
| 17. | Johnstown Pass. Railway Co., (kodak) | | Johnstown, Pa., | 330 " |
| " | Rust & Mason, | 2d " | Forest Mills, Minn., | 65 " |
| " | Shaw Stocking Co., | | Lowell, Mass., | 10-Jun. |
| " | Kalamazoo Paper Co. | 2d | Kalamazoo, Mich., | 75 " |
| " | Unknown, | | Moscow, Russia, | 35 " |
| " | " | | " " | 25 " |
| " | " | | " " | 15 " |
| 17. | Unknown, | | Moscow, Russia, | 35-Stan. |
| " | " | | " " | 25 " |
| " | " | | " " | 15 " |
| 18. | O. B. Shallenberger, | | Rochester, Pa., | 15 " |
| " | Irvin Van Wie, | 9th order, | Syracuse, N. Y., | 15 " |
| " | R. D. Nuttall & Co., | 2d " | Allegheny, Pa., | 15 Jun. |
| 20 | Fontaine Crossing Co., | 8th " | Detroit, Mich., | 5 " |
| " | Roberto Law, | 4th " | Monterey, Mexico, | 5-Stan |
| 22. | Standard Oil Co., | 3d " | Bayonne, N. J., | 35 " |
| " | Hoyle, Harrison & Kaye, | | Philadelphia, Pa., | 25 " |
| " | Alex. McLaren, | | Osceola, Ont., | 50-Jun. |
| 24 | E. B. Hillman & Co., | | Kahoka, Mo., | 50 " |
| 25. | Spreckles Sug. Ref'y, | 64th " | Philadelphia, Pa., | 75-Stan. |
| " | " " | 65th " | " " | 100 " |
| " | " " | 66th " | " " | 100 " |
| " | " " | 67th " | " " | 100 " |
| " | " " | 68th " | " " | 100 " |
| " | Otis Falls Pulp Co., | 2d " | Otis Falls, Me., | 5 " |
| " | Charleston Gas and Electric Co., | 2d " | Charleston, W. Va., | 330-Comp |
| " | Rob't Mitchell Furn. Co., | | Cincinnati, Ohio, | 50-Jun |
| 26. | Long & Marvin, | | Glenville, Minn., | 35 " |
| " | William Knight, | | Chicago, Ill., | 35 Stan. |
| " | Tacony Iron and Metal Co., | 2d " | Tacony, Pa., | 10 " |
| " | Justice, Bateman & Co., | 2d " | Philadelphia, Pa., | 15 " |
| 27. | Moore, Arms & Thompson | | Bellows Falls, Vt., | 75 " |
| 28 | Balt. Elec. Refin. Co., | 5th (kodak) | Baltimore, Md., | 100-Comp |
| 29. | Balt. Traction Co., | (kodak) | " " | 260 " |
| " | Penoles Mining Co., | | Mapimi, Mex., | 10-Jun. |
| " | Ott, Mergenthaler & Co., | | Baltimore, Md., | 50 " |
| 31. | Globe Furniture Co., | | Northville, Mich., | 75 " |
| " | Cohannett Mills, | | Taunton, Mass., | 5-Stan. |
| " | Gaiety Bijou Theatre, | | Boston, Mass., | 5 " |
| " | Niag. Falls Paper Co., | | Niagara Falls, N.Y., | 35 " |
| " | Waters-Pierce Oil Co., | | St. Louis, Mo., | 50-Jun. |
| " | Colum. Exposition, | 7th order, | Chicago, Ill., | 330-Comp |
| " | " " | 8th " | " " | 330 " |
| " | Unknown, | | St. Louis, Mo., | 50-Jun. |
| " | Westinghouse Machine Co., | 10th " | Pittsburgh, Pa., | 25 " |
| " | Kahn, Lang & Co., | | Epinal, France, | 65-Comp |
| " | Monongahela Furnaces, | 1st " | McKeesport, Pa., | 5-Stan |
| " | " " | 2d " | " " | 5 " |
| " | Carnegie Steel Co., | 16th " | Pittsburgh, Pa., | 5 " |
| " | Allegheny Co. Lt. Co., | 54th " | " " | 5 " |
| " | " " | 55th " | " " | 5 " |
| " | Otis Falls Pulp Co., | 3d " | Otis Falls, Me., | 5 " |

## SUMMARY.

| | | | |
|---|---|---|---|
| 33 Compound Engines, | aggregating | 5185 | H. P. |
| 35 Standard | " " | 1180 | " |
| 30 Junior | " " | 1160 | " |
| TOTAL, 98 ENGINES, | aggregating | 7525 | H. P. |


(108) R. C. Buffalo, N. Y., says

In an engineering book I read lately, the expression vis-viva is often used. What does it mean? *A.*—It means the mechanical or "kinetic" energy of a body in motion.

(109) Inventor, Pittsburgh, Pa., asks

How much saving of fuel do you think I could gain by putting a jacket around the smokebox and smoke-stack, and leading heated air from there to the ash-pan. *A.*—None.

(110) J. B., Chicago, asks.

Why is it that one can start a screw with a long screwdriver when you cannot move it with a short one? *A.*—With a long screwdriver the inclination off the perpendicular gives increased leverage.

(111) J. E. T., Chatham

What course do you recommend to fit a boy leaving school as a first-class mechanical engineer, either for railroading or other purposes? *A.*—Go into a shop and learn the machinist trade, and then attend the classes of a good engineering school.

(112) F. H. R., Philadelphia, writes

I claim that George Stephenson, the inventor of the locomotive, was the inventor of the Stephenson link motion, but some of the men in the shop say I am wrong. We decided to refer the dispute to you. *A.*—The link motion was invented by an apprentice in the Stephenson works at Newcastle, England, named Williams, and put into practical shape by a pattern-maker named Howe, in the same works. It was applied experimentally to one of the Stephenson locomotives and to the surprise of the leading engineers of the time, it was a great success from the first. Stephenson had no hand in the invention. It is a mistake to speak of George Stephenson as the inventor of the locomotive. He was merely a prominent improver of the engine.

(113) J. S., Jackson, Tenn., writes:

We have several Rome engines and the point in suspension of the saddle-pin is $\frac{11}{16}$ inch out of center. The radius is 100 inches, plade-pin holes $11\frac{1}{2}$ inches apart. The engine uses more steam in back end of cylinder than front. I would like to know the rule by which they get the pin set back $\frac{11}{16}$-inch. We take half the distance between the centers for the saddle-pin. *A.*—The correct location of the saddle-pin to insure an equal cut-off in both strokes is a much more complex problem than our correspondent realizes. A variety of parts of the engine's machinery influence the location of the saddle-pin. Among these might be mentioned the ratio of crank to length of main rod, the radius of link and the location of the blade-pins, the length of the link-hangers and the location of the tumbling shaft. Besides these the angular advance of the eccentrics and the travel of the valve have to be considered. Full particulars of this problem may be found in Meyer's "Locomotive Construction" or in Sinclair's "Locomotive Engine Running."

(114) J. D., Chicago, Ill., writes

One authority asserts that it requires from $3\frac{1}{4}$ to 4 pounds of air per pound of coal for perfect combustion, while another claims that it takes 12 pounds for perfect combustion and 24 pounds as it takes place in the locomotive. Who is right? *A.*—Combustion is the chemical union of carbon and oxygen and the combination of 12 parts by weight of carbon to 32 parts by weight of oxygen. It takes 4.35 pounds of atmospheric air to supply one pound of oxygen, so it will take close on 12 pounds of air to provide enough oxygen to combine with one pound of coal. In the rapid combustion of locomotive fireboxes, the burning fuel has to be saturated with air, and it is calculated that complete combustion cannot be maintained unless from 20 to 24 pounds of air is passed into the fuel for every pound of coal burned. 2. Do different kinds of coal require different quantities of air? *A.*—Yes. The quantity of carbon or hydro-carbons present in one quality of coal may require more or less air than coal with different constituents. There are also certain qualities of coal of a refractory nature that seem to need a hurricane of air blowing into the mass to effect combustion. 3. What percentage of the air that is admitted to a firebox escapes through the stack and what percentage is consumed during the operation of combustion? *A.*—The coal that burns enters into combination with oxygen in the proportion of 12 to 32, or 12 to 16 if the supply of air is restricted. All the air not deprived of its oxygen by combustion in the proportions mentioned passes out through the stack.

(115) John Strouse, Bellwood, Pa., writes

Could you inform me if a Baldwin four-cylinder compound, high-pressure cylinder 13-inch, low-pressure 22 x 24-inch stroke, is equal to a simple engine 20 x 24 inch, both of same general dimensions? *A.*—In reply to this and several others of the same character, we append a letter from the Baldwin Locomotive Works on this subject. "The formula is the same in principle as that for calculating the tractive power of a single expansion locomotive. The formula for single-expansion cylinders is the square of the diameter of the cylinder multiplied by length of stroke multiplied by the mean effective pressure on the piston and divided by the diameter of the wheel. The result is the tractive power. For example: The tractive power of a 20 x 24-inch cylinder with 48-inch wheel and 100 lbs. mean effective pressure would be $\frac{20^2 \times 24}{48} \times 100 = 20{,}000$ lbs.

"For a compound locomotive a formula on the same principle is used, as follows: Assuming the diameter of high-pressure cylinders as 13 inches and that of low-pressure cylinders as 22 inches, we have

$$\frac{13^2 \times 24 \times \text{M.E.P.} + 22^2 \times 24 \times \text{M.E.P.}}{\text{diameter of wheel}} = \text{tr. p.}$$

The diameter of piston of driving-wheel and the length of stroke are to be expressed in inches. The mean effective pressure in the low-pressure cylinder must be arrived at empirically, and experience has shown that it may be taken at

$$\frac{\text{M.E.P. in high pressure cylinder.}}{2.7}$$

In designing the engine, however, the diameter of the high-pressure cylinder is found by allowing a ratio of 3 to 1 in the proportion of the squares of the diameters of the pistons as near as even sizes will permit."

## Recent Express Locomotive Practice in England.

By Hugh Sharp.

It is curious to note that English and American express locomotive practice is each year becoming more divergent. About twenty years ago it seemed as if the two types were losing their distinctive features and were approaching a common standard. In England the bogie was extensively introduced, outside cylinders were increasingly employed, large single driving-wheels were generally replaced by coupled wheels of more moderate diameter with equalizing beams between the springs, and although the characteristic slab framing was never departed from it was generally placed inside the wheels, which was not the usual practice before 1870. But the modifications here noted were mostly made under protest rather than from conviction. This especially applies to the coupled driving-wheels. English designers have always had a strong predilection for single drivers, but the increasing weight of trains demanded increased locomotive power. The single engines which were usually employed for express service in 1860-70 lacked adhesion; nor were heavier engines of the same type admissible, for the comparatively light iron tracks of those days were unequal to carrying a greater load concentrated on a single pair of wheels. A coupled engine was the logical outcome of these conditions, and although such engines had existed in England, they were now employed almost exclusively. In the meantime great improvements were being made in the manufacture of steel. Steel rails soon became as cheap as the iron rails with steeled surfaces hitherto employed, besides being far more durable. The principal railway companies began to relay their tracks with steel rails of a considerably heavier grade than the iron ones they replaced. The greater strength of the improved roads afforded an opportunity for the re-introduction of the favorite single engine with its driving-wheels more heavily loaded than heretofore, and from the table given further on in this article it will be seen that this type represents the most recent practice in England except where the grades are unusually heavy.

It has been said that the bogie came into extended use in England about 1870, but during the last decade there has been a marked reaction in favor of a rigid wheel-base. On inferior tracks, even where the curves were not severe, the bogie had been found to greatly assist the easy running of the engine by solidifying the tracks for the drivers to follow on. With the improved tracks this advantage disappeared, and the bogie is only retained now where a flexible wheel-base is necessary to prevent the excessive wear and tear on the leading tires in passing round curves at high speeds, with the additional risk of derailment. Nor had outside cylinders been employed from any conviction that this position was the better, but simply to avoid the expensive and, at that time, unreliable cranked shaft, which latter quality was becoming increasingly apparent with the greater demands made on it by higher pressures and larger cylinders. There, again, the improved manufacture of steel applied to these shafts as it had to rails. They became cheaper, and failures were rare, so inside cylinders were again adopted where they had been discarded, just as the single drivers had again replaced coupled. (In connection with inside cylinders it should be remembered that all engine sheds and repairing sheds in the old country are very completely equipped with pits, and dealing with inside motion under these conditions is not inconvenient.)

The drift of English practice seems to be toward a locomotive with a single pair of driving-wheels between 84 and 92 inches in diameter, and a pair of 50-inch leading and trailing wheels (rigid) with outside journals. The Great Western engine is thoroughly characteristic of modern English practice and represents the class employed for working the celebrated "Flying Dutchman." This engine has outside journals throughout, double slab framing of unusual depth, weighs in working order 100,000 pounds, with 40,000 pounds on the drivers, the working pressure is 165 pounds, and the total heating surface 1,440 square feet.

Express Locomotives with Single Driving-wheels in 1892.

Great Western—Cylinders, 20 x 24 in., driving-wheels, 92 in. Six-wheeled engine with inside cylinders and rigid wheel-base.

Great Northern—Cylinders, $18\frac{1}{2}$ x 26 in., driving-wheels, 90 in. Six-wheeled engine with inside cylinders and rigid wheel-base. Previous type had outside cylinders, single driving-wheels and leading bogie.

Northeastern—(Compound. Worsdell and Van Borrie's patent)—Cylinders, 28 x 24 in. and 18 x 24 in.; driving-wheels, 92 in. Eight-wheeled engine with inside cylinders and leading bogie. Previous type was a simple engine with coupled drivers and a leading bogie.

Midland—Cylinders, 19 x 26 in., driving-wheels, 90 in. Eight-wheeled engine with leading bogie and inside cylinders. Previous type was otherwise similar, but had coupled driving-wheels.

Northwestern (Webb's patent)—Cylinders, 15 x 24 in., 15 x 24 in. and 30 x 24 in., driving-wheels, 86 in. This engine, the "Great Britain," has two pair of disconnected driving-wheels. The leading pair are actuated by the single low-pressure cylinder placed inside frames beneath smokebox. The second pair are actuated by the high-pressure cylinders, which are outside the frames. There is one pair of carrying wheels with radial axles beneath the smokebox, and a second pair behind the firebox, with straight axles.

These five companies probably have a greater mileage to their credit than any other ten in England, and their practice may therefore be taken as representative. During the last decade, the writer knows of no company, except the Great Eastern (not in the above list), which has substituted coupled wheels for single. Of course, all these companies use coupled engines extensively, but it is a noticeable fact that, for their fastest and heaviest traffic, single engines are employed.

Compounding is losing headway in England. It has been experimented with extensively, but at this time only two companies, the Northeastern and the Northwestern, continue to build compound engines. The locomotive superintendents of both these companies are the patentees of the respective systems of compounding employed on their railroads.

The writer has purposely refrained from drawing any comparisons between American and English practice. It is beyond the scope of this article. But in conclusion one reference to this subject will be made: The conditions, as regards speed, gradients and weight of trains, are practically similar on the New York Central, the Great Northern and the Great Western railways, whereas the English and American engines employed for these services are about as dissimilar as they can well be.

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Considerable attention was excited at the last Master Mechanics' convention in a piece of steel exhibited by Mr. W. Smith, superintendent of the Chicago & Northwestern. The steel had been in a firebox for twenty years and had shown no tendency to crack. The makers of crucible steel claimed that it was their product. Mr. S. Wellman, of the Wellman Steel Company, has lately investigated the matter, and gives plausible reasons in support of the belief that it is open hearth steel.

## Locomotive Running Among the Bushwhackers.

BY OLD SOLDIER.

About the latter end of 1863 the government sent to Nashville what they called a stray dummy. I think they got it from the Pittsburgh & Fort Wayne road. Well, it was used for a kind of an inspection car. I was assigned to run it as engineer and conductor We had a porter, cook and waiters

General Grant and some of his staff came aboard, and we started for Chattanooga on a tour of inspection, but we did not get any further than Bridgeport, and we were three or four days making that place on account of inspecting. After arriving at Bridgeport the General and staff proceeded to Chattanooga.

I had better tell you here why I did not get through. It was because the Johnnies held the road from Bridgeport to Chattanooga—a very good reason for not pulling General Grant on their road.

I remained there at Bridgeport for four or five days, when he came back and got aboard of his car and we proceeded back to Stevison. The Memphis & Charleston road crossed us there. This run on the military roads the boys used to call going around the "Horn," as this run was from Stevison to Huntsville, and over the Nashville & Decatur road to Nashville. The run was almost always from Nashville, over the Nashville & Chattanooga road, to Stevison, then over the Memphis & Charleston to Huntsville, then down the Nashville & Decatur road Well, as I said before, the General went down the Memphis & Charleston road and about seventy-five miles down the Nashville & Decatur road, and then back to Bridgeport. There I left him and he proceeded on to Chattanooga and Knoxville. I returned to Nashville with my dummy. I had the car full of sick officers. We arrived at Nashville at night.

This car was a great curiosity to the natives and the negroes. I gave it up on my arrival at Nashville and took the passenger train to Chattanooga. This passenger run I considered the best run on the road, as we did not have to go around the "Horn." I almost forgot to mention here that in cold, wet winters both armies went into winter quarters. The bushwhackers enjoyed themselves more in the winter than in the summer, as then they raided the country and captured both wagon and railroad trains and made it a point to keep both armies in hot water.

The railroads had about the same business while the army was in winter quarters as when on the march in active service. After General Grant made his inspection of the Army of the Cumberland and left it in command of General Sherman, he went to Chattanooga, Knoxville and Atlanta In the meantime the Rebs had sent a brigade to hold the Nashville & Chattanooga road between the Tennessee River and Chattanooga for, although we had Chattanooga, they kept us from operating the road. I think General Grant was ordered to Washington City to take command of the Army of the Potomac and he telegraphed the superintendent to have me with my engine to take him from Stevison to Nashville on a special. I met him with one baggage car and a coach. Old Jesse Cinceebaugh was conductor of the train. We got orders that all trains would be side-tracked for us, and as far as possible we would have clear tracks.

I should have told you in the start of my reminiscences that the Louisville & Nashville road was the first military road opened out of Nashville. While we operated both ends of this road the Rebs operated the middle, but we soon cleared them out and got the whole road At the time that General Grant went South the L. & N. had been turned over to the company, and it was operated by the company, and only in case of danger was it in any way used for the military excepting carrying government stores. No military orders went on the road. They were running regular passenger trains.

The morning train left at 7.30 A. M. General Grant and party, with myself at the throttle, left Stevison about 11 P. M. It was at about this time Cumberland Mountain was a hot country for sharp-shooters. We left with orders to make it as quick as we could, and to be sure and make connection with the L. & N. train at Nashville. Well, I had a good, old-time Roger engine, 15 x 22, with 5½ foot wheel, only two cars, and about fifty soldiers for guard. I suggested to General Grant before we left Stevison to get from prison some rebs and sit two on each side of the tank, so that I might have some protection for myself and fireman, but General Grant said "No, Mr. Engineer, we do not want to freeze prisoners to death in that way."

Now do not imagine that I am heartless because I mentioned this idea. I knew the night was so cold that no man could stay out all night and not freeze, especially while running I wanted them for company and would have taken them in the cab, as I felt almost sure we would be captured, and I so expressed myself to General Grant. He said that was the fate of war, and if we were captured we could sell our lives dearly unless we were ditched and crippled. I answered him that I was not afraid, for if I was I would not be there.

This talk all happened while we were waiting for orders When we got them, away we went My engine was good for two coaches up the Cumberland Mountains. They always kept a pushing engine at the foot of the mountain to push trains up, and of course the mountain was pretty well guarded at this time, but no extra guard on account of this train as no one knew we were coming except the operators, and they did not know it was General Grant. All they knew was they had orders to hold all trains and clear the main track, so it was kept very quiet about General Grant going over the road on a special, and I guess it was a good thing it was kept quiet, as almost any Johnny would have tried to capture him at this time, although none of us knew he would be made a full General and then President, as you all know he was afterwards.

When I arrived at the foot of the mountain all trains at that point were side-tracked. Of course I struck all side-tracks with train under control. We did not have the air-brake as we have now. When I found track all clear I pulled out. I was very short of wood in my tender, and I knew she would chew it up pretty fast going up the mountain. I knew where I had passed a good cedar-wood pile, going down the mountain. The fireman told me that all of our wood was gone excepting what was in the fire-box. I told him she would make the pile I expected to get, and so she did, but when I got to where it had been the wood was gone. I knew of another pile about two or three hundred yards ahead of that, but I could not get another car length on that mountain as my fire and steam both were low

Old Jesse and the porter came out in order to throw on wood. He claimed I stopped in the wrong place. I told him I began to think so, too, as there was no wood there, but I told him there was a pile there the day before but some one had gotten it I told him there was another pile about two or three hundred yards ahead, and that if I could cut the engine loose I could make it. Then the Captain of the guard jumped out and said we could not cut the engine loose unless General Grant said so. I told him to go back quick and ask the General, which he did, and he was told "not to let us cut loose"

General Grant himself came out. I told him the situation, and he said we must not cut the engine loose, but suggested we back down the hill.

I told him we could not do that as other trains had left at the foot of the mountain.

"Well," he says, "what can we do in this case?"

I told him we could run the empty engine up and get the wood.

He said, "No."

"Well, then," I says, "send the train guard, or some of them, say about ten men, and let each man bring an armful of wood."

He told the Captain to take the men up and get the wood for the engine I told him I would go along with them, but he said no, I must stay with the train and engine I told him all right, I would stay, and so would any of you if you had been in my place, because he was not a man to hold an argument with. At this time he took particular pains to examine and see where I showed the place for the wood-pile to have been, and if he had not seen the stakes and bark off the wood, I am afraid it would not have fared well with me at that particular time

I pulled up the stakes that had racked the wood up and carried them up to the engine and threw them in the firebox. I had two tank-boxes made of wood and I took them also. I told the General that I had burned up all the household furniture and that was all I could do That kept up fire and steam until the first soldier got to us with an armful of wood. The soldiers came in pretty fast, as we all wanted to get away from that place, and I have often thought since that if the Johnnies had thought of General Grant being there at that time of night they would have risked their whole army to catch him, and I think General Grant thought so too. I was very well acquainted with him, and that was the first time I ever saw him nervous. He remarked a couple of times that it was a hard looking place. You could not see bottom below, nor could you see the top of the mountain We were about three-quarters of a mile from the mouth of the tunnel. The guards were stationed at the tunnel, but patrolled the track on the mountain. Of course I knew this and told the General of it, which I think made him feel better, for he remarked that if we were captured, his chances were better than mine, especially if Dick McCann or Forrest got us. I did not think that Forrest or Dick McCann was on that mountain, and they were the only Johnnies I feared.

Well, I got a good tank of cedar wood, and then I told the General I would have my way clear now, if I did not go in the ditch. My delay there must have been about one hour, so I had to hustle to make the connection, and you just bet that little old Roger engine flew after I got my side of the mountain. All the telegraph offices were asked about the special and they answered that something had just flew by which they guessed was the special. Well, we made the connection at Nashville, but not much time to spare. I took him across the trestle to the L & N. depot. If the General were living to-day he could describe this trip better than I can. The night was bitter cold.

There is one little instance I forgot to mention. Coming down Raines' cut, near Nashville, the water, which had been falling for nearly a month, ran over the rocks and froze solid. I was running as fast as I could when the coach the General was in swung over and struck the ice. This so frightened the General that he jumped up and declared that the coach had turned over, when the brakeman ran up and told him she had only swung over and struck the ice and that all was safe Well, as I said before, when he came to me in the L. & N. depot at Nashville and bid me good-bye, he congratulated me on my safe trip. I told him I thought our safe trip was owing to the extreme cold night. He gave me a bottle of good brandy and a $5 gold piece and a good cigar. He did not tell me what he was going to Washington for, and I doubt if he knew himself at the time, as he said that if he came back to the Army of the Cumberland he would look me up if I remained there You all know he never came back to the grand old Army of the Cumberland, but I guess Lincoln and Stanton thought they placed him in charge of a grander army, well, perhaps it was, but I cannot think so. I have been told that the engineers in the Army of the Potomac had their cabs iron-clad. We had none of this, but ran our engines with open cabs. I do not tell this to brag, nor to say that we were braver than the Eastern military engineers As for myself, I never took an engine that I did not notice the thickness of her dashboard, and always made it a point to keep as little wood in the tank as possible, and never to allow a fireman to build a very high fire-rack, for the well of the tank was very good breast-works for bullets.

I never saw General Grant but once after that trip, and that was when he was on his Southern tour in this country. Then I could not get up to speak to him, everybody and anybody turned out to see him We have a few cranks in the South, as you do in the North and East, but not quite so many. I could have seen and talked with him that night, but one of those cranks kept me from it, as well as a good many old vets. I will not explain here, as a good many people might misconstrue my meaning and cast reflection on the Southern people, who, I assure you, are among the noblest works of God's people.

The night that General Grant spent in this town he was guarded closer by the old rebel vets than by the Federals.

You can all rest assured of this, for I was there and know of what I speak. The hotel where he stopped was guarded by rebels and Yankees as long as he remained. This was all caused by two cranks of this town that never smelt powder, and I think General Grant left here none the wiser that he had been guarded while on his visit.

## Early Railway Traveling.

The first regular train service in England commenced on the Liverpool and Manchester Railway on Friday, September 17, 1830, two days after the opening of the line. It was not on a very ambitious scale, three trains each way on week days and two on Sundays were deemed quite sufficient. The novelty of the thing, however, at first and very soon its proved safety and efficiency, led at once to a much larger traffic than had been anticipated, and as soon as the company could obtain more rolling stock the service was increased.

For a time people who had ventured to risk their lives by the new mode of conveyance were the objects of admiration for their courage or of contempt for their foolhardiness, but one by one the coaches had to be taken off the road, and everybody went by rail.

The time occupied in the journey was at first seldom more than two hours and often less, the distance being thirty-one miles, but even this rate was too fast for some people, for a gentleman, writing about six weeks after the opening of the line, says the speed was too great to be pleasant and caused him to feel somewhat giddy.—*Cornhill Magazine*

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We found a very ingenious and useful practice in shop whitewashing followed by Master Mechanic McKenzie, of Oakland, Cal He mixes the whitewash in an old air drum, passes a perforated air-pipe through the mixture, puts on a good pressure of air, and leads a hose from the top with a perforated cap. This is directed toward the parts to be whitewashed and a thin spray of the mixture is applied. Any one wanting to use this remedy for soot-covered walls and ceilings can obtain full particulars from Mr McKenzie The work is done quickly and at small cost.

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One of the eight-wheel Rhode Island compound engines, recently bought by the Minneapolis and St. Louis Railroad, is now being thoroughly tested on the Chicago division of the C., R. I. & P. R. R.


No. 1.


No. 2.


No. 3.


No. 4.


No. 5.


No. 6.



No. 7.


No. 8.

Your choice of any of these cases with Premium No. 1. All are 14-karat gold with the guarantee shown. State plainly the make of movement you choose and the number of case.


No. 9.


No. 10.



No. 11.


No. 12.


No. 13.


No. 14.


No. 15.


No. 16.

Your choice of these 10-karat cases with Premiums Nos. 2 and 3 with this guarantee. Pick out the case you like best and order the works by NAME, the case by number.

# Locomotive Engineering.

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### GENERAL.

## CORRESPONDENCE.

# INDEX. PERSONAL POINTS.



## ASKED AND ANSWERED.

[*The figures noted in this department relate to the number of the question asked.*]



## NEW BOOKS.

# LOCOMOTIVE ENGINEERING

A PRACTICAL JOURNAL of RAILWAY MOTIVE POWER AND ROLLING STOCK.



VOL. VI, No. 1. NEW YORK, JANUARY, 1893. 20 Cts. Monthly. $2.00 Per Year

## The Best Shop I Saw in England.

[EDITORIAL CORRESPONDENCE.]

If Crewe is the largest railroad works—you never say shop in England unless you mean a store—those at Horwich are the most modern and the best.

Horwich is a little mite of a village, about nine miles from Manchester, where the Lancashire & Yorkshire road have located their main sho—works

ERECTING SHOP LANCASHIRE & YORKSHIRE RAILROAD, HORWICH, ENGLAND.

These shops run lengthwise down a green little valley, a mile or so to the side of the main line, and being new and very extensive present a fine appearance.

The buildings are of red brick with stone trim, iron truss roofs, etc. They are arranged in three rows, each row being one building harmonious in size, etc., on the outside

The office stands at one corner of the large inclosure with a little park in front of it, beyond this is the stores and paint shop; further along at the back of the inclosure, and fronting on its end, the erecting shop stands, and a grand one it is. This splendid building is 117 feet wide and 1,500 long, of course it has several fire-proof partitions, but it is a beauty to the eye of the railroad-shop man.

This shop is served by the best specimens of rope-driven cranes I have seen, a good view of which is had in the illustrations shown herewith; they were built by Hetherington & Co., of Manchester, and there are enough of them to prevent delays in so big a shop.

Our front-page picture was taken at one end of the shop and shows just half its width; the style of roof and iron structure that carries the cranes are well shown.

As can be seen, between the two pit tracks there is a central track for the temporary storage of wheels and other parts of engines undergoing repairs, the cranes having head room enough to swing a locomotive over anything placed on this center track; beside the pit tracks there runs an 18-inch gauge for little engines such as described in article last month on the Crewe works

You will note chalked on an axle in the center track "Bent Axle", it is the custom when dismantling an engine to mark defects that might possibly be overlooked. The picture on page 3 shows the other end of the shop, looking at the front of the engines. Note the row of vises down the left side of the building I couldn't help noticing the great number of vises in all European shops, and all of them say as plain as A B C, "hand fitted"—you might as well brand the engines so—it means scraped joints and ground seats and reamed and lapped holes and filing—ah, it makes one's arm ache just to think of it

Immediately behind the paint shop, but back about 300 feet, running parallel with the erecting shop, is the machine shop, this shop is 110 feet wide and 110 feet from the erecting shop. It contains most of the machine tools, is served by overhead cranes, but has all through it that great convenience so seldom found in an American shop, the traveling jib crane. This device travels on a single rail, only occupying 18 inches of aisle room, it is supported by a girder rail above and driven by a rope. The operator sits on the frame and by handling one wheel runs the crane forward or back, swings the jib and lifts and lowers loads of moderate weight—as heavy as any piece about a locomotive except the boiler This crane is often called a "walking crane."

A great many manufacturing operations are going forward in the machine shop, for Horwich, like all the other British main works, makes pretty nearly everything the road uses.

They don't roll their own rail, but they do roll the merchant-bar and some plate, they make their own track chairs, frogs, switches, signals, etc., cut their own nails, make their own screws, build their own telegraph instruments, etc., etc.

One hundred and ten feet from this shop stands another building some 1,300 feet long and 110 wide, this is divided from the end toward the office as follows: boiler shop, smithy, forge, and foundries.

The steel foundry is a large and important part of these works, and the L. & Y. engines contain more pieces and more pounds of cast-steel than any other in the world!

Mr. Aspinall, the locomotive superintendent, is a progressive man (he comes to America once in a while to see how we do things), and has paid a great deal of attention to cast-steel.

His first experience was in "boughten [illegible] and while some pieces gave the [illegible] there were many failures. [illegible] up his mind that if *some* steel [illegible] could be made that were good, [illegible] them could with care. He built a [illegible] foundry and experimented, the result [illegible] that they are getting uniformly good [illegible] and there is hardly a forging to be found on the L. & Y. engines of recent build. All the wheels are cast-steel, the [illegible] plate, which has something like our [illegible] except that it is inside the [illegible] supports the guides, is slotted for the [illegible] and carries the guides to the [illegible] — the motion-shaft for Joy-[illegible] ng-shaft for links, all the [illegible] saddle, brake rig, levers, [illegible] are cast-steel.

[illegible] the secrets of sound castings [illegible] to be enormous gates and lots of [illegible] a 42-inch wheel will have three on [illegible] and one at the hub, all bigger than [illegible] part below them. These are cut off with saw.

All castings are rough-turned or planed, where they are to be finished, and then placed in an annealing furnace for forty-eight hours. The result is strong, tough working parts.

I noticed in the machine shop several big millers on heavy work, but in the tool room Brown & Sharpe millers, from the well-known Providence, R. I., works, are employed.

They use a great many multiple-drill machines in which one or more drills can be thrown out; on these tools they drill mud-rings, which, by the way, are also made of cast-steel.

I couldn't help but notice the stationary engines made of old locomotives; the inside engine makes a very neat and small double-cylinder upright when stripped and the crank-shaft lengthened.

The hydraulic lift in the boiler shop can handle a 30-foot shell over the riveter.

In one part of the shop there is set up four car-brakes—automatic vacuum—the same as in use; these are operated automatically, the brake going on and off every few seconds day after day; a counter tells just how many applications are made. This is used for testing sacks, hose and cylinder packing.

One very interesting machine is a huge hydraulic press over an immense table moving like a planer; this is used to straighten plate frames.

THE ROAD.

The Lancashire & Yorkshire is the only considerable road in England running east and west; it spreads out like a spider net over the northern part of England. It is only some 500 miles long, but has 700 signal towers. It is double tracked, heavy steel rail laid in 56-pound chairs (see them in the cut)—by the way, they make these at the rate of 2,000 a day; one man makes 3 per minute, 440 being his day's work; he uses a half of a machine—one that he runs by hand, but it withdraws the pattern. These chairs are held down by screws, spikes and round wooden pins. There is a machine for making these pins,—it sort of molds them, saturating them with something like creosote and making the pin hard.

THE ENGINES.

Like all the other roads the L. & Y. have a distinctive color for their engines—theirs is dark blue—and boiler and all are painted that color.

Most of them have the Joy valve motion, and all are inside-connected. The engine shown to the left in the first engraving is a saddle-tank switcher, the one on the right being a suburban engine, and a very good one, having six wheels connected and a radial truck and some sort of excuse for a cab. They have many eight-wheelers for passenger service, and freight is hauled by the standard six-wheeled truckless machine made just as plain and straight as a Puritan Sunday.

The top of the driving-boxes have two places for oil; one has a wool wick in it—a "trimming"—the other has cold tallow that can run only when the box gets hot. These boxes have a metal cover to which is riveted a lining of felt; this prevents wear and insures a tight joint.

The cylinders have common cups on the heads, as a rule, but they have a large brass cup on the engineer's side of the cab (or what ought to be the cab), and pipes run from this to the chest—you remember there is only one chest for both cylinders—there are no glass feeders on this lubricator, but there is a force pump in it with a pump-handle hanging out; when the bold engineer—no driver—wants to get a little slipprication to the valves, he wiggles the pump-handle. This is safe and cheap, and I believe well liked by the men.

The injectors are of the self-contained type, check, starting valve, lazy cock and injector, all in one piece on the boiler head. They have in use a few exhaust injectors; they are rather awkward looking affairs.

The blower-cock is simply a packing-nut and a handle on the boiler-head. The pipe goes directly through the boiler; no pipes outside.

The vacuum brake is used, and there are several plans of locating the big ejector. One is to cast it as part of the nozzle-stand, the ejecting jets being ahead of the nozzle and aimed up the stack.

No gauge-cocks are used, but there are two water glasses.

They use a device that we ought to adopt in this country at once, and that is a cylinder for raising and lowering the water-scoop. Theirs is operated by vacuum, but air could be applied easier. The fireman takes water by simply turning the handle of a three-way valve. There is no room taken up in the gangway, and no danger of injury if the operative forgets where the end of the trough is, their water-scoops having small rollers that prevent their ruin if the scoop is left down too long. The suburban engines have a scoop that has an opening both ways and is used when the engine is running in either direction.

They were building sixty of these tank engines for local trains and suburban work during my visit. They have 17 x 24-inch cylinders and weigh 44,000 pounds.

These inside-connected engines have a partition in the exhaust nozzle but four inches high. The nozzles are set on a level with the top row of flues.

The boiler fronts are beautiful jobs—smooth, clean, all rivets cut off and filed down flat, nice joints, but hard to repair if struck.

There is a large man-hole right over the crown-sheet. This man-hole ring and its cover are of cast-steel. The crown-bars and roof arches for stays are cast-steel.

The domes are welded up, not a rivet in them.

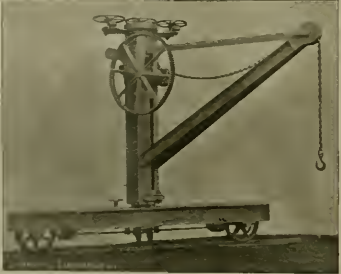
In some of their solid-ended rods they use a cast-iron bush, in others a bush made entirely of babbit.

There is no hose between the engine and tender, but a slip coupling combined with a ball joint is used. Just such schemes were in use in this country forty years ago.

They use a radial truck, the single pair of wheels being kept in the center by stiff springs.

I was shown some brass valves on which they had tried to make the Richardson balance strips work, but without success. It was evident that the strips were not deep enough, and perhaps the metal had something to do with the failure, or the slots may have been milled instead of planed. Good cast-iron valves are a success when properly fitted with this device. Nice work is done on ash-pans, and the dampers are tight, the operating rods are screwed up and down. In fact, an English locomotive is operated by screwing something all the time. The driver operates his reverse-gear by a screw and a hand-wheel, those on the L. & Y. being located just where the driver ought to sit down, and the place where the screw ought to be is vacant.

They cast steel crossheads with about a foot of 5 or 6-inch metal where the rod ought to be. This is drawn out under a hammer into a piston-rod; as the taper fit in the piston-head is larger than the rod, and the crosshead occupies the other end, the gland has to be put on in halves. This style of crosshead and rod seem to have had quite a run of popularity in Britain, but Mr. Aspinall, as well as several other locomotive superintendents, told me that they should make no more; when the rod is worn out they have to throw away a lot of work on a crosshead that would run for years.



WALKING CRANE.

INGENIOUS TEST.

I was quite interested in the way they look for cracks in crank-axles. An axle having two immense cranks in it is very liable to develop almost invisible cracks. When an engine comes in for overhauling, her crank-axle is cleaned, right down to the iron, bright and dry; then the pair of wheels are rolled sharply against another pair or any other stationary object. This sets up considerable vibration, and if there is a hidden crack anywhere the oil will come to the surface and expose it. When this does occur a clean paper is pressed upon the part, which takes an exact print of the fracture, in oil, and its location is defined exactly. This is filed away in a book with the age, kind, size and previous condition of servitude, all noted down for future reference.

J. A. H.

**Punctuality of Trains.**

One of the best threshed themes of discussion that a traveler hears constantly ventilated in the smoking-rooms of sleeping cars is the want of punctuality of trains. The average drummer is not inspired with much patience when delays of trains interfere with his business engagements, and he loves to air his woes to fellow travelers and to indulge in a little wholesome abuse of railroad companies.

We have frequently borne the infliction of late trains without Christian resignation and used uncomplimentary expressions toward those responsible for bringing in trains behind time. We wish now to make a general retraction and bear testimony to the punctuality of American railroad trains as a rule.

Two months ago we went out to view the extent of the country, and made a very long tour and gained much experience of traveling, even though moving about the world was no new proceeding. We sat behind some of the New York Central flyers to Buffalo, and the Lake Shore train took us at satisfactory speed to Cleveland, where Big Four's power whirled us to Cincinnati. The same line landed us in Chicago. By the handsome cars of the Chicago, Milwaukee & St. Paul we journeyed to Cedar Rapids, Iowa. The Burlington, Cedar Rapids & Northern took us comfortably to Burlington, and we did not get suffocated quite in the dirtiest car we have seen for many a day, which took us on the Chicago, Burlington & Quincy from Burlington to Fort Madison.

At that point we went upon the Atchison, Topeka & Santa Fé and rode upon it for about a week on all sorts of trains, from limited to way freight. We went from Fort Madison to El Paso, Texas, and back to Albuquerque, New Mexico. It was really the same fine road that took us from Albuquerque to Los Angeles, California. The Los Angeles Terminals Company conveyed us to view the Pacific Ocean and the great orange groves and fruit orchards of Southern California. Next we joined the Southern Pacific lines and traveled on them for about a week, finally transferring to the Rio Grande Western at Ogden. This line took us to Grand Junction, Utah, and delivered us to the Denver & Rio Grande, which conveyed us to Denver. The Union Pacific took us to Cheyenne and Omaha, and the Chicago, Rock Island carried us comfortably to Chicago.

In all that long journey over the numerous roads we were not once an hour late in reaching the destination or meeting point. The trains were not by any means run slow, and many of them made as good time as the express trains of lines east of Chicago.

After reaching Chicago we went to Cincinnati, and landed two hours late, the most of the time having been lost in the first 100 miles. From Chicago we went to Pittsburgh, and got in there one and a half hour late. After remaining in Pittsburgh a couple of days we started for New York with the evening train, and got in three hours late. Nearly an hour was lost in the last fifty miles with hot boxes on a car. Two of these got hot on different trucks. That was the first hot box we had seen attended to the whole tour.

## Directions for Setting Valves on a Locomotive.

BY PRACTICAL MACHINIST.

I will speak of an eight-wheeled, two pair drivers connected, 17 x 24-inch cylinders, 5-foot wheel, indirect valve motion, that is one with a rocker arm between eccentrics and valves. Valves have $\frac{11}{16}$ of an inch outside lap, $\frac{1}{16}$ of an inch inside lap, $\frac{1}{16}$ of an inch lead; eccentrics have 5-inch throw, link-saddle set back $\frac{5}{8}$ of an inch.

First see that the shoes and wedges are up to their proper place, the main rods the right length so the clearance will be the same at each end of cylinders when piston is at end of stroke, the rocker arms are the same length on each side, that is, the two lower ones are the same, and the two top ones are the same. It is not necessary that the top and bottom arms be the same length; the link-hangers are the same length, the arms on tumbling shaft are both the same length, and at the same angle from reach rod arm on tumbling shaft, notice that the eccentric blades lead to the links properly, that is, the forward eccentric blade is connected to top of link, and backward eccentric blade to bottom of link.

In this class of engines the eccentric that moves the valve follows the crank-pin both in forward and backward motion.

The throw of eccentric will be set as much less from right angles to crank-pin as the sum of the lead and lap

Lead is the amount the steam port is opened when the piston is at end of stroke.

Lap is that part of valve that extends over the outside edge of steam port when valve is on center of valve-seat.

You will find in some build of engines that the lower rocker arm is not in line with the top arm. It sets back a little. That is, the center of valve-stem pin, the center of rocker shaft, and the center of link block in lower arm, will not be in line. This is to make a uniform motion, the top of rocker being at right angles to the valve stem and the bottom at right angles to the center line of motion in mid-gear. In most engines the link saddle-pin is set back. The object of this is to overcome the error caused by the angularity of main rod. This can be better understood by referring to Fig. 1, $A$ is center of main axle, $B$ center of cross-head pin when piston is in center of stroke, $C$ and $D$ center of crank-pin when on forward and backward centers, $E$ and $F$ center of crank-pin when at top and bottom quarters. The distance between $A$ and $B$ is length of main rod. Using this length as the radius, the circumference of the circle will not reach the points $E$ and $F$. This shows why the crosshead and piston travels farther for the crank-pin to move from the forward center to the position where crank-pin is at its lowest point, or bottom quarter, than it does for the crank-pin to move from that point to back center. The crosshead and piston travels less for the crank-pin to move from the back center to the position where crank-pin is at highest point or top quarter than it does to move from that point to forward center. To overcome this difference of travel in crosshead and piston so that nearly the same amount of steam will be taken at each end of cylinder, the link saddle-pin is set back—one defect counteracted by another.

Examine rocker arms and see that they are both the same distance from main axle.

Before marking the valve-stems to show the port openings, see that the valve-yokes are a good fit on the valves If not, it is a difficult job to get your engine to sound "square," as the valves are set as the cylinders begin to take steam and the engineer hears her as she lets go of the steam or exhausts.

When everything, as rocker-boxes, arms, eccentrics and blades, links and hangers, valves and yokes and arms on tumbling shaft, are all right, it is not a very difficult job to get an engine "square." When one is wrong, as is frequently the case, then it is a more difficult job.

A good way to mark the valve-stems, is, if engine is all put together, to let the front end of one eccentric blade where connected to link, on each side down, then put a piece of tin in the steam port and move the valve up to the tin, then with a tram that has one point longer than the other, put the short end in center, punch mark on steam chest stuffing box at Fig. 2, and with the long end of tram make a mark on valve-stem as shown at $B$ Fig. 2, then move tin to the other steam port on same side and mark that one the same as shown at $C$, Fig. 2, you then have the two points, $B$ and $C$, Fig. 2, that give the position of valve when it begins to admit steam; mark the other side the same way. The distance between these two points is the lap on both sides of the valve. It is a good idea to get the center of these two points so that you can tell when the valve is covering both steam ports.

A person cannot be too careful in getting the port openings, I would here suggest that you be careful in getting the centers, and all work in regard to setting valves should be done with a great deal of care and attention.

I said use a tram that had one end longer than the other on account of valve-stem being lower than the stuffing-box on steam-chest, so the tram will stand at right angles to your stem, or you can mark the stems, using a center punch mark to move on top of cylinders; when you do this, there is no chance for the marks to move when the steam-chest cover is put down, as there was when using mark on stuffing-box.

It is not necessary to start at any particular point when getting dead centers, any center will do.

Starting with the right crank-pin a little below the back center the crosshead will be near the end on the back stroke, put one point of the tram on wheel cover at $D$, Fig 2, and make the mark $E$ on tire of driving-wheel, put one point of tram on back guide block at $F$, Fig. 2, and make a mark on crosshead at $G$, then move drivers over the center until the tram point reaches the mark $G$ on crosshead again, stop moving the drivers and make the mark $H$ on tire of driving-wheel, using the same tram and point on wheel cover used in making mark $E$. Get the center of these two marks $E$ and $H$ which is $I$; put reverse lever in back notch of quadrant, then move the driving-wheels back until tram will reach between the two marks, $D$ and $I$; the engine is now on back center in backward motion; make a mark on guide where end of crosshead comes, do this at each end of guides on both sides. When marking guides on front end use front end of crosshead, when marking guides on back end use back end crosshead. These marks to be used when running engine over in cut-off. With the valve-stem tram put one point at $A$, Fig. 2, and with the other point of tram make a mark on valve-stem; move the drivers still more back until all lost

THE BEST RAILROAD SHOP I SAW IN ENGLAND.

motion is taken up, then put reverse lever in front notch of quadrant, move driving-wheels forward until tram point reaches point I again, this is back center on forward motion, put one point of valve-stem tram at A, Fig. 2, and make a mark on valve-stem. Move the drivers forward until the crosshead on left side is near end of stroke, stop moving the drivers and make a mark on tire of left main driving-wheel same as done on right side, get the dead center and mark the valve-stem same as done on right side. For forward and backward motion, continue this until all four dead centers have been obtained, always moving the drivers both forward and backward, so as to take up all lost motion. When marking the valve-stem let the marks for forward motion be from the center of valve-stem to outside, and the marks for backward motion be from center of valve-stem to inside, so as not to get the marks for forward and backward motion confused.

Fig. 3 represents the left valve-stem, after getting the centers, and marking the valve-stem, A is front steam port, B back steam port openings, C shows for forward motion front end, valve 1/8-inch blind, D back end 1/16-inch lead, E backward motion front end 1/16-inch blind, F back end 1/8-inch blind. The distance between A and F is the lap on both sides of the valve. Holding valve-stem tram one point in center punch mark on steam-chest stuffing-box, the other point at A, the steam port for front end is just opened, when tram point reaches between the points A and B the valve is blind, outside the points A and B the valve has lead.

Get all the eccentric blades the right length first, then move eccentrics on axle to give the proper lead.

Valve stem on right side shows for forward motion on front end 1/4-inch lead, back end 1/8-inch lead, to make that eccentric blade the right length, make it shorter, one-half of what the lead it has in front end more than it has at back end, 1/16-inch, that will make the front end 3/16-inch and the back end the same, as it takes 1/16-inch off the front end and puts it on the back end.

Backward motion for right side shows on front end 1/8-inch lead, back end line and line, to make that eccentric blade the right length, make it shorter, one-half the lead it has on front end as the back end is line and line, that takes 1/16-inch off lead in front end and puts it on back end, so that will now show 1/16-inch lead on both ends. The right valve stem will now show for forward motion 3/16-inch lead and for backward motion 1/16-inch lead.

Valve stem on left side shows for forward motion on front end 1/8-inch blind, back end 1/16-inch lead, to make that eccentric blade the right length, make it longer, one-half the sum of what it is blind on front end and the lead on back end, 3/32-inch, taken off front end, leaving that 1/32-inch blind and putting 3/32-inch on back end, which takes 1/16-inch lead off and makes it 1/32-inch blind, same as front end.

Backward motion for left side shows on front end 1/16-inch blind, back end 3/16-inch blind; to make that eccentric blade the right length, make it shorter, as it is more lead on back end than on front end, so that blade is shortened one-half the difference what it is blind on back end more than on front end, taking 1/16-inch off back end and putting it on front end, leaving that 1/8-inch blind on front end, and same on back end. The left valve-stem shows for forward motion 1/32-inch blind, and for backward motion 1/8-inch blind.

It is a good idea to go over this the second time, beginning at the first, getting the marks on valve-stem and the dead centers. If any changes are needed, make them. It is seldom you will find everything right on going over them again, for by changing either of the eccentric blades to any great amount it changes the other one on that side a little, so it is best to always go over them the second time.

When there is more lead on front end than on back end, shorten eccentric blade; when more blind on front end than on back end, lengthen eccentric blade; when more lead on back end than on front end, lengthen eccentric blade; when more blind on back end than on front end, shorten eccentric blade. In the above rules the eccentric blades are to be shortened or lengthened one-half the excess lead, or what it is blind for either forward or backward motion. When there is lead on front end and blind on back end shorten eccentric blade one-half the sum of what it is blind and the lead, when there is lead on back end and blind on front end, lengthen the eccentric blade one-half the sum of what it is blind and the lead. All the above rules are for forward or backward motion.

The eccentric blades are now the right length, eccentrics are now to be moved on axle so as to give the proper lead, which is 1/16 inch on both forward and backward motion.

Put reverse-lever in forward notch in quadrant, move engine forward until crosshead is on right-front center, the valve-stem shows 1/8 inch lead, move the forward motion eccentric away from crank-pin until valve-stem shows required lead 1/16 inch, fasten that eccentric, put reverse-lever in back notch in quadrant, move engine forward to take up all lost motion, then move engine back to center again; valve-stem shows 1/8 inch lead, move the backward eccentric away from the crank-pin until valve-stem shows required lead

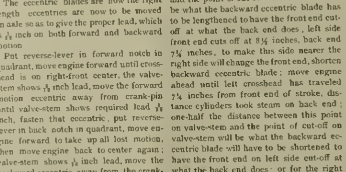


Fig. 2. Fig. 3. Fig. 1.

1/16 inch, fasten that eccentric, then move engine back until crosshead is on back center on left side with reverse-lever in back notch of quadrant; valve-stem shows 1/32-inch blind, move backward eccentric toward crank-pin until valve-stem shows required lead 1/16 inch, fasten that eccentric; put reverse-lever in forward notch of quadrant, move engine back until all lost motion is taken up, then move engine forward to center again, valve-stem shows 1/4-inch blind, move forward eccentric towards crank-pin until valve-stem shows required lead 1/16 inch, fasten that eccentric. It is best to go over this work again, for moving one eccentric to any great extent changes the lead for the other one on that side. Remembering moving eccentrics towards crank-pin, gives valve lead, and away from crank-pin makes valve blind.

The engine is now supposed to be "square" in the corners, or working steam nearly the full stroke, as the engine is worked at that point only when getting a train under headway, or on a hard pull, it is best to go over the valves when the reverse lever is hooked back, so engine will not work steam so far on each stroke.

Put the reverse lever up near the center of quadrant, any notch of quadrant will do, move engine ahead, holding tram on valve stem with one point at A, Fig. 2, another point on valve stem, watching valve stem, when mark C gets to point of tram stop moving engine, when that point is reached the steam is cut off from that end of the cylinder; measure the distance from front end of crosshead to mark on guide at front end of stroke, the mark made when the dead centers were obtained which is 5 inches, mark it on top of the guide the crosshead traveled over, this distance is length of stroke the cylinder was taking steam, the balance of the stroke the steam will expand in cylinder; move engine forward and get point of cut-off on the front end of left cylinder, and that shows the cut-off at 8½ inches, mark that on guide, get the point of cut-off for back end of right cylinder, that is 6½ inches; get the point of cut-off for back end of left cylinder, that is 7¼ inches; the left side front end cuts off at 8½ inches, back end at 7¼ inches, right side front end cuts off at 5 inches, back end 6½ inches. To have the front end on right side take steam same distance as back end, will lengthen the backward eccentric blade, with the reverse lever in the same notch in quadrant it was when cut-off was got; move engine ahead until right crosshead has traveled 6½ inches from front end of stroke, distance cylinders took steam on back end; one-half the distance between this point on valve stem and the point of cut-off on valve stem will be what the backward eccentric blade has to be lengthened to have the front end cut-off at what the back end does, left side front end cuts off at 8½ inches, back end 7¼ inches, to make this side nearer the right side will change the front end, shorten backward eccentric blade; move engine ahead until left crosshead has traveled 7¼ inches from front end of stroke, distance cylinders took steam on back end; one-half the distance between this point on valve-stem and the point of cut-off on valve-stem will be what the backward eccentric blade will have to be shortened to have the front end on left side cut-off at what the back end does; or for the right side lengthen the forward motion eccentric blade, and that would have let cylinders take steam longer on front end and less on back end, for the left side shorten the forward motion eccentric blade, and that would have let cylinder take steam longer on back end and less on front end.

When an engine is "square" in the corners and lame hooked up, you will have to sacrifice either the backward or forward motion, when working steam full stroke, unless you can discover what is wrong, then make the change at that place; it is at times a difficult piece of work to locate the defect, as it may be in various places, and at times a more difficult job to change after it is located.

The engine is now supposed to cut off on right side front end, at 6½ inches, back end 6½ inches; left side front end, 7¼ inches, back end 7¼ inches, will change one side so it will cut off nearer to what the other side will raise the tumbling shaft box on the long or left side, or shorten link-hanger on same side, or do the opposite on the right side, lower the tumbling shaft box or lengthen the link-hangers. To find how much to change the tumbling shaft box or link-hanger so that both sides will cut off the same, will change the right side, which is the shortest. With reverse lever at same notch in quadrant as it was when points of cut-off were got, move engine ahead until crosshead has traversed 7¼ inches from front end on right side, with a surface gauge make a mark on tumbling shaft as shown at P, Fig. 2, then move reverse lever until valve has cut steam off from that end of cylinder, as shown by valve stem tram, then make another mark on arm of tumbling shaft. The distance between these two marks on arm of tumbling shaft will be what the tumbling shaft box or link-hanger will have to be changed, as it is, the short side, to be changed, will lengthen the link-hanger the distance shown on arm of tumbling shaft, or lower tumbling shaft box the same distance.

Raising tumbling shaft-box is the same as shortening link-hanger—makes valve cut steam off earlier on the stroke, and lowering tumbling shaft-box is same as lengthening link-hanger—makes valve take steam longer on the stroke.

It frequently happens that after an engine has had general repairs the reach rod is not the proper length; to find out how much to change it so it will be the proper length, put reverse lever in forward notch of quadrant, move engine ahead until forward motion eccentric is at its full travel in front, crank-pin will be a little in front of the bottom quarter, make a center-punch mark on side of firebox near reach-rod, or any point that will not move, make a mark on each rod as shown at L, Fig. 2, put reverse lever in back notch of quadrant, move engine back until backward motion eccentric is at its full travel in front, crank-pin will be a little in front of the top quarter; make a mark on reach-rod as shown at M, Fig. 2, using same center-punch mark on side of firebox used before, then disconnect the back end of reach-rod from reverse lever, and raise the link up until bottom of link strikes the link block, and then make another mark on reach-rod at M, the distance between these two marks, the front ones on reach-rod, is clearance at bottom of link ⅞-inch, then put the link down so top of link block strikes the top of link then make another mark on reach-rod at L; this distance is clearance at top of link, it is ¾-inch, this gives clearance on right side, try the left side the same, so to get clearance at the top and bottom of that link. The difference between the clearance at top and bottom of the link on right side is ⅛-inch, so shorten reach-rod one-half the difference, 1/16-inch, then the clearance will be the same at both top and bottom. Have changed the reach-rod on the supposition that left link had same clearance as right one, if clearance for left link had been different from right, would have changed reach-rod to correspond with both links.

Better results will be obtained when running the valves over if the engine is in same condition as when in service that is, has water in boiler, and under steam have engine hot, so all parts affected by heat will be expanded.

The engine that I have been trying to explain to you how to set the valves on, is now supposed to be square in all points, or as near as can be, without making other changes. I have endeavored to make it plain, so it could be understood by all.

In setting valves there is much to be learned by practice; it is practical experience only that will make a person perfect in setting valves on a locomotive.

*Portland, Ore.*

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Locomotive Engineer J. Puffenberger, of the N. Y., O. & W., is a candidate for the position of United States supervising inspector of boilers at Washington, D. C., and his division, No. 292, has unanimously indorsed him for the job. "Puff" is a well-known engineer, and has represented his division in several international conventions, and a host of friends will be glad to hear of his success. We don't suppose there is any law, if there is a precedent that prevents a man who has actually had charge of boilers from becoming an inspector. Should "Puff" get there his folks would not be in the hysterical condition that is attributed to the wife of Mr. Thompson when he was appointed Secretary of the Navy. "Oh, dear," said she, "I'm so scar't; somethin' will happen. Mr. Thompson's appointed to the navy *and he can't swim a stroke*."

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The C., St. P., M. & O. have but twelve engines out of service for general repairs out of a total of 266, which speaks well for the machinery department.

### A Remarkable Wreck.

The reproduction from a photograph on this page was sent us by a friend, and is a striking illustration of what can be done by slamming two trains together real hard.

As is plain, it was a winter wreck, and it looks as if a passenger engine was being assisted through the snow when they collided with a freight train.

As the two consolidations met on even conditions as to size and weight, they clinched, welded their heads together, and froze up.

The passenger engine was lighter, and after throwing her big leader's tank over on the said leader's back, and collecting a pile of trucks to climb on, started up in the air, aided by the weight behind her. It looks as if the consolidation that played it alone against the combination had stood her ground well, but that her tank had been thrown more than sixty feet ahead of where it belonged. The work done in lifting about 100,000 pounds of locomotive eight or ten feet in a second is considerable.

Wrecks always have and probably always will occur as long as men railroad, but something can be learned from each and every one of them.

We know nothing of this wreck, nor the fate of the crews that "got together" on this occasion, but we hope they escaped injury.

We don't believe in being one of the kind of heroes that "grasp the throttle and die to save their trains" when they can just as well put on the emergency and jump for a snow bank.

### Tragic Times on the Atlantic and Pacific.

In the early days of the Atlantic & Pacific locomotive engine running was a terribly difficult and perilous occupation. The feed water was so densely charged with solids that it required skill to keep water in the boilers; gauge cocks would choke up solid in a few hours, and there were very limited facilities for doing work on the engines. All sorts of inferior men were hired and their blunders and mismanagement made the position of others more difficult and uncomfortable. Quite a number of English and of Reading engineers were hired. Few of these men understood running on train orders or how to avoid other trains that were scheduled. The result was numerous collisions. It is a grim fact that the engineers who had not been brought up on Western roads were quickly thinned out by getting killed in collisions caused by their own ignorance. On some divisions of the road there is scarcely a mile that does not show the scene of a tragedy with the blotting out of more than one life. Natural selection has left a highly efficient set of engineers on that system. Mistakes in train orders are very rare nowadays.

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The *New South Wales Railway Budget* is worried to know what "double-header" means, it seems they don't put a pair of smokingines on one train over there. We notice their railroaders have the trade habit of inventing phrases—they call a delay a "nap," not so bad, *eyether*.

### Off in Figures.

There has been some agitation in Victoria lately about the pay of engine drivers in the colony, and there is some inclination to make out that these men are too well paid as compared with other railway employés. One of the leading papers of the colony recently had an editorial on the subject in which the stand was taken that the engine drivers were the best paid class of men in the world, and that their duties were not more responsible than those of guards (conductors). A high-favored class among these engine drivers receive 15 shillings or about $3.75 a day. Others receive 13 shillings, but the most common pay is 11 shillings a day. People who write about this being the highest pay in the world for engine drivers, do not know what they are discussing. The highest pay quoted is the common figure in America, and there are many of our locomotive engineers who earn more than twice the Victoria rate. With continuous brakes in use there is no comparison between the responsibility of the engine driver and the guard.

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Last month an Erie freight train stalled and delayed the limited, No. 8, and the irate super. telegraphed the well-known and ominous words to the engineer "What was the cause of that delay to No. 8?" The freight man is a distant relative of Shakespeare, and wired back

"The wind was high, the steam was low,
The train was heavy, and hard to tow,
The coal was poor and full of slate,
And—that's why we held No. 8."

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An English government official lately made a statement explaining why such locomotive works as Baldwin's could build so many engines at low cost. He said that Americans only had two types of locomotives, and that consequently they could be turned out like sewing machines, new drawings and patterns never being needed. The facts are that Baldwin's people have built about 1,500 different kinds of locomotives, and the orders that come from abroad nearly always call for diversity of design.

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A leading railway company in England which experimented extensively with lighting passenger coaches with electricity, abandoned the light on account of its cost. There was no difficulty in the manipulation of the electrical appliances and the system of lighting was regarded as an entire success except that it was much more expensive than gas or oil.

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There has been a great deal of agitation among the people who expect to visit Chicago during the World's Fair to compel railroad companies to carry passengers at the lowest possible rate. Railroad fares are not the only expenses connected with a visit to the Exhibition. The hotel keepers and caterers of Chicago are looking forward to the reaping of a golden harvest from the great influx of visitors. We second the *Railway Age* in a suggestion made that part of the public energy devoted to squeezing down railroad rates be bestowed upon the people who are most noted for fleecing travelers.


A WRECK THAT WAS A WRECK

### Tools for Repairing Compounds.

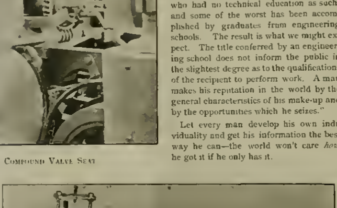
It is remarkable how soon a demand is filled in the machine field There were some mechanics who wondered how in the world they were ever going to re-bore the valve bush of Vauclain's compound when it needed it, especially those located inside and below the frame

A very simple boring bar has recently been devised that will go almost any place and can be used in any of the Baldwin compounds built Our upper engraving shows it at work on the valve seat of a large compound, where the low-pressure

Boring Bar for Vauclain Compound Valve Seat

cylinder is below the high-pressure The second engraving gives the details and the lower one shows the bar in a difficult place to get at, it also shows the valve of a Baldwin compound.

This tool can be made cheaply, or the Baldwin Works offer to furnish them when the user prefers to buy rather than build




Details of Boring Bar.

### Chemists Differ.

During the course of the investigation of iron and steel by a committee of the Master Mechanics' Association last year, analyses were made of specimens of steel by different chemists, and the results obtained gave serious offence to some steel-makers and no doubt did their product injustice. It appears now that chemists differ as much in their analyses as doctors in their diagnoses. At an engineering meeting lately, Dr. Dudley, chemist of the Pennsylvania, read a paper in which he said

"I have recently seen a series of, I think, sixteen determinations of sulphur in a piece of pig iron, supposed to be the same iron, that differed from each other from 0.005 up to 0.02 per cent., or the extreme results (I am giving these figures from memory) were about as 1 to 4. Now, obviously, while the amount of sulphur is excessively small in this case, not being a matter of very great importance, yet, as bearing on the accuracy of chemical work, the result is something appalling I have seen a series of phosphorus determinations recently, made by six or seven chemists, where the extreme results differed 0.03 to 0.04 per cent, in a total of about 0.10 per cent. I have a friend, who, for a number of years, was manager of a large furnace, who some four or five years ago sent out borings from some pig iron to eight or nine different chemists for phosphorus determination, and when he got the results back, no one of the chemists knowing that any other was working on them, they differed almost as 1 to 2, and, in his nervous, energetic way, he said 'I said, in my wrath, all chemists are liars'" Perhaps it is not necessary to mention any more discrepancies, I might, however, give one more instance. In a recent analysis of bronze, we obtained in our laboratory a trifle over 9 per cent of tin; another chemist, working on what was supposed to be exactly the same metal, being half of the same pig, got over 10 per cent., the discrepancy being about 1½ per cent. Now, obviously, there is something wrong somewhere"

The cause of the discrepancy he holds is the different methods of analysis employed, and he proposes to establish standard methods which he thinks will produce uniformity when the same conditions exist.

### A Dangerous Safety Device.

There has been considerable discussion in Eastern papers about an accident which happened on the New York, New Haven & Hartford, in which a dining-car was burned up and several trainmen injured. The accident was caused by the vicious rule that permits a conductor to stop a train by pulling open the escape air valve in the car instead of signaling the engineer. The passenger train to which the accident happened was running at night and had passed a point where a fast freight train had the right to start three minutes afterward Shortly after passing that critical point the conductor discovered that the dining-car at the hind end of the train was uncoupled and was pulled by the safety chains. Instead of displaying the judgment that would have prompted him to reach down and shut the air off the uncoupled car so that it would couple itself the first time the engineer shut off steam, the conductor pulled open the air-valve in the car and stopped the train. The margin of three minutes appeared to have passed before the flagman started out, and the freight train came thundering on with almost no warning of the danger ahead. The air having been all drawn out of the train-pipe, there was not sufficient volume in the main reservoir to enable the engineer to release the brakes, and they held the passenger train fast while the freight train plunged into the rear car.

The practice of using the conductor's valve for anything but accidents should be discouraged. More than one bad accident has happened of late because this valve was opened and not closed again and the engineer could not release his brake.

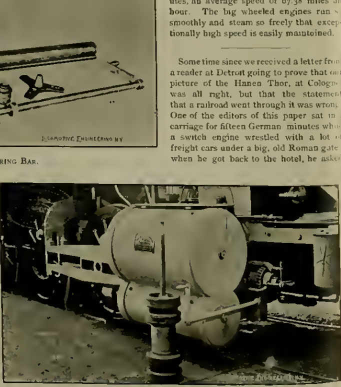
Whoever was responsible for the removal of the old conductor's valve, that closed itself by a spring, and the substitution of the plain straight-way cock, made a mistake. The old valve might have leaked a little, but when the excited conductor or passenger did let go of them the engineer could get his brake off. Just as many accidents can be prevented by taking the brake off at the proper time as in putting it on

### Some Plain Truth.

Mr H. F. J. Porter read a paper before the Mechanical Engineers' Association in this city last month, in which he said

"Some of the best engineering work of the country has been accomplished by men who had no technical education as such, and some of the worst has been accomplished by graduates from engineering schools. The result is what we might expect. The title conferred by an engineering school does not inform the public in the slightest degree as to the qualifications of the recipient to perform work. A man makes his reputation in the world by the general characteristics of his make-up and by the opportunities which he seizes."

Let every man develop his own individuality and get his information the best way he can—the world won't care *how* he got it if he only has it.



In a Tight Place Low Wheel Engines.

### Wrong Material in Car Repairs.

One of the most fertile subjects of conversation in the offices of master car builders and superintendents of railroad machinery is the unreasonable and unjust acts done in the interchange of cars. It appears that men who are otherwise of high character lose all sense of fairness and justice when trying to get the advantage of their connecting lines in disputes about the repair of cars. We heard particulars of a fairly representative case lately. A car belonging to A got damaged on the B line, and had to have new sills put in. The original sills were of an odd size, and the repairing road put in those they had in stock, which were about half an inch thicker than the old ones. When the car got home a charge for new sills was made upon the repairing road on the ground that wrong material had been put in, and Rule 19 was quoted as authority for the charge. The officer under whose charge the work was done protested that the cars were better than they would have been had the original size of sills been put in, but the owners insisted on their pound of flesh. Word was then sent to return the sills that had been put in and the charge would be allowed. The owners of the car made no answer to this request, and the claim was dropped.

### The Fastest Long Run.

There is nothing more common nowadays than the hearing of passenger trains on our leading lines being run at speeds varying from sixty to eighty miles an hour for a few miles, but it is still a novelty to find a train running over 100 miles at higher speed than a mile a minute On November 8th the Empire State Express broke the record for long continuous speed by running 115.76 miles in 110 minutes, an average velocity of 63.14 miles an hour The train consisting of four cars, pulled by engine No. 893, Engineer Chase, left Syracuse thirty minutes late and made up twenty minutes in the run to Albany There was a stop of three minutes at Utica. For two miles out of Syracuse station the speed had to be held down below twenty miles an hour, but after that the train was spun along in great style, for the run from Syracuse tunnel to Utica, 51.67 miles, was covered in forty-six minutes, an average speed of 67.38 miles an hour. The big wheeled engines run so smoothly and steam so freely that exceptionally high speed is easily maintained.

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Some time since we received a letter from a reader at Detroit going to prove that our picture of the Hanen Thor, at Cologne was all right, but that the statement that a railroad went through it was wrong One of the editors of this paper sat in a carriage for fifteen German minutes while a switch engine wrestled with a lot of freight cars under a big, old Roman gate when he got back to the hotel, he asked the porter—who knows everything—what gate it was, and was told the Hanen Thor Again he asked the photo dealer for a picture of the gate with the railroad and was given a Hanen Thor again. Since receiving the letter we wrote to the manager of Thos. Cook & Son, at Cologne, and he informs us that the road enters through the Pantaleans gate. As long as it came in decorously through a gate we don't care which gate it was, but if there had been any fence climbing we should have resented it.

### Progress of American Transportation Facilities.

At the recent State Fair of California, held at Sacramento, the Southern Pacific Company made an exhibit that attracted a great deal of attention; it was intended to show the stages of transportation facilities in the Golden State.

The first stage was represented by a set of Indian tepee poles; these, as is well known, are tied on each side of a pony, one end dragging on the ground, and loads of scanty household furniture carried thereon.

The second stage was represented by a cumbersome Mexican "caretta." This was introduced into the State when the Mexican superseded the Indian on the fertile coasts of the Pacific. The specimen shown is a splendid one from real life; the wheels are simply disks sawn off a log, with a heavy wooden axle and wooden linch-pin—not a scrap of iron about it.

Then they exhibited the first locomotive they owned, the "C. P. Huntington, No. 1," with one of their latest and best 10-wheeled passenger locomotives.

One of their cars of fifteen years ago and one of their latest furniture cars—about twice as large.

A passenger car of two decades ago stood up beside one of our modern 62-foot coaches.

The old style scoop-plow was shown together with the latest Rotary steam-plow.

The Southern Pacific Company have only been operating a road for some twenty-four years, and the improvement in that time is best told by the object lesson of this exhibit.

The fine illustrations of the different exhibits were made from photos taken on the ground.

First Stage, Indian Tepee Poles.

Second Stage, Mexican "Caretta."

The First and the Latest Locomotive.

Snow Bucker—The Latest and the Oldest.

New and Old Style of Freight Car.

Modern Coach and Old Passenger Car.

The Baker Car Heater Works have removed their machinery to their new factory at Hoboken, N. J., and have opened an office and show-room at 143 Liberty street.

We want to call every reader's attention to our new heading, head-letter and dress. We think the typographical get-up a great improvement.

The Locomotive Engineering calendar for 1893 is ready for delivery—just right for the cab—sent to all who ask for it.

Wm. H. Owens, who has been for some years an engineer on the Buffalo division of the P. & R., has been appointed road foreman of engines on the line between Manchester and Sayre, including the Ithaca branch. The appointment took effect December 6th.

Mr. J. J. Ellis, master mechanic of the C., St. P., M. & O., at St. Paul, has all eccentrics of his engines put up in two pieces, the smaller part of the cam being made of wrought iron. Mr. Ellis has found that eccentrics so put up wear well and there is not the tendency for smaller part of cam to break in the event of heating, as heretofore, when both parts were made of cast-iron.

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*The editors reserve the right to use or discard matter for the reading columns entirely on its merits The reading columns will not be sold*

*Correspondents must give their names and addresses, but not necessarily for publication*

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### Notice.

Our reserve for binding, 100 copies, is now ready for delivery We have forty-two bound volumes of 1892 on hand and about thirty complete volumes, unbound. When these are disposed of there will be no back numbers of LOCOMOTIVE ENGINEERING for 1892 We will enter the orders as received, first come first served. We do not propose to do a back-number business. We will bend all our energies to the making of an interesting paper each month—and nothing else. We shall try to keep enough papers to insure the complete year to every subscriber, if wanted, but no "year before last" business.

ANGUS SINCLAIR,
JOHN A. HILL.

### Our Birthday.

Five years ago this month the first LOCOMOTIVE ENGINEERING, *neé* LOCOMOTIVE ENGINEER, was issued It was a little 16-page, 3-column infant, but it yelled lustily, and—most important of all—lived.

Its editorial policy was unlike most other papers in the field, and its aim was more to interest and instruct the rank and file in the railway motive-power and rolling-stock departments rather than to cater entirely to those high on the ladder.

This policy has done enough good to make the paper the favorite one among progressive railroad men high and low, has increased the page to 4 columns, the number of pages from 16 to 48, and the monthly mail-bag from a few hundred pounds to *more than five tons.*

As we do not blow our own horn in the reading pages but this once a year, we may be excused for having our little New Year's say and feeling good because there are plums in our birthday cake and peanut candy on the frosting

Last year the great enlargement of the journal and the doubling of the subscription price was going to ruin the paper—so we were told

But the LOCOMOTIVE ENGINEERING nurses had experience, and felt assured that the railroad men of this country would not drop a good paper because it had been made twice as good—and charged for accordingly.

This year the report of our old club-raisers from far and near are that they will increase their lists, and from every part of the country come applications for permission to get subscribers—the circulation is assured

Advertisers know a good thing when they see it, and the doctrine that a big circulation is a bad thing for advertisers is not making converts to any alarming extent.

During the year we have spent a great deal of time and money to make the paper interesting and instructive, and for the next year propose to fill its pages with such matter as will confirm and, well, sort of "rub in" the words on the seal of public approval "Most Interesting Railway Paper Published"

LOCOMOTIVE ENGINEERING starts out on her sixth year with new head, new dress, new ideas and new courage She sends a greeting to one and all, old friends and new, and wishes them a Happy New Year

ANGUS SINCLAIR,
JOHN A. HILL

### Exhaust Nozzles.

Those who have enjoyed opportunities of watching the working of locomotives in foreign countries are nearly always struck with the light exhaust of the engines compared to the violent noises caused by the steam passing from the exhaust pipe of American locomotives. Why there should be such a distinct difference is not readily apparent. American locomotives, as a rule, are required to do much heavier work than most of those abroad, but when a foreign engine is seen pulling with maximum power, the sound of the exhaust is weak compared to the ringing detonations that shoot from the smoke-stack of all our engines working at the same rate. Why this should be so is well worthy of investigation

The noisy exhaust proclaims that, in passing from the cylinders, the steam is performing laborious work against the atmosphere, and that in consequence the capacity of the cylinders for doing the useful work of pulling cars is reduced This fact that a noisy exhaust means a weakened engine is not so well recognized as it deserves to be There are many persons influential in the care and handling of locomotives who believe that a noisy exhaust means a powerful engine, and this fallacy, no doubt, has something to do with the prevalence of contracted exhaust openings. Various causes make it necessary that many of our locomotives should use exhaust nozzles that are too small for economy of fuel or for free working of the engine, but others suffer from contracted nozzles that would steam better were the exhaust openings enlarged.

Small nozzles and the noisy exhaust resulting therefrom came into fashion through the use of boilers that were too small for the cylinders and had to be constantly forced to supply the steam required. The small nozzles would make a sharp blast that burned coal rapidly and, of course, created much heat for steam making. The small nozzles would also prevent the free escape of the steam, leaving part of it in the cylinders, thereby in a small way decreasing the quantity to be drawn from the boiler. Another practice that encouraged and demanded the use of small nozzles was the obstructing of the hot air passages with spark-arresting appliances Cones and diaphragms, and all sorts of deflectors and nettings, would be put in the way of the exhaust gases for the purpose of stopping sparks, but with the added effect of nearly stopping the draft or of offering much resistance to the full movement of the gases This action is very much of the same character as that of a miller who attempts to make the water from his wheel run up hill There is a correlation between the forces of nature that demands compensation if one is thrown out of balance When the smoke-stack or smoke-box is obstructed, the gases must be forced through with a greater velocity or there will be reduced generation of steam. Reduced nozzles is the usual resort for overcoming the restrictions put upon free movement of the exhaust steam and gases of combustion

Small boilers and spark arresters are necessary evils that have to be made the best of, and the use of contracted nozzles becomes the smallest in the choice of evils. There are, however, defects in locomotive construction that entail the use of small nozzles when changes could be made at very small expense which would remedy the evil Foremost amongst these is the use of grates that have not sufficient opening to admit air freely. A designer schemes with great care and ingenuity to provide as large a grate surface as possible for an engine, and then another man spoils the thing by making grates that make nearly a solid bed of metal under the fire. Men who do this sort of thing fail to understand the true relations that exist between fuel-burning and steam-making An engine has a certain size of grate area and a certain weight of coal must be burned per square foot to supply the heat necessary for steam making. Each pound of coal requires a certain volume of air to convert it into heat-gas, and unless this air is supplied the heat will not be generated. If the grate that the coal is resting on contains 50 per cent. opening the air will pass through much more freely than it will when the openings only amount to 25 per cent There are no mechanical difficulties in the way of making the openings amount to half the grate area, but it is much more common to find the spaces left for air to pass through only about one quarter the area. Here the superfluous metal of the grates performs the same part as the obstructions in the smoke-stack The restricted opening must be compensated for by increased velocity of the gases, and this is brought about by contracting the nozzles. One of the most successful master mechanics in the country lately remarked "Opening the grates leads to opening the nozzles, and no other light repair change can do so much to improve the engine"

An insuperable obstacle in the way of enlarging the nozzles of locomotives on most railroads is the diverse character of the coal supplied. Some qualities of coal are of a free burning nature and readily combine with the air passing through the incandescent mass. This kind of coal makes steam with a comparatively small supply of air Other coals are of a refractory character and require a strong gale of air to maintain combustion. The supply of air that would generate steam freely with the first mentioned coal will be found entirely inadequate with the latter. As the refractory coal has to be burned sometimes the nozzles must be made small enough to supply a sharp blast that will draw the necessary volume of air Owing to this, the nozzles of most locomotives are made small enough to cut the worst quality of coal, although the worst kind may not be supplied once a month. A few railroad companies have found it a good plan to establish uniformity in the grades of coal supplied with the result that the draft appliances of the engines are regulated to suit the coal, and decided saving of fuel is secured. Nearly all railroad companies could improve their practice in this respect without increase of cost in coal handling if only attention were directed to the matter. But to the greater part of the men who regulate the purchase of coal there is understood to be no difference in the product of different mines, and no attempt at uniformity is ever thought of.

On some railroads it would be highly inconvenient to make the coal supplied of uniform quality. In such cases we do not see why expanding nozzles cannot be employed so that the draft may be regulated to suit the quality of coal supplied. There is a strong prejudice against variable exhaust nozzles because so many forms have been tried and abandoned as worthless. This does not prove that all the expanding nozzles tried were impracticable, for many things that are now successfully used in connection with railroad rolling-stock were condemned when first tried. There is great demand among railroad managers for a reduction in fuel bills, and all enterprising master mechanics are striving to meet the call for increased economy of fuel. This has led to the introduction of compound locomotives upon many lines. From what we have seen of the working of good variable exhaust nozzles we are inclined to believe that great saving could be effected by their use. To make them successful care and energy are requisite, but the gain to be made is worthy of the effort.

### Dissensions in Car Interchange.

The principal railroads running into Cincinnati entered into an agreement about a year ago to handle freight cars by joint inspection, but it is not working well and there is great likelihood that the arrangement will soon be abandoned. Some of the railroad companies are perfectly satisfied with the working of joint inspection, and the officers admit that the plan facilitates the movement of cars, but others are strongly opposed to it. We listened to a rather heated discussion of the joint inspection plan at a meeting of railroad officers, and the impression received was that the men who are most vigorously opposed to joint inspection are actuated by unfair motives. They want to get the best of their connecting lines and joint inspection does not encourage this. There is also an inclination among some of the superintendents to establish rules for their inspectors that do not harmonize with the M C. B. rules of interchange. This is a very unsatisfactory state of affairs.

The formulating of rules indicating the condition in which cars are safe to run naturally belongs to the car department. The interests of railroad companies would be promoted by leaving the control of joint inspection in the hands of the man best able to understand the merits of disputes that will arise in the best regulated interchange yards. Obedience to the spirit of the M. C B. rules of interchange of cars is the only way in which the business between connecting roads can be carried on with any degree of harmony. When an inspector is responsible to authority that he concludes cares little for the M. C. B. rules, he only follows the weak dictates of humanity in frequently ignoring the plain dictates of the rules. If a railroad company is not prepared to place the joint car inspectors under the officers whose voice and counsel have been instrumental in perfecting the M C. B. rules of interchange of cars, it would be wiser to withdraw entirely from the Association, for rules that are not enforced become forms for enabling unscrupulous men to follow dishonest practices

A committee of the Master Mechanics' Association has sent out a circular calling for information about wheel centers and tires. There has been so much increase in the size of driving-wheels since the standards were established that it is considered necessary to make additions to the list The standard centers at present range from 38 to 66 inches, the upward steps being by 6 inches. There ought now to be standard centers as large as 84 inches, and many master mechanics believe that a step smaller than 6 inches should be made between the standards. Those who are interested in this important subject ought to give the benefit of their views to the committee.

At a recent meeting of the New York Railroad Club it seemed to be the general opinion that there was no real reason for using flangeless tire on any class of locomotive. Men who had run consolidations for years with all tire flanged, spoke in their favor.

### Rights in the Word "Engineer."

At the last meeting of the American Society of Mechanical Engineers the oft-ventilated grievance was again aired of the injury and disrespect endured by mechanical engineers on account of the men running locomotives being called locomotive engineers. The graduates of engineering schools are particularly exasperated that men who never heard of the differential calculus or of the adiabatic curves should be called engineers. The proposal was made that railroad officers should call their locomotive engineers runners, engine-drivers, or enginemen, in the hope that that would lead the general public to give the appellation of engineers to those who carried a certificate from some school dubbing them engineer. The proposal did not meet general support, and no one was able to devise a satisfactory solution of this stupendous difficulty.

We are afraid that it is beyond a remedy and that the exclusive-minded college graduate, who very often knows nothing of real engineering, will have to endure to hear the high-sounding honor of engineer borne by men who handle locomotives. The change has been proposed too late in the day. The popular voice has decided to call the men who handle locomotives locomotive engineers, and the talk of mechanical engineers' societies and technical school societies about changing the practice will have as much effect as the old woman's efforts to sweep back the ocean with a broom. One or two of our contemporaries began years ago to sedulously avoid calling locomotive engineers by any term except runners, and the practice has been religiously maintained, but we never saw any indications that a single convert had ever been made to the use of the "reformed" expression.

The man with a piece of parchment in his pocket solemnly certifying that the bearer is an engineer deserves some compassion in the dilemma where he is placed. We once saw one of these gentlemen introduced to a lady as an engineer, and his face was a study when she sweetly inquired what kind of an engine he ran? That indicated the extent to which the ordinary mind goes on bearing the term engineer. The nomenclature of the people on this continent terms the man an engineer who handles an engine. There is no decided impression among the public as to the term that mechanical engineers should be known by. If this class of men are aggrieved beyond remedy on account of being classed with greasy engineers, they might devise some other term for themselves, and there is a possibility that the public would learn to call them by their chosen appellation. Unless they agree to do something of this kind, they will have to endure for all time the mortification of hearing others called by the name they think sounds so sweet.

### Learning to Detect Broken Stay-bolts.

The hammer test for ascertaining the condition of stay-bolts appears to be highly satisfactory on some roads, while on others it is not considered worth using. From what we have seen and heard about locomotive boiler inspection we are inclined to believe that no test is positively reliable, but that the hammer test is valuable if made intelligently by men who practice it enough to become expert. The Pennsylvania railroad people, who have devoted particular attention to the inspection of boilers and practice the hammer test, made some curious experiments to find out its value. They had a boiler about to be cut up They invited the boiler inspectors from all over the road to attend at a certain shop and try the hammer test on the boiler All the stay-bolts were numbered, and the inspectors were required to report on a blue print each carried the condition of the stay-bolts. The boiler was then taken apart and the stay-bolts examined. None of the inspectors had detected all of the broken stay-bolts, and they all reported bolts to be broken which were found to be intact. It was said that a deaf boiler inspector came nearest being correct.

The men were sent home and told to keep on with the hammer test but to try to acquire more skill in detecting broken stay-bolts. After a time a second boiler was to be broken up and they were invited to come again and try what they could find out about the condition of the stay-bolts. When the boiler was taken apart and the broken stay-bolts compared with the reports of the inspectors, it was found the latter had greatly improved in their efforts at detection. After another interval of time the inspectors were called to examine a third boiler that was about to be broken up, and they all detected all the stay-bolts that were broken. This is a striking illustration of the value of training and it is well worthy of imitation by railroads generally. There is a vague idea prevailing that any boiler-maker can detect broken stay-bolts by the hammer test, but a boiler-maker has to learn this special part of his art by careful practice and study, just the same as any other man. Nearly all roads have to renew their fireboxes frequently. It would be a good plan to examine those to whom are intrusted the work of inspecting boilers by having them test the stay-bolts of a firebox about to be removed. This would show whether or not the inspectors were reliable

Broken stay-bolts are such a serious source of danger that no reasonable means should be neglected to insure their detection.

### Malleable Iron for Driving-boxes.

There are very few driving-boxes made of malleable iron, but we believe that this material would be a remedy for the breakages of driving-boxes that cause so much annoyance on many locomotives. The prevailing increase of speed, the practice of putting larger driving axles into old engines, and the harder work done all tend to make the driving-box a weak point The size cannot be increased in all engines, so that a stronger material is urgently in demand. Steel has been found objectionable on account of its tendency to cut the wheel hubs and the wedges. Malleable iron does not have this objectionable character. In fact, there is good reason to believe that malleable iron to cast-iron would cause less cutting and wear than cast-iron to cast-iron.

The experience of many people using malleable and cast-iron in machinery tends to prove that they work exceptionally well in contact The latest illustration of this we have noticed was in the construction of the Chapman jack. The small jacks of this kind were first made with screw and base of malleable iron. When the jacks made in this way were put into service it was found that they did not wear well. This induced the makers to look for a remedy, and they tried gray iron for the base. This combination has proved so durable that no other base is now used in the small jacks.

We have known some cases of eccentric straps being made of malleable iron, and they display extraordinary wearing qualities. Those who are annoyed with the breakage of driving-boxes and eccentric-straps would do well to try the use of malleable iron.

### Preventing of Grievances.

The trainmen of the Fall Brook railroad were treated to an agreeable surprise last month in the shape of an announcement from General Superintendent Brown, who stated that all would be paid for overtime when delays kept them on duty beyond certain hours.

A committee of the engineers presented an address of thanks to Mr. Brown in which they say

"We are agreeably surprised to learn that the company has voluntarily granted pay for overtime. We appreciate the company's kindness and consideration for their employés in this and many other instances.

"The increase means a good deal in the way of additional comfort to ourselves and families. We desire to thank you sincerely for your efforts in our behalf and request that you convey our thanks to President Magee.

"We shall endeavor to show by our work, as we have in the past, that we appreciate the company's desire to meet its employés fairly in all reasonable requests. We are solicitous in common with the officials to maintain the high reputation the Fall Brook railroad has won in comparison with other roads for its methods of doing business."

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There appears to be agitation among the railroad telegraphers all over the country to obtain concessions from their employers in the shape of increased pay There have been several strikes lately as a means of emphasizing the demands of the men, and in every case that we are aware of the railroad companies were the victors in the fight. The real trouble with telegraph operators is that their business is too easily learned, and that it is a genteel occupation which numerous young men who aspire to always work with a starched shirt on are glad to enter. The grim law of supply and demand makes the supply of telegraph operators excessive, and the natural result is that the competition for positions keeps the pay low Telegraph operators at railroad stations perform highly important duties, yet railroad companies generally pay the lowest remuneration and get the poorest operators in the business. The men are striving by combination to compel the companies to pay them living wages, but they do not appear to have been very successful this time. Unfortunately railroad companies have never displayed any inclination to pay according to the value of the services performed unless compelled to do so by labor organizations. The telegraph operators may be beaten all along the line this time, but the blind policy of railroad companies will strengthen the cause of organization so that the men will become sufficiently united to win in the long run.

### BOOK REVIEW.

TIPS TO INVENTORS. By Robert Grimshaw, Ph.D., M.E., etc. Published by the Practical Publishing Co., 21 Park Row, New York Price, $1 00.

This is another neatly bound book by Grimshaw So far as we are able to see, there is not a line in it of any value on earth to anybody. It is small and divided up into subjects—Electrical, Metallurgical, Railway, etc.—and under these headings it tells the professional and the amateur inventor what to invent. Under the heading, "In Railway Lines," he advises inventors to get up a brake that takes hold of the rail, and says there is a chance for inventors to change our whole system of train-braking. We think so, too—a slim chance. He wants some one to get up a typewriter that you can see the last letter printed—there are several good ones on the market. He says there is room at the top, and also cash for the inventor who "gets there," with jet propulsion for vessels. Grimshaw's advice about taking out patents is all good enough, but his "tips" are about as good as race-course tips in the evening papers—and no better.

CAB AND CABOOSE By Kirk Munroe G P. Putnam's Sons, New York, publishers. Price, $1 25.

This book is one of a series of books for boys recently put on the market. The young hero of the tale, "Rod. Blake," does almost everything, possible and impossible, saves people from all kinds of disasters, catches train robbers, runs locomotives, etc., etc., and ending up as private secretary to the President. The story is interestingly told, and exciting enough for any boy, and the author seems quite familiar with railroad operations and railroad phrases.

### PERSONAL.

Mr. J. S. Turner, master mechanic of the Mexican Central at Jimulco, has resigned.

Mr. M. M. Reid has resigned the position of master mechanic of the Savannah, Americus & Georgia

Mr. Robert Walker has resigned as master car builder of the Missouri, Kansas & Texas, on account of ill health.

Mr D D. Sewall, formerly general manager of the Consolidated Car Heating Co., has been elected vice-president of that company.

Mr. J. F McElroy, formerly mechanical superintendent of the Consolidated Car Heating Co., has been appointed consulting engineer of the same company.

Mr. W. S. Wakefield, one of the oldest master mechanics on the Chicago, Rock Island & Pacific, has retired. He rose from the foot-board and ran the first engine that went over the road in 1857.

Mr. C. C. Keenan has been appointed general foreman of the shops of the Western New York & Pennsylvania, at Olean, N Y. He was formerly connected with the Pittsburgh Locomotive Works.

Mr. Samuel Irvin has been appointed master car builder of the Missouri, Kansas & Texas, to succeed Mr Robert Walker, resigned. Mr. Irvin was long master car builder of the Missouri Pacific, at St. Louis.

Mr J H. Sewall, formerly assistant general manager of the Consolidated Car Heating Co., with headquarters at Chicago, has been appointed superintendent of construction of the same company with headquarters at Albany.

Mr. F W Sargent, formerly engineer of tests of the C., B. & Q., and for some years general agent for the Congdon Brake Shoe Company, has been appointed superintendent of the latter company's brake shoe and iron department.

Mr. J. H. Berry, master mechanic of the Cincinnati division of the C. C. C. & St. L., has had his jurisdiction extended over the Sandusky division, his headquarters remaining at Delaware, Ohio. This division was formerly in charge of Mr. J S. Porter.

Mr A. W. Quackenbush, lately superintendent of machinery of the Chicago & Alton, has not long remained out of harness He has accepted the position of master mechanic of the St Louis, Cape Girardeau & Fort Smith road, with headquarters at Cape Girardeau, Mo.

We have received a paper containing a lengthy account of the success achieved by Mr. G. A. Haggerty, mechanical superintendent of the Canadian Pacific at McAdam Junction, N B. From what we have seen of Mr. Haggerty's management we can indorse all the kind things said about him.

We have been informed by Mr. F. D. Casanave, superintendent of motive power of the Pennsylvania lines west of Pittsburgh, that they are building seven more of the class X engines at Fort Wayne. The engines of this class already in service are reported to give entire satisfaction in pulling heavy trains.

Mr H G Bechhold has resigned the position of general foreman of the Chicago & Erie at Huntington, Ind., and gone to be general foreman of the Cleveland Frog and Crossing Co., at Cleveland, O. Before leaving Huntington he was presented with some substantial presents by the men who had worked under him.

Mr. D. H. Neale has returned to the editorial staff of the *Railroad Gazette* and is engaged preparing a new edition of the

"Master Car Builders' Dictionary," work for which he is peculiarly well fitted Mr Neale has been mechanical engineer of the New South Wales railways for several years and left there to take his old position on the *Gazette*.

W G Nugent, roundhouse foreman of the Iowa Central, at Marshalltown, has lately been appointed acting master mechanic, *vice* M. C Wheeler resigned Mr Nugent is a young man of more than ordinary ability and above all an excellent organizer His early training was under John Player, as an engineer

Mr Leonard Crossman, who was once master mechanic of the Central Railroad of New Jersey, died at Elizabeth N J, last month Mr Crossman went to the road in 1855, with an engine called the ..., built at Taunton and ran it till he was made master mechanic, a position he held for eighteen years, being succeeded by William Woodcock

Mr Thomas Smethurst, master mechanic of the Mexican Central at Guadalajara has been transferred to Jimulco, to succeed Mr J S Turner, resigned Mr C E Thackford has been transferred from San Luis Potosi to Guadalajara to succeed Mr Smethurst and Mr D M Haynes, recently general foreman in the shops in the City of Mexico, has been appointed master mechanic at San Luis Potosi, in place of Mr Thackford

A number of changes have recently been made in the organization of the West Milwaukee shops of the Chicago, Milwaukee & St Paul Mr Elijah Fairbairn, master mechanic of the shops has resigned and has been offered another position Amos E Allcutt general foreman, Joseph Corner, foreman of the erecting shops and other foremen have resigned Mr C A Place, who has been paymaster since 1861, will retire on January 1 with a pension

Mr Matthew Ellis, formerly master mechanic of the Chicago, St. Paul Minneapolis & Omaha, died at St Paul last month. Mr Ellis had to retire from active service about two years ago owing to ill health Mr Ellis was born in England and worked for a time in the Stephenson Works at Newcastle. He came to America about 1860 in company with the late Mr Lowrey, of the Chicago, Milwaukee & St. Paul, and several other young mechanics, who became mechanical officers of American railroads

We have to acknowledge a very pleasant visit from Mr. T F Rotheram, locomotive superintendent of the New Zealand railways, who is visiting this country while on his way to Europe Mr Rotheram is naturally very much interested in our railroads and in our methods of operating He sees many things to admire, but on the other hand is a keen critic of some practices that are common here. He is a man remarkably free from insular prejudices and will doubtless profit by what he has seen in this country.

J N. Lauder, of the Old Colony, is fixing up an exhibit for the World's Fair He is putting into first-class shape the last inside-connected engine, built by Geo S Griggs twenty-three years ago for the Boston & Providence road, now a part of the Old Colony system This engine is the last of a class of famous early engines built by Mr Griggs, she has 17 x 22-inch cylinders An old English passenger coach, that has been carefully preserved since the '40s, is also being fitted up This car will have its original wheels, body and brake

Mr Cecil Gabbitt, who made a miserable record as general superintendent of the Central of Georgia, has been appointed by the receiver general manager of the Savannah, Americus & Georgia. Mr Gabbitt is inaugurating his rule on this road by turning out the principal operating officers This is the policy so often followed by small men who do not understand their business. It is the most certain way to achieve failure Men of sense always understand that the old men on a road will do better than new ones everything else being equal But Mr Gabbitt is an old track man and evidently thinks that men suitable for superintendents are as numerous as men suitable for track foremen

Mr H Stanley Goodwin, general superintendent of the Lehigh Valley Railroad, died very suddenly at Bethlehem, Pa, on Christmas morning. Mr Goodwin was one of the best known civil engineers in the country He began engineering work in 1852 as a rodman on the Delaware, Lackawanna & Western, and eight years later, after varied experiences in his business, he attained the position of resident engineer of the Pittsburgh, Fort Wayne & Chicago Three years afterward he became chief engineer of the Northern Central In 1882 he was appointed superintendent of the Lehigh Valley railroad. He was considered one of the best authorities in the country on railroad engineering problems

For the last month there have been rumors that owing to incompatibility for pulling in harmony with the purchasing department, Mr E P. Lord, superintendent of motive power of the Big Four had been asked to send in his resignation The tendency of the mechanical chief of this road to be out of harmony with the purchasing agent is nothing new That the management would be willing to sacrifice their remarkably able superintendent of motive power upon this altar of discord we were inclined to doubt, and we now have reason to believe that the rumors of a change originated with those who were anxious to see one made A change is badly needed on this road, but not in the head of the mechanical department The real cause of trouble is that the striker imagines himself to be captain of the boat.

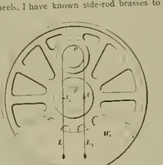
Mr Eugene Chamberlin, the well known master car builder for the New York Central, has resigned and accepted the position of superintendent for Rood & Brown, wheel-makers, Buffalo. We are very sorry to see a man like Mr Chamberlin leaving railroad service, for he is a man of commanding ability who would be a credit to himself and to his employers in any line of business. He is a persuasive public speaker and was a power in the Master Car Builders' Association By power of argument and by sagacious management he several times carried the convention to adopt measures that seemed to have no support till he became their advocate Besides this he was an exceptionally good officer, and has few equals as a shop manager There are very few first class railroads in the country that would let a man like Mr. Chamberlin go to a private firm

One of the most popular of our supply men appears to be making an unqualified success as a railroad manager. About six months ago, Mr J. K. Bole, of the Otis Steel Company, was appointed receiver of the Valley Railroad, at Cleveland The road was a complete wreck and Mr Bole devoted a little of his well-known energy to regenerating the concern, and he has already got the road in good working order on a remarkably small expenditure of money He is putting in new ties, new rails and new rolling stock, as fast as the limited means at his disposal will permit. Trains can now be run over the road at fifty miles an hour safely Four months ago it was jeopardizing the lives of all concerned to run trains faster than fifteen miles an hour They did not require to hold trainmen down to schedule speed They were frightened to hold up to it, but there is a very decided change now

## Roundhouse Work.

BY OBSERVER

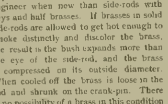
Practical machinists who have had experience in filing rod brasses will have noticed that the connections will often warm up after filing, and wear rapidly until they accommodate themselves to the oscillating of the driving-wheels of the engine The rougher the track the greater the change in the length of engine's side-rods, and the greater the movements of the driving-wheel's centers. After the rod brasses have accommodated themselves to the different movements of the driving-wheels, I have known side-rod brasses to



run for months with but little additional wear if the engine is kept continuously on the same run. It is not always good practice to file side-rod brasses when they show a little loose on crank-pin

Solid side-rods with brasses pressed in require a little more attention from the engineer when new than side-rods with keys and half brasses. If brasses in solid side-rods are allowed to get hot enough to smoke distinctly and discolor the brass, the result is the bush expands more than the eye of the side-rod, and the brass is compressed on its outside diameter. When cooled off the brass is loose in the rod and shrunk on the crank-pin. There is no possibility of a brass in this condition to run cool again until it is taken off and refitted to rod and crank-pin. Solid side-rod brasses ought to be fitted loose on crank-pins. Do not let them get hot enough to smoke and you may expect good results. This, I am sure, is the general experience with solid side-rods. Keyed side-rods are adjusted to accommodate the driving-wheels, but driving-wheels must be adjusted to accommodate solid side-rods.

A great many derangements of the locomotive can be attributed to poorly adjusted connecting rods. Bolts are sheared, keys are lost out, crank-pins sprung and



cut, rods bent, finally axles of driving-wheels bent and driving-wheels twisted on axles Those are derangements that are not in a general way early determined by the ordinary roundhouse machinist Crank-pins can be tested in various ways, but more quickly and correctly by using gauges made for the special purpose. For bent driving-axles in the ordinary way, caliper between treads of driving-wheels. If the treads are parallel with each other the axle is not bent. To determine if driving-wheels are twisted on axle, the operation as illustrated on accompanying engraving will demonstrate. With a pair of dividers inscribe circle on end of driving-axle equal in diameter to collar of crank-pin, as marked *c c* Hang a double plumb-line with double plummet over collar of crank-pin. Pinch engine backward or forward until double plumb-line cuts circle of same diameter as collar of crank-pin on end of axle, marked *l l*. Wedge the driving-wheels so they remain in position. On driving-wheel on opposite end of axle inscribe circle equal in diameter to collar of crank-pin. Place straight-edge on collar of crank-pin, cutting circle of same diameter as collar of crank-pin on end of axle. Make straight-edge fast to driving-wheels with clamps, and apply plumb-rule, *P*, to parallel straight-edge. If the driving-wheels should be twisted it is determined at once by the plummet, *B B*. This operation can be gone through in a short time

The cost of maintenance of the vacuum-brakes on the New York Elevated Road is an interesting item to those in charge of suburban railroads. General Manager F K. Hain recently made a report on this subject in which he says "The cost of material and labor for the maintenance of the Eames vacuum-brake on 1,043 passenger coaches and 310 engines for the year ending September 30, 1892, was $6,339.84, an average of $4.68 for each of the 1,353 pieces of equipment for the year; 83,000 stops are made daily." It would be very hard to beat that record.

Many members of the New York Railroad Club gave evidence at a recent meeting that there was no practical reason why consolidation or mogols should have blind, or flangeless tire, men were present who have run locomotives with 15-foot-8-inch rigid wheel base for years on crooked track with flanges on the four pair of wheels The practice seems to be to make the forward and back flanges from ¾ to ⅝-inch short of gauge and those in center of the wheel base up to gauge.

In answer to a correspondent, who writes to show how much will be gained by the increase of ten seats in the Chicago Elevated cars, we have to say that his figures have been wasted. The cars on the Chicago road seat 48—just the same as the N Y. Elevated—and we fail to see how double doors will move the crowds quicker, because the gates are the same. It's a good deal like putting in 30-inch ports and leaving the nozzle 3¼.

We have received notice that F H Coolidge and R. E. Meehan have gone into new quarters in the Equitable building, Atlanta, Ga. Mr. Coolidge is southern agent for the Westinghouse Brake Company and Mr. Meehan handles the products of Paul S. Reeves Smelting Works. Mr Meehan is son of Mr. James Meehan, of the Cincinnati, New Orleans & Texas

The American Waltham Watch Company has recently completed, ready for delivery, watch movement No. 6,000,000 It took twenty years to make the first million watches, five years for the second, four years for the third, three years for the fourth, two years for the fifth, and about eighteen months for the sixth.

The work of the American Railway Association has increased the car mileage of the country from ten miles per twenty-four hours to seventeen miles It hardly seems possible that our freight cars only average seventeen miles a day.

How many of our readers will find in Cy. Warman's touching little poem on page 11 a case much like one they have known

The C., B. & Q. are in the market for some additional power variously stated to be from fifty to seventy-fifty engines

The Norfolk & Western have let 1,000 freights to Pullman and 2,000 will probably be built at Roanoke.

The Schenectady Locomotive Works have an order for three moguls from the Maine Central.

### A Successful Absurdity.

Readers of Chordal's letters will remember that the author speaks in an amusing strain on the mechanical paradox illustrated in the working of a locomotive. In expert evidence given in a law suit, a few months ago, Mr. James W. See, author of the book mentioned, has this to say about locomotives

"A railroad locomotive on a steam railroad contains many elements of absurdity in general principles. Its tractive power is due only to its weight, and its own weight is a dead weight to be carried along with the paying train. If each wheel of a railroad train were animated, then every pound of freight or passengers carried would become traction weight and the absurd locomotive could be suppressed. The electric locomotive is as absurd as the steam locomotive. The axle of the paying car is the place to apply the tractive power."

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In the course of a conversation with Mr. Bissel, general manager of the Wagner Car Works at Buffalo, we learn that they are extremely busy preparing for the exceptionally heavy business expected next month. They are employing 1,800 men, and this large force has to be worked overtime. Orders have been given to further increase the force this month. All of the old cars are being overhauled as fast as they go into the shops, and new cars are being turned out rapidly. The company has, during the year, added about $40,000 worth of improvements.

Some parties connected with the New York, New Haven & Hartford Railroad Company have got a practical illustration of the adage that "'twixt the cup and the lip there is many a slip." They had prepared to swallow that goodly morsel of railroad property, the Connecticut River Railroad, and a meeting of directors was called so that the parties most interested might participate in the feast. When these gentlemen got together it was found that the Boston & Maine, otherwise the Philadelphia & Reading, had carried off the game.

A startling accident happened with a tire in the shops of the Rhode Island Locomotive Works, at Providence, R. I., last month. A set of Midvale tires had been applied to the double-ended Johnstone engine built for the Mexican Central Railroad. The usual allowance for shrinkage was made. Some hours after they were put on, one of the tires burst into several pieces. The owners of the locomotive are very thankful that the accident was not delayed till the engine was at work above the giddy precipices common on the road.

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Messrs. John Wiley & Sons, New York, report that their popular books of the season are "Modern Locomotive Construction," by Mr. J. G. A. Meyer, associate editor of the *American Machinist*, and "Mechanical Drawing," by Professor McCord. Both these books are first-class works, original productions by men expert in the lines they are writing about. We are glad to learn that the real honestly written books are crowding out the fraudulent compilations which have been so importunely forced upon the engineering fraternity of this country.

At a meeting of the Consolidated Car Heating Co., held at Albany, December 6th, a number of changes in the officers were decided on, the particulars of which will be found in our personal column. The Vice-President and Treasurer reported that the business of the company had averaged $1,000 a day for eighteen months.

We are printing 25,000 copies of this number of LOCOMOTIVE ENGINEERING. A pretty healthy pile of papers. When piled up, one on top of the other, they would make a monument 166 *feet and eight inches high*. This is the kind of a monument we want.

### HERE COME THE CARS!

By Cy Warman.

How often at night, when I'm rocked o'er the rail,
 And the little stars shine overhead,
My mind wanders back, over memory's trail,
 And I think of the days that are dead.
The red locomotives we had for our toys,
 The coaches so gaudy and gay
How we played together, Bill, when we were boys,
 And again I can hear you say

"Chuchu!! Chuchu!! here comes the railroad!
 I'll be the brakeman and open the bars."
Big bell a-ringing,
Somebody singing
 "Chuchu!! Chuchu!! here come the cars!"

And here, where your sleep is so dreamless and still,
 In this silent city I stroll.
O, send me some signal, or speak to me, Bill,
 How is it, old friend, with the soul?
I fancy the loved ones who went on before,
 Away from the world and its care,
Knew when you were coming, and on the bright shore
 Were waiting to welcome you there.

How is it up there on your heavenly railroad?
 The moon for a headlight, for white lights the stars.
The glad bells are ringing,
The angels are singing
 "Chuchu!! Chuchu!! here come the cars!"

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When cars for the moving of grain begin to get scarce, Kansas City is nearly always the first place to proclaim the existence of a famine. There are two causes for this. Kansas City is a center through which large numbers of cars are drawn for loading with farm produce; then the people of that region are so energetic in pushing business that their howling is heard from ocean to ocean when their peace is not bought by supplying their wants as soon as they arise. Kansas City at this hour of writing, two days before Christmas, is reported to be 6,000 cars short of the demand, and the citizens are rending the air with their complaints in a manner that will disturb the peace of Christmas in divers railroad households. We pity Kansas City, but we pity more the victims to whom the complaints will be made.

The committees of investigation appointed by the Railway Master Mechanics' Association are displaying unusual activity this season. Four circulars of inquiry have already been issued and several of the committees that are collecting information through direct investigation and personal correspondence are reported to be actively at work.

At the last meeting of the New York Railway Club, Mr. Dolbeer's paper on the "Proper Time to Destroy a Locomotive" was well received and discussed. Mr. Dolbeer's belief is, that more old engines should be scrapped, and he showed some interesting figures to prove that an engine eight years old would cost more to maintain for eight years longer than it would to scrap it and buy a new engine. The plan recently adopted of sending blanks to members to fill out, asking the club to take up some certain question, succeeded so well that the members voted to dispense with a paper at the January meeting and discuss ten of these topical subjects in order to clear the docket.

Out in New Zealand there are four or five systems of railroad in different localities, not yet connected. There are nearly 2,000 miles of road of 3-foot 6-inch gauge, all under the management of the government. This is a good deal of railroad for a country so sparsely settled as the little continent in the South Sea--they only have 600,000 people. For £10, or, practically $50, your can buy a season ticket, good for a year, and you can ride on any road in the colony as long as you want to.

### Some English Steel Tests.

One rainy day last August the writer put in some hours at the plant of the Leeds Forge Co., Ltd., Leeds, England, the works of Sampson Fox, who made fame and fortune by the introduction of the corrugated furnace tube.

I won't attempt to describe these works, yet there is an impressive lesson to be learned at every turn, and one of the most impressive is the advantages of a specialty—the developing and improving of one thing.

When Fox first started his works he rolled iron and steel of varying qualities to meet the different prices and the different classes of trade, but as soon as he got into the pressing of steel, flanging and corrugating, he discovered that his reputation depended entirely on results, and, like the keen business man that he is, he decided that only the best material should be used for the new line of work.

The way to insure good material was to take all the poor material out of his place, remove all the furnaces and processes for producing it, buy nothing and make only the best. This he did.

No coal fires are used in the works, gas or water gas being the only flame that comes in contact with metal to be worked.

The writer was particularly struck with the care used in inspecting plate. They were making up stock for carriage frames, trucks and boilers for one of the Indian roads, and off of every sheet of boiler steel *twelve* test pieces were cut—six for their own standard tests and six for the inspectors.

A heavy steel ingot is heated and drawn out under a hammer, and about a third of its upper end cut off and thrown away. Every steel-worker knows that the bottom end of an ingot is always the best steel, the top is uneven and filled with bubbles that, if rolled out, make a *pipe*.

When a plate comes out of the rolls it is laid on the cooling floor, and a man gets into position where he gets the proper light on the sheet, and if it shows a dark spot or spots in cooling, these places are chalked. It is usually found that there is a lamination there; the sheet being virtually double it cools quicker than the solid parts.

In flanging the back-head of a locomotive boiler, for instance, that part of the sheet that was made from the bottom of the ingot *must* go at the top—better metal for the flange—they have discarded sheets that were flanged "wrong end up."

All pieces that have to be flanged or pressed are operated upon at one heat—a frame for a 6-wheeled tender on a truck is made at a single heat.

Metal is never worked unless it is hot enough in every part to ignite a piece of hard wood.

After flanging or pressing a piece it is annealed and then straightened and trimmed cold

They were making "goods-waggon" frames for India, the sides, sills, cross and end sills were of pressed iron of a U or trough form, the sides and ends folded up, some of the angle-braces were not over 4 inches wide; the ends folded on an angle and the work done so as to thicken the metal wherever it bent. All the pieces of this frame have the edges trimmed on shears and then ground true on emery wheels, and the holes drilled in jigs.

One of these frames was set up in the shop on horses, but instead of being riveted up, there were taper pins driven through the holes to keep it together. This was the first frame and the standard.

Every piece made for the several hundred wagons in the order, had to be a duplicate of the one in the standard frame, and the inspector had a perfect right to order any part that don't seem to "jibe" to be tried in the standard frame, if it don't fit to a T, without drifts, or bending, or anything else, it is laid on the ground and a hole punched through it with a sledge, on one end of which is a punch—the inspec tor of the road is paid to hunt for these things and he hunts.

Many of the English, rather British, roads are using a considerable number of pressed steel trucks similar to ours, and for some classes of cars they are slowly creeping into favor

The big presses here are a wonder to a mechanic, one of them has two 36-inch cylinders and six 12-inch cylinders, capable of getting a 200-ton squeeze on a sheet On this press they flange the lower half of a 14-foot marine boiler-head with the outer flange thrown one way and the flange for the three furnaces the other This press also takes in a 6-wheeled truck frame, flanging the whole edge one way, the three jaws another and oval openings, to lighten the plate, flanged the same as the edge In such work the big parts are taken care of by the 36-inch cylinders and the other parts by the smaller cylinders, each operation following in such a way as to prevent the "crimping" or folding of the plate and insuring that each corner will be thicker than the flat part of the sheet

The latest production of the works was a car axle box of the American pattern for passenger service a floating box This was folded up with flange in front and back, places on the sides for the jaws, etc , looking just like a cast box it weighs only 21 pounds as against about 60 or 65 for a cast box. This box is now being duplicated at the Fox Works at Joliet, Ill., an institution, by the way, of which Mr Fox is very proud He says that if two such hustlers as Jim Hackney, in the shop, and Jim Brady on the road, don't make a success of pressed steel in America he misses his guess.

The machines for welding up furnace tubes 4 feet in diameter and 8 long are very ingenious and elaborate, the tube is slipped over a long heavy arm that carries a pipe terminating in a fire-brick burner about a foot or 15 inches long, another arm

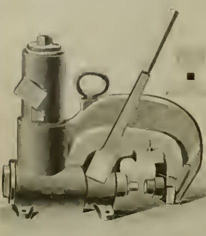

Fig. 1

extends out above this, carrying a similar burner and two heavy flames of water gas soon heat a long section of the lapped edges of the tube When this is at the proper heat it is moved out over an anvil and steam hammers weld it down. They were welding up some locomotive domes this way when the writer was in the works

The corrugations are rolled into furnace tubes after they are welded

In the shops they were making some moderate sized square fireboxes for torpedo boats, the two sides and crown sheet being in one piece and put up without stays. These boxes were expected to stand a pressure of 160 pounds.

In these works it is not necessary to make new dies for every piece wanted. They have a system of segmental dies that can be built up into varying shapes and sizes All round corners are of a standard radius for several sizes, ovals and circles can be formed, etc , so that a change in centers simply means the dropping into or taking out of the die of another segment.

All work is done on the piece work plan.

J. A H

## Some Modern Hydraulic Tools for Track.

Watson & Stillman, of this city, have recently put on the market two efficient tools for track work that have distinctive advantages. Fig. 1 shows a hydraulic punch for making the bolt holes in the web of rails It is light enough to be handled by an ordinary section gang and can be used without removing the rail from its place.

By the use of a quick acting lever, shown in the middle of the cut, the ram may be worked in and out a distance of 2 inches without the loss of time and labor of pumping. In mounting the die in a sliding bolster, which latches it in position an additional opening is obtained without the extra weight, which would be necessary to get a 4-inch movement and also a reservoir of sufficient capacity A guide is placed at the top of the jaw which once set for any pattern of rail, will cause all holes to be punched at the same height. In returning the punch to the cylinder the pumping socket must be brought down against the head lug before the quick-working lever can be used.

Two sizes are made, the one for 70-pound rails weighs 225 pounds and uses a pressure of 50 tons, while the one for 90-pound rails weighs 300 pounds, but uses a pressure of 120 tons

Fig. 2 is an adaptation of the hydraulic punch, for the purpose of punching the spike slots in the base of heavy rails for regular railroad service, as is frequently desired on switches and curves, and is the first tool of the kind which is convenient, expeditious and reliable, making a clean cut slot The body of the punch is somewhat longer than in the regular style of punch, and is cut out in front to bring the center of the punch to the proper position. The punch may be brought down to the work without the labor of pumping, being both raised and lowered by the lower lever

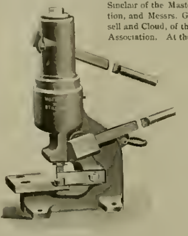

Fig. 2

shown in the illustration. The head is of the same construction and size as in the corresponding sizes of the regular make of punch. The No 2 with 1½-in. jaw, weighing about 90 pounds, has sufficient power to punch the [illegible] x [illegible] slot in the side of the base of 90-pound steel rail Guides are placed on the side for determining the depth, and also act as strippers.

## The New York Air-Brake.

The New York Air-Brake Co is rapidly coming to the front. The company have made some recent discoveries that give grounds for the assumption that the younger company has been making more progress in the art than its older competitors, and if results in practice bear out recent experiments in the shop, the railroad world may prepare itself for some surprises in the science of air-braking

Stockholders in the New York Air-Brake Co are feeling enthusiastic, and believe the New York Air-Brake Co. will yet eclipse all others.

The New York Air-Brake Co is now filling orders for the New York Central & Harlem Railroad, which road has begun the equipment of its old cars.

The works of the company at Watertown will be rapidly enlarged to a capacity of 250 car equipments per day They are now turning out 100 a day and are crowded with orders

The pump of the New York Air-Brake Co. is claimed to be rapidly replacing others, as its superiority is conceded.

## A Novel Cutter.

The illustration herewith shows a novel form of their patented milling cutter for

circular work, such as rod-brasses, recently put on the market by the Ingersoll Milling Machine Co., of Rockport, Ill.

## Meeting Place of Railroad Conventions.

On December 13th, a meeting of the Joint Committee of the Master Car Builders' Association and the Master Mechanics' Association was held at Hollenden Hotel, Cleveland, for the purpose of deciding on a place of meeting for the next conventions.

Mr. John Hickey was elected Chairman, and Mr. John W. Cloud as Secretary of the meeting. There were present, Messrs. Hickey, Garstang, Blackall, Stewart and Sinclair of the Master Mechanics' Association, and Messrs. Grieves, Casanave, Bissell and Cloud, of the Master Car Builders' Association. At the call of the Chairman, Mr. Sinclair explained the objects of the meeting.

The expressed desire at the last conventions that the coming conventions should be held near Chicago was carefully considered, and careful attention was bestowed upon the accommodation available at different places near Chicago. Various gentlemen were invited to express their views about suitable places of meeting, among them Messrs. Freeman, Sewall and Richardson, the Committee of the Supply Men. The accommodation available at Waukesha, Milwaukee, Detroit, Cincinnati, Cleveland, Lakewood on Chautauqua Lake, and Saratoga were discussed very thoroughly. After this was done, a vote was taken which resulted as follows Four for Lakewood on Chautauqua Lake, N Y., two for Saratoga, two for Cleveland, one for Old Point Comfort. Another vote was taken to decide on the second place, which gave Saratoga the preference. A sub-committee, consisting of R. C. Blackall, Chairman, representing both Associations, T A. Bissell, representing the Master Car Builders' Association, and Angus Sinclair, representing the Master Mechanics' Association, was appointed to determine whether Lakewood would be suitable or not and to settle on one of the other places if it was not.

This committee met the hotel-keepers of Lakewood, at New York, on the 15th, and an agreement was made by the committee that Mr. Sinclair meet Mr. Freeman (the latter for the Supply Men), and go to Lakewood and examine the hotel accommodation. This was done, and the accommodation being satisfactory, arrangements were made to hold the conventions at that place.

## The First Railway Master Mechanic.

We have received from Mr. T. Hackworth Young, general foreman of the Chicago, Milwaukee & St Paul at Chicago, a memoir of his grandfather, Mr. Timothy Hackworth, who is called the father of the locomotive. Those who are familiar with the history of locomotive engines will remember that Mr. Timothy Hackworth entered a locomotive built by himself for the famous Rainhill competition, where the Rocket of Stephenson came out victor Many of the leading engineers of that day believed that the "Sanspareil," as Hackworth's engine was called, was the best in the trial, but one of the cylinders failed on the day of the competition and that proved fatal to the engine

Mr Hackworth was the first man to make the locomotive a commercial success through his invention of the exhaust blast Before he introduced this improvement the locomotives on the Stockton & Darlington Railway, where he was master mechanic, were more expensive to operate than horses, and there was strong likelihood of their being abandoned, when the simple act of passing the exhaust steam through the chimney gave them such increase of boiler power that the future success of this form of engine was assured.

The Stockton & Darlington was the first railway regularly operated, and Mr. Hackworth being the first man in charge of the machinery of that road, was the first railway master mechanic in the world.

The Pennsylvania Railroad Company last month made some experiments with a train equipped with a re-enforcing brake intended for use at unusually high speed. The New York Air-Brake Company made experiments of the same character with a train on the New York Central.

We are frequently asked to recommend draughtsmen and graduates of technical schools to parties looking for that kind of help If men of this class looking for work will send us their names and addresses we will be glad to put them on a list which we keep and recommend them when the opportunity comes.

Parties using the Butler attachment for car drawbars say that the device is a perfect preventive of the loss of draft springs, and on that account alone it pays to use the attachment.



## OUR ENGRAVINGS.

Of late we have had a great many inquiries as to who made the fine half-tone plates shown each month in LOCOMOTIVE ENGINEERING. Credit is due the expert anywhere and we are glad to recommend the engravers of our plates to those wanting good work at reasonable prices. All the half-tones and reproductions we use are made by the STAR ENGRAVING & PRINTING CO , 607 & 609 Sansom St., Philadelphia, Pa.

SINCLAIR & HILL.

### Johnstone's Double-Ended Compound.

The double-ended locomotive shown in the annexed illustration is one of three built for the Mexican Central Railroad by the Rhode Island Locomotive Works, after designs prepared by Mr. F. W. Johnstone, superintendent of machinery of the road. The engine, as will be readily seen, is an extraordinary form of a locomotive. It looks like two moguls fastened cab to cab, but it is structurally a good deal more than that. The purpose of this odd form of engine is to provide an exceptionally powerful motor for climbing the steep mountain grades of the Mexican Central Railroad, and with flexibility sufficient to go round the very sharp curves with the least possible frictional resistance. The flexibility is obtained by securing the driving-wheels in a truck which is free to move in a line different from that followed by the main frames. In the Mason bogie engines the drivers are grouped in a flexible truck which carries the cylinders. In the Johnstone engine the cylinders and boiler are carried on the main frames separate from the driving-wheel truck.

As the cylinders are not in line with the driving-wheels in passing curves, it is necessary that a special method of transmitting the power from the cylinders to the crank-pins should be employed. This is done in a very ingenious way through levers that transmit the power and compensate for the varying distances between the pistons and the crank, due to the swiveling of the driving-wheels. But for this compensating arrangement it would be necessary to give the engine so much cylinder clearance that the loss of steam would be very great. The power transmitting levers are seen at the back of the cylinders, connected at the top by a short link and the bottom ends pinned to the front end of the main rods. There are two of the latter, one connecting with a crank-pin, the other with a return crank. The piston transmits motion to the back one of the two levers, and that gives motion to the front lever, which is fulcrumed securely to the frame near its center. We must delay giving our readers an analysis of this motion until we receive drawings of the levers and connections.

The engines are compound with annular cylinders, the high-pressure cylinder being in the middle and the low-pressure cylinders outside. The high-pressure cylinder is 13 inches diameter and the low-pressure 28 inches. The stroke is 24 inches. It is calculated that the cylinder capacity of each pair of cylinders is equal to a 19 x 24 simple engine.

The boilers are of Otis steel, 9-16 inch diameter, and carry 180 lbs. of steam to the square inch. They are 54¼ inches diameter and have 201 2-inch tubes, 15 feet 9½ inches long. The fireboxes are of the Belpaire type, 56 inches long and 56 inches wide.

The arrangement of working is that the valve motion of the two engines is operated by one screw reverse lever. The engineer is located at one side of the cab with all the apparatus for working the engines within his reach, the fireman is on the other side and applies the coal through side doors. A coal passer is employed to help the fireman.

This is the heaviest and most powerful locomotive in the world. The weight, in working order, is about 130 tons.


Double-Bogie Compound for Mexico

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The Brooklyn Union Elevated Railroad people are in the market for about twenty coaches. They want to secure a delivery for May.

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The Buffalo, Rochester & Pittsburgh R. R. are just receiving the last of their recent order for 850 cars, all equipped with the New York air-brakes.

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A St. Louis inventor is reported to have received $50,000 for a patented brake which is designed to grasp the rail. The inventor was more fortunate than the purchasers are likely to be.

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The Brooklyn Elevated Railroad is in the market for about ten locomotives. The manager talks of ordering some more compounds. He has three Rhode Island compounds now on the road.

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Owing to increasing demand for the Lunkenheimer brass and iron specialties, the company has been compelled to double its capital for the purpose of increasing the manufacturing facilities.

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The Schenectady Locomotive Works have received an order for sixteen locomotives for the Chicago & Eastern Illinois, and three freight engines for the Maine Central, all to be equipped with the New York air-brakes.

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The increasing demand for Coffin treated material for axles, cranks, pins, etc., has necessitated an increase in the already extensive turning and forging facilities at Johnstown. Some six or eight roads are added to the list of users of this material.

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The largest single order for car-heating material ever given for new stock was received by the Consolidated Car Heating Company, on December 15. This order was for the equipment of 100 New York Central standard coaches. The Gilbert Car Manufacturing Company, of Troy, N. Y., are building these cars.

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The Northern Pacific intend to build many of its freight cars in the Edison shops, Washington, in future. Lumber is so much cheaper there than it is in the East, that the cars can be built cheaper, although labor is slightly higher. As a start on the new policy, the shops named have received an order for a large number of logging and lumber cars.

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Spon & Chamberlain, New York, have lately issued "The Practical Polish and Varnish Maker," by C. Standage. This is a book that all progressive railroad painters ought to have for ready reference. The book is by a practical painter and contains receipts and formulæ for the manufacture of polishes, lacquers, varnishes and japans of all kinds for workers in wood and metal, with directions for their use.

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The Empire State Express, on December 21st, was detained by reason of a freight breaking in two, which occurred on the Hudson division. The train left Peekskill late and ran from Peekskill to Albany, a distance of 101 miles, in 96 minutes, an average running time of over 63 miles an hour. It ran the distance from Hudson to Albany, 28.43 miles, in 25 minutes, slowing down to 20 miles an hour over the Stockport bridge, an average running time for this distance of over 68 miles an hour.

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The Dixon Crucible Co., of Jersey City, N. J., are putting the fifth story to their lead pencil factory, the floor being 175 x 75 feet. One would think, to see the improved machinery in this place turn out lead pencils, that a week's run would glut the market of the world. The pencil department is only a small part of the works, yet its business is so large that they will build in the spring a brass-shop and a rubber-shop just to supply the millions of little pencil tips of various designs that they make.

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Not a long while ago we reported in the pages of *Hoisting* that a locomotive crane was doing duty in a quarry as a switch engine, shunting cars from the quarry to the siding on the main track. We have since seen a locomotive crane employed to pull a small train of cars out of a machine shop, for the purpose of getting them out of the way. Shunting cars and switching trains is not exactly the prime purpose for which a locomotive crane is built or purchased, but the above uses serve to indicate the general adaptability of a movable crane with self-contained power to the necessities of the shop or yard where it is used.—*Hoisting*.

# Railway Liars' Association.

Dr. MUNCHAUSEN, Sec'y.

References as to experience and ability required of all candidates.

## Two Examples.

The master mechanic sat in his big revolving chair and put question after question to the nervous fireman who was being examined, to see if he knew enough to take charge of the handles in the cab of a switcher.

"Now, my young friend, there are two things I want to impress on your mind, and they are as follows, to wit, namely:

"R-u-n s-l-o-w and

"D-o-n-'t d-r-i-n-k!

"Now, you can see examples every day of the work done by drink—

"Yes, sir; I'm the master mechanic."

This was said to an old man who opened the door with an inquiry.

"Come in, sir."

The old man came in; he was six foot, had a keen eye, snow-white beard and hair, an elastic step, sharp, well-preserved and impressive. He had called to get the address of his grandson, who was an engineer on the line.

"I think, sir," said the M M, while the fireman drew into the background, "I think you are one of the finest examples of well-preserved manhood I have ever seen. Might I inquire your age?"

"I'm 86, sir."

"Eighty-six years! Well, I believe you are as hearty as I am, and I'm not quite half that."

"I rode twenty miles on horseback this morning, sir. I can't see but that I am just as good a man as I was forty years ago—never sick a day in my life."

"Remarkable, remarkable," muttered the M.M. "May I ask, sir, to what you attribute your health? Do you use tobacco?"

"No, I never used it."

"Nor liquor?"

"Never a drop of the stuff has passed my lips."

"Ah, I thought so. I was just talking to my young friend here about temperance. You are an example for him; let's see, your name is—"

"Wood."

"Ah, yes; why, your grandson is out in the roundhouse now—step right through that door and you will find him at the engine numbered 186."

"There is an exam—

"Yes, sir; come in."

Another old gentleman, as hale, as hearty, and, if anything, better preserved, stepped in.

"Excuse me, gentlemen, I expected to find William here."

"You refer to an old gentleman with white beard, like yours?"

"Yes, sir, he is my brother."

"You are the younger, I see."

"Oh, no, Bill's two years younger than me."

"A remarkable family, sir, a sermon on temperance."

"Temperance! Why, you ought to hear Bill preach on temperance; he's a teetotaler; I do all the drinking for the family."

"You may take a drink now and then, but you know enough not to abuse it."

"Well, I don't know, I've been drunk weeks at a time, my boy, whole weeks, and since I was nineteen years old Sunday night has never seen me sober. I enjoy life, I do. Why, my dear sir, I have drank enough whisky right in this town to float the biggest man-of-war Uncle Sam owns. I'm huntin' Bill now to borrow $10 to get a demijohn to take home. Temperance is good enough for women, but I don't propose to let my whistle dry up as long as my name is Wood."

The M M. looked out of the window as the sprightly old drinker mounted his horse.

"How do you account for that fellow's health, sir?" asked the fireman.

"Well, Jimmy," said the M.M., turning his paper-weight over and over, "I guess that the old rule stands good, and that says, 'To preserve *wood*, you must keep it either very *wet* or very *dry*'—but mark ye, boy, to preserve the crown-sheet of the 18 you keep it wet, and to preserve your job you keep *your own* crown-sheet dry—dusty dry, boy!"

## The Crown-Sheet in Danger.

"Everybody on the Pacific Coast," writes a correspondent, "has heard of the late Hank Smith, as good an engineer as ever turned a brake handle—but wet, decidedly convivial. Some time before his death, while the ultimate result of his sickness was yet in doubt, his physician positively forbade the use of liquor.

"Swearing off was about as hard on Hank as dying, in fact it was about the same thing. About the time that the order stopping liquid supplies had been issued, some one asked young Smith how his father was. The young man knows something about an engine himself. He answered:

"'Well, they've made the old man stop drinking and he's burned his crown-sheet. They don't know yet whether it'll fall in on him or not.'"

## The Cinch on McCormick.

"A long time ago," said the old-timer, stopping to tamp down the cut-plug in his cob pipe; "A long time ago, when I was on the South Park road, we were having a good many wrecks.

"Most of these were caused by runaways, the stock was equipped with straight vacuum, and it wouldn't suck wind for a cent—'cause they didn't take keer of it.

"We had a superintendent then of the name of McCormick, who was a holy terror on the fire, he'd discharge a man just on suspicion; new men come and went on almost every train.

"Every few days there'd be a runaway, and McCormick would fire the whole crew—just to keep up the discipline.

"One night, Sam Black's Mason-Fairlie—we always called 'em 'jim-crows'—got away from him on Kenosha hill, and Sam and the whole crew were killed.

"The news came early, and a lot of us gathered at the little depot at the foot of Larimer street, Denver, to meet No 2 and help carry the remains of the boys home. McCormick was pacing up and down the platform with his hands behind him.

"Whilst we were waitin', sorter quiet-like, each man kinder thinkin' how near it come to him, and feelin' sorter sober, I happened to notice an old Irishman sitting on the edge of the platform smoking a clay pipe and watchin' a little ant hill between the ties.

"Pretty soon another old fellow, of the same nationality, came along with a spike maul over his shoulder, evidently he did not know the reason of the gathering. He jerked his head cornerways at his friend and said:

"'Mornin', Jimmy.'

"'Good mornin', Moike, did ye see MeKor-mick?'

"'Oi did not.'

"'MeKor-mick is cryin' this mornin'.'

"'Sure, phwat's the matter ave him, Jimmy?'

"'There does be foive min comin' in that he can't discharge anny more—bad cess til him.'"

## The Brake and the Boiler.

When railroads were first experimenting with the Westinghouse air-brake there was considerable mystery among train men as to the working of the apparatus.

A railroad company in Ohio was negotiating with the view of adopting the automatic brake, and an experimental train was provided to show how well the brake worked. This train started out in charge of Conductor Meyer, who had been carefully instructed as to how the thing worked. Among the information given to the conductor was an explanation of the working of the conductor's valve. By pulling the cord attached to the valve, he learned that the train could be stopped at any time without signaling the engineer.

The train started out and Meyer was delighted with the way the braking was done—all the effort of stopping applied from the locomotive without the least help from the brakemen. It was a great invention, but still Meyer was nervous about it.

When they had got about half way over the division, a friend of Meyer boarded the train, and, of course, the extraordinary air-brake was the leading topic of conversation.

"Do you mean to tell me," inquired the friend, "that you can stop the train by pulling that cord without the engineer shutting off steam?"

"Yes," replied Meyer, "at least, that is what Morris Sellers said. He is the brake company's agent, you know."

"I would believe that readier if I saw it done," remarked the friend, skeptically.

"Well, we can easily prove it," said Meyer. They were standing near the door of the car and Meyer pulled the valve rope. The sudden pull of the brakes sent the friend's head through the glass door. When the extra strain was suddenly put upon the locomotive, the packing of a gland blew out, enveloping the engine in a cloud of steam. At this time Meyer looked forward, and seeing the steam, exclaimed:

"It's just as I feared it would be. Putting on the new-fangled brake has busted the boiler of the engine."

## Lost an Exhaust.

Road Master Mike Sullivan, of the B., C. R. & N., always had an idea that locomotive engineers were a trifling class of men and that they were constantly scheming to cause embarrassment to the road department. Controlled by this fixed idea, Mike kept a sharp eye upon the movements of the engineer when he had an engine doing construction work.

One summer he had an old Grant engine pulling a ditching train, and Frank Davis was the engineer. The engine needed a great deal of nursing to keep her alive, and Frank took his time.

"Frank Davis, yez be the shlowest mortol in loway," Mike would say. "Phwy didn't yez hev that owld kittle sowdered up before ye left the Rapids? Git a move on yez or divvil a load will we git out this mornin'."

One morning there was greater delay than usual, and Mike found Frank inside the smokebox. The eccentrics of the engine were chronically loose, and were always slipping. One of them had moved without loosening the set-screws, and Frank thought that the trouble must be in the smokebox. The position of the eccentrics was a good deal of a mystery to him anyway.

"Phat 'n the divvil's the matter now, Frank Davis," demanded Mike, in an irate tone, "don't yez see that ye are shtoppen the intire operation av this railroad?"

"I can't help that," grunted Frank, "I've lost a go-ahead exhaust and I am trying to find out what's the matter."

"Lost a go-ahead exhaust; divvil take you, you are always losing somethin'. But I'll find an exhaust for you."

Mike hurried back to the nearest station and wired to the master mechanic:

"R. W. B. Please send a new go-ahead exhaust for the 26 with the first train."

## A Startling Disclosure.

Teddy Cunerty was sweeper in the roundhouse, and had gotten the job, so the boys said, by claiming that he had got a touch of rheumatics from helping the boiler-washer so long.

When the company appointed a doctor there was considerable talk over the long bulletin notice, and Ted was anxious to know what it said, as he had neglected to study "readin'" at school.

A waggish wiper read it all over to him at noon-time, and added:

"All employés not examined by the company doctor before the 20th will not be able to draw their pay until such examination is made"—and this was the 17th.

The next morning Ted appeared with his "store clothes" on under a clean suit of overclothes. He was going to see the new doctor at noon so as not to lose time.

By this time the stove committee got on to the "job," and one of them had interviewed the young surgeon.

Ted came back looking rather doleful and with a decided limp. He went right for the roundhouse foreman.

"Mister Grane, Oi must lay aff for a few days and take hot sulphur baths."

"Why, Ted, what's the matter?"

"Well, sor, I knew Oi had touches ave the rumatics, but I never suspicioned before, till the dochtur tould me, that me constitooshun were bein' undermined wid de *ippecure's gout*."

## Against Gas-lighted Cars.

A very large volume of the immense suburban business of New York City is carried by the Delaware, Lackawanna & Western. This business grew up against the wishes of the company, which gave particular attention to freight traffic, and very little was done for years to develop the carrying of passengers. Among the drawbacks complained of by the passengers was badly lighted cars. Of late a new and more progressive policy has been adopted by the company, and among improvements introduced has been the lighting of the cars with Pintsch gas. Only part of the cars have yet been equipped with the gas-lighting apparatus, but the indications are that the whole of them will, in the course of time, be provided with this admirable light.

We are among the travelers on this road who appreciate the use of a light which enables a person to read his evening paper with comfort. It was then with surprise that we lately heard a conductor growling:

"These darned Pintsch lights are a nuisance. I wish they had never been put into our cars."

"What is the matter with the Pintsch lights?" we ventured to ask.

"Matter? There's everything the matter. Don't you see this car so full that people are standing in the aisles? Now look back at the oil-lighted cars and you will see empty seats. As soon as they get off the boats the passengers just run to get into the gas-lighted cars and pack themselves so that I can scarcely get through. Plague upon the gas, I say."

The Thirsk railway accident in Scotland, which we commented on last month in connection with the capability of American cars to safely sustain the severe shocks of a collision, appears to be exciting our British friends to investigate the merits of our style of car. London *Engineering*, which is always ready to supply information on all engineering subjects, has lately illustrated the style of framing used in American cars. In connection with that the explanation has been given of how European cars with side doors must necessarily be weaker than cars that have continuous side framing that forms a strong truss.

# Practical Letters from Practical Men.

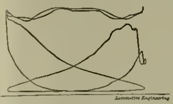
Facts Wanted. There's a glut of Opinions.

**Write on one side of the paper, state your point plainly and briefly, and then quit. We supply the generalities. No letters noticed unless name and address accompany.**

## A Puzzle Diagram.

*Editors*:

Being a constant reader of your valuable paper, and taking considerable interest in the so-called puzzles, I thought I would have you get the opinion of some of the




indicator-expert readers of your paper as to what caused the peculiar end on this inclosed diagram. F. S.

*Kaukauna, Wis.*

## Front Brasses Fitted Open.

*Editors*:

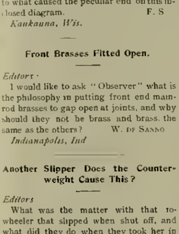
I would like to ask "Observer" what is the philosophy in putting front end main-rod brasses to gap open at joints, and why should they not be brass and brass, the same as the others? W. DE SANNO.

*Indianapolis, Ind.*

## Another Slipper. Does the Counterweight Cause This?

*Editors*:

What was the matter with that 10-wheeler that slipped when shut off, and what did they do when they took her in the shop? It was three or four months ago, and I never saw an answer to the question. We have an 8-wheeler, 15 x 22 inches, driving-wheels 4 ft. 10 in., that will slip on a damp rail on down grade shut off, and would tear herself to pieces if not stopped with the driver-brake. She will slip on level track shut off if the rail is wet or a few leaves are on the rail, at any speed above twenty miles per hour, or even eighteen miles per hour. Twice in a




few weeks she has been brought in with her side-rods bent out near the center, and bolts in straps partly sheared. The counterweight in her wheel has three panels cast solid the full thickness of the wheel, but on examination we find one panel, although flush on the outside, is not flush on the back side of the wheel, it being less than half the thickness of the other two.

This engine is used as spare, and every engineer and fireman dread to go out on her. I inclose a rough sketch of the wheel on this engine. Who can tell us what is the matter? J.

*Pontiac, Mich.*

## The First Locomotive for America.

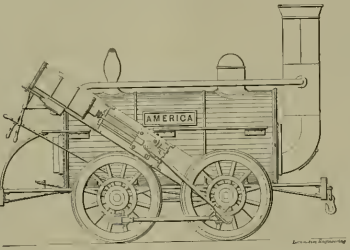
*Editors*:

In looking over the back numbers of your paper I cannot find any diagram of Stephenson's first engine for America, named "America," 1828. It was sent from England at the end of the year 1828 by the sailing ship Columbia, and arrived in New York, January 15, 1829. It was the first locomotive for a railway in America.

CLEMENT W. STRETTON, C. E.

*Leicester, Eng.*

[Diagram of the *America* is here reproduced from drawing sent by Mr. Stretton. The *America* might have been the first ordered, but she was not the first to run in America. Horatio Allen went to England in 1828 to investigate steam railroads, and while there ordered three locomotives, two from Stephenson, one of which was probably the *America*, and one of Foster, Rastrick & Co. This last engine, named the *Stourbridge Lion*, was sent to




Carbondale, Pa., on a canal boat, and there, on August 8, 1829, ran on the rails under steam—the first in America.]

## Some Difficulties in Keeping an Engine Clean.

*Editors*:

You see and hear a great deal about firemen keeping clean engines. At some times and in some places this can be done with pleasure and profit, but, let me tell you how encouraging it is here on the B., C. R. & N.

It means about twenty-four hours on freight to make a 100-mile trip, and after this the fireman shows up to clean and draw his supplies.

He has to go over the jacket about twice with a broom before he can use waste—because the clinker men and ash-pan cleaners don't use the blower. Then he blacks his front end and stack, wipes up his paint, cleans his windows, plumbagoes the boiler-head, scours his brass, fills his lamps and oil cans and lubricators and otherwise puts in from six to eight hours—for which he receives nothing—and goes home believing that he has done his whole duty and that the old girl looks as good as any of 'em. The next morning he comes up ready to go out, and see how his work is appreciated.

The cab brass, windows and paint are smoked so that you can write your name anywhere, the men who fired her up have left the door open.

The hostler has taken her out and done it so artistically that she looks as though a flock of blackbirds had roosted over her. Then he took her to the coal chute, and filled her tank, forgetting to lower the curtain; this helped the chance to write your name.

The tank is full of coal about the size of the door, the water pail is gone, the night machinists have emptied part of the oil cans, the new shovel has been exchanged for an old one, a window glass broken and perhaps the broom gone.

While you are standing up to your knees in disgust, wondering whether it would be best to kill some one or commit suicide, along comes a man of authority and wants to know why you can't keep that engine looking decent.

This is no imaginary picture—it is our regular daily ration, ask any B. C. R. fireman. A. STOKER.

*Cedar Rapids, Iowa.*

## A Blow; Where Was It?

*Editors*:

I have a kink or puzzle I should like to submit to the consideration of your many readers.

I was running some time ago an 8-wheel coupled or consolidated engine on the C. & E. I. Ry., the next to last pair of drivers being the main ones.

While switching one day, and in the act of starting ahead, a heavy blow occurred. I ran the engine ahead a few hundred feet, and watching the crosshead on the right side found the blow occurred as it started from the front of the guides. I opened the cylinder cocks, but they showed no indications of the packing blowing, the blow did not occur while the crosshead was returning.

There were some thirty to thirty-five cars coupled on behind the engine, and not wishing to block main track, started to back them on the side track. The engine was all right backing up, there being no blow. I then thought that valve had been cocked, but on moving ahead again I found the blow was still there.

I was pretty well puzzled by this time, and after examining eccentrics, blades, links, rocker-box and arms, and finding them all right, I was more puzzled than ever.

I took up the right steam-chest cover and found the valve-yoke broken in front of valve. I couldn't think how that would cause such a blow, but the seat being pretty dry thought that the yoke sprung open and allowed the valve to cock.

I blocked the valve and disconnected engine and took her to the shop, where the yoke was repaired, and I was called to leave at 3 30 A. M. I arrived at roundhouse before engine was taken out and found the blow as bad as ever when she was moved from the house, and, as she was badly disabled, was held in. I waited until the day foreman and several engineers and machinists had looked at her, but they were as badly puzzled as I was.

The engine was put back in the roundhouse and the right steam-chest taken up and the packing out of both cylinders, but there was nothing out of the way. The eccentrics, links, rocker-box and arms, etc., were examined, but were all right. Where was the trouble? C. G. B.

*Danville, Ill.*

## Some Points on Tramming—Talking Shop—Getting Pointers—Some Questions.

*Editors*:

While traveling through the South I visited a railroad repair shop, and there noticed a young man who was engaged at

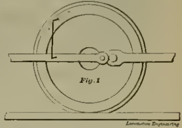



Fig. 1

setting the slide-valves of a ten-wheel engine which, having undergone general repairs, was about ready for service. While watching this man work I noticed that in marking the dead-center points on the rim of the main driving-wheel he trammed from a prick-punch mark on the side rod, which brought the tram nearly into the position shown by Fig. 1.

I asked the young man why he trammed from the side rod, his reply was, "because we can't tram from the main rod." Said I, why tram from either rod; do you not think that it would be correct to tram from the wheel-cover? He replied, "I don't know, we have always trammed from the side rod, and that settles it." Of course that put an end to farther conversation with him on the subject, but it did not quite "settle" to my satisfaction that his method of tramming was correct. I was very sorry that the young man was so short with me, for I desired very much to ask him a few questions with the sole object of gaining information.

The questions I had in mind are the following, and I shall feel obliged to him, or any others among the many readers of LOCOMOTIVE ENGINEERING, for an expression of their opinions upon this subject through this most excellent paper.

1st. While using the tram in the manner shown will a person not be subject to error owing to the lateral motion on the pins of the side rod from which he trams? This motion might be all taken up toward the outside while making one mark on the wheel, and toward the inside when the other mark was made, in such a case

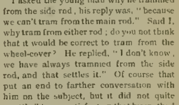



Fig. 2

would the dead-center mark be in the proper place on the wheel rim?

2d. When a tram is used in a nearly perpendicular position, as shown in Fig. 1, will not every irregularity in the track be more noticeable than where a person trams from the wheel-cover, and the tram is used in a horizontal position as shown by Fig. 2? And in the latter position it strikes me that all the lateral motion a person would have to contend with would be that of the forward drivers, and this he would have to contend with in either case. I can readily see that while tramming from the side rod a slight movement of the driving-wheel is

more perceptible at the upper tram point than where you tram from the wheel-cover and hold the tram horizontally, but is not this advantage more than balanced by the disadvantage mentioned?

Now, while I readily excuse the young man for his short answer to me (he being very busy at the time), would it not be to the advantage of any young mechanic to talk intelligently upon such subjects, disregarding the question of which method was correct, for by thus talking these matters over we all gain information and get new ideas? Would this not be better, I say, than to snub a person who desires to have a little friendly conversation with you? And I wish to say for the benefit of the younger readers of this paper, that I have yet to hear of a case where a person was in any way injured by showing a proper amount of courtesy to strangers.

I also wish to state that the young man in question does not work for the E. T., V. & G. road at Selma, for here in the shops, offices, and on the road will be found as nice a lot of men as can be met anywhere. L. C. HITCHCOCK.

*Selma, Ala.*

## Those Richmond & Danville Drawings.

*Editors:*

I note in your last issue that Mr. H. K. Griffith, of the Richmond & Danville, devotes twelve lines to defending his drawing of that cab-bracket and the other fifty-two lines of his article to delivering us a sketch of his mechanical career.

Suppose, now, that we analyze those drawings and see just how they do look. Fig. 1 is the sheet just as it comes from Washington. We find the plan *B* in the center, and *A* is a view of the curved end or front looking horizontally, while *C* is a view the reverse of *A*. Now, is *C* essential to make matters clear? Does not *A* explain and show all that we find in *C*? Removing *C* or *A* from the sheet, could we not just as well construct our pattern? I guess yes. Owing to its reversed condition, does not *C* tend to bring forth a question of uncertainty in the mind of the "wood-carver"? If we make two things when one is a plenty, does it not take more work and thought? Then is not this a case of "needless labor and waste of brains"?

The proper way to have made this drawing I illustrate in Fig. 2. A plan same as in Fig. 1, and a section through line *xx*, showing in bold, unmistakable outlines just how the component parts of the pattern are grouped together, shutting off all questioning on the part of the pattern-maker and putting him *en rapport* with the designer. But Mr. Griffith says, "We will readily see that a section would be very awkward to make." Well, if we have no conception whatever of the rules for projections, and can form no idea of how the object will look from all sides, nor have a perfect brain photograph of what we are trying to design, then I will admit it is "awkward," and our best way out of the dilemma is to make it a little mixed and throw the responsibility on the poor constructor.

Again let us analyze those drawings, taking Fig. 2, which is Mr. Griffith's made clear. It is composed of six pieces, two flanges, two straight ribs, one curved rib and a web so designed that they must go together slowly and carefully. Draft has to be worked out on both sides for the molder, and still it is a mean thing to get in and out of the flasks in the foundry. All this inconvenience to the men who have to work with their hands compels them to slow up. Slowing up means loss to employé and employer both.

Now suppose we make it as shown in Fig. 3, as has been done by others. The flange and web are all in one piece with ribs easily glued and nailed to it. Draft is all one way and we easily "follow-board" it and the molder jerks it in and out of the sand in "half-past-two" time.

We do find that the form shown in Figs. 1 and 2 are almost 6 per cent. stronger than that shown in Fig. 3, but practically this small amount is unworthy of consideration in a cab-bracket; while the latter form will save four hours in the pattern shop and as many more in the foundry, adding nothing to the comprehensive draftsman's time or labor.

Probably those cylinder drawings would confuse me. That is the great trouble with some professors of mechanical design. The more "confusing" they get things the more science they think they display, and never dream of the reversed blessings invoked upon them by those who have to bring order and results out of their chaotic work, nor the thousand and one little molecules of time thus wasted for their employers.

*Rensselaer, N. Y.* "OLD MAN."

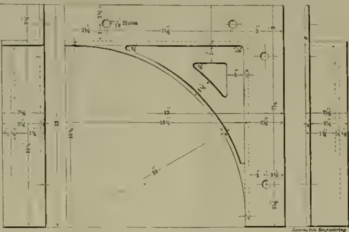


*Fig. 1*

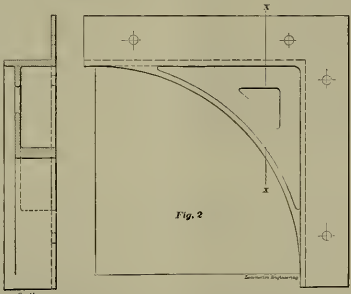


*Fig. 2*

*Section through X.*

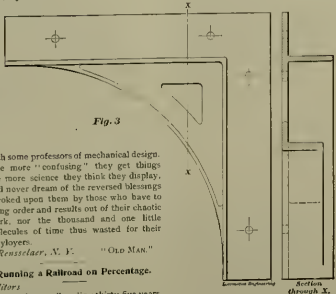


*Fig. 3*

*Section through X.*

## Running a Railroad on Percentage.

*Editors:*

I have been railroading thirty-five years and for many years at the head of a department, but have only recently found out how to run my end of the thing economically.

An oil man recently offered to guarantee me a saving of 30 per cent. if I used his lubricant; the next day a grease man promised 15—he was modest.

It was not long before an extension-arch fellow offered to run us on 20 per cent. less coal if we used his device.

Every improvement seems afflicted with the per cent. fever. The injector saves some, the air-brake more, the compound locomotive is going to bite off all the way from 15 to 45 per cent., while if you only care for a paltry 10 per cent., why, just buy metallic packing, cylinder lubricators, revolution counters, chine whistle, or a pee-wee valve.

The way I am fixed here galls my ambition and gives me no chance to show what is in me—I am hampered by the powers above.

What I want is a position as general manager. I will buy all these per cent. savers, have coal to sell, operate the road for nothing, and pay 98 per cent. dividends. I can do it if figures don't lie, and who dares say they do?

Don't you think there is something in this plan of mine, or do you think that lying is getting a regular place in trade, or that this mark % is being overworked?

*Houston, Tex.* OLD RAILROADER.

## Marks Is Scared About the Revolution in Locomotives.

*Editors:*

It haz bin sum time since I last wrote you regardin' the advent of the elektrik lokomotiv, as wuz predikted by our frend Marks and Prof. Bell, but as that day hasnt yet arriv I am still hangin onto my old job and waltzin ther same old skrap heap over the road on time five days in ther week.

But there is more danger ahead fur us old runners who aint so nimble jointed as we was wunce and who may not be able to do the flyin trapeze act in quick enuf time fur ther new inventions.

Ther latest skeme fur paralyzin time and gettin ter New York and back before breakfast is now on exhibition on Arch street in ther village called Philadelphy. But I warn all ther boys not to go there unless they wear neck ties and look as though they wuz preachers or other stock holders, as this is not bein exhibited fur information, but ter sell stock; at least that's what they told me when I wanted ter see the masheen run. This arrangement is patented, I believe, by two men from the wild and woolly West, and besides bein' wild and woolly it duz seem as though they wuz "rare"—sort of underdone like, not thoroughly baked, as they sometimes say.

The names are Holman and Caldwell, and for pure, unadulterated "genius" they outrival Keeley himself. Ther plan of operatin (?) is sumthin like this. Ther engin is much like any engin on ther road, but it is jacked up on two sets of trucks run under ther drivin' wheels, so as ter make the drivin wheel tire run on the truck axles and ther upper story of ther truck play ther same game with the basement tenants of this double-decked arrangement.

Even an old back-woodser like me can see that when ther drivin wheel revolves once ther upper trucks will turn more than once, and this iz agin multiplyed in ther lower trucks, so that it seems clear as mud that ther engin will travel a whole heap faster "goin at ther same speed" as they do now, I mean they will run over more ground when the drivers are runnin the same as now, and their seems no limit to the speed with this arrangement. Ther great beuty is that (as must seem perfectly clear to all) it takes no more power to run ther engine too turns a minit when she is up on stilts than if she was on the rail, and yet (as must also be clear) she will cover a grate deal more ground than when built on the ground floor plan as at present.

As ther loads will be no heavier and it takes no more power ter turn ther wheels at this same rate, which moves ther engin over double the ground, it shows that by simply adding this patent double geared friction truck ther speed of ther train is doubled and yet no power is consumed. Uv corse this dont seem exactly possible, but as we can see that the doublin uv travel takes place with ther same speed of drivers, it cant take eny more power as I can see, and ther thing *must go*. Now if this was some elektrikal duck who talked about volts, watt meters and gas meters and ther like, I shouldnt think anything uv it, but set him down as a crank and know it wouldnt work anyhow, but here it is, a plain every-day locomotive (sumthin like my old skrap heap), only with a two story "apartment house" truck shoved under ther drivers and truck wheels, doublin ther speed and only takin ther same power, as must be plain ter eny-one, and how can I dispute ther workin of it. I can now see the folly of Fontaine

and his "upside down friction wind-mill." Ef he had only put those friction wheels *under* ther drivers instead of *over* them he would have had things "by the neck" as the boys say "and had a down-hill pull." Then too if he had only put in two sets of extra wheels in place of one he might have made the engin howl more than she did. But what iz worryin' me is not thet ther engin will go but thet I may hev to run one of ther animals instead of my old skrap Now I'm not stuck on my engin at present, but as I never wuz an akrobat think I would rather hev her than wun of their new ones fur several reasons

Not bein a hod carrier by professhun I dont like ther idea uv climbin up several flights of stairs to reach the top story of thi family hotel, namely ther cab. then agin if the wheels should bee damp and greasy sum of these mornings I dont fancy livin over such a grist mill or thrashin masheen as these two story truck wheels and ther drivers on top will keep goin after they get started on a good slippin match if I saw a train ockupyin ther same trak I wuz on, and wuz runnin one of this kind of mill at ther high speed they would run it seems to me thet I should stop ter calkerlate whether it woud do more damage ter let her run than ter try ter lap on ther emergency air. Thrashin masheens at startin or slippin wouldnt kompare with ther circus broke loose when this happened. Just imagin all ther wheels in all ther double decked trucks etc. tryin to go both ways at once and think of stayin up over this bedlum and "hangin on ter throttle to ther last et cetera." Might just as well tho fer you wouldnt get more than half way down from your perch before ther engin would hav covered several miles or so But for genuine akrobatik performances you want ter run this mashéen on sum of ther mountain roads where the kurves dont seem morn six foot radius when your runnin at good speed; and imagin these cartload of truck wheels chasin each other round these kurves with ther drivers all ther while trying ter climb over them all.

It may be thet Im gettin too old for the railroadin of to-day and if this is ther engin of the future I shall be thankful thet I lived before they bekame popular, but it isnt the high speed thet I kick against as it is carrying around a load of truck wheels in order ter fool ther steam into doin twice as much work as now without knowin it. Ther piston would be travellin just ther same as usual and yet ther engin would be bumpin itself over the ground in a manner that must make ther steam dizzy and ther engineer sea sick especially if ther trucks are not covered from his view. Now while I dont believ in Takin such unfair advantage of ther steam and also throwin fireman out uv work, if this iz to be done and called fair why not do it up brown and put three four or five sets of trucks under ther engin insted uv two and so get more speed, or if you dont want to go so fast, to reduce ther size engin rekwired to do ther work. If your goin ter tell a lie it might jest as well be a whopper as a small one, and its no worse ter fule ther steam into doin four times as much work as now than doin twice as much, and it seems ter me (fer havin seen the engin *I know it will do all they klaim fur it*) thet if they only get truck wheels enuf they wont need eny boiler on ther engin, but if they can get some good talkers, auctioneers, hammer blow men or sumthin of ther kind to just talk into a cylinder, the engin could run like the wind, for all they need is "wheels." So that if ther wheel foundries only hold out we kan expect ter see engins with no boilers but only wheels—wheels on every side.

Unless you kan find another job fer me shall hav ter go inter training in ther gymnasyum and also go ter sea, so as ter learn not ter get sea sick and then perhaps I kan tackle ther new animal when she comes on ther road

R. E. MARKS,
(No relation ter the Prof.)

*Camden, N. J.*

## Fires, Tuyeres and Points for Workers of Tool Steel.

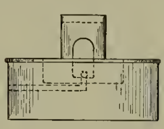
*Editors:*

I will continue on steel at present and fall back on iron in the future. In a recent letter in LOCOMOTIVE ENGINEERING I somewhat criticised some of our steel-makers

Now, it is true that good steel properly worked is among the most useful of man's productions. You may say it is used by every man and woman on earth, and is consequently taking the place of iron, wood and tin. Now you stop and think of the large percentage that is spoiled in working it up. Nearly every workshop in the country has a different way of working it, and still the different grades are all made about the same and ought to be worked about the same, and if worked right there would at least be a saving of 25 per cent. on an average of steel, besides the labor.

Did any of you toolsmiths ever figure up the amount of tools you spoiled in tempering every six months—just those you have cracked and broken, besides those you

*Fig. 1*

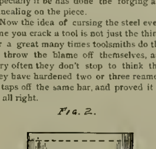


FRONT VIEW.

have let go into machine shop, boiler shop and car shop? If you have not, stop and do this and it will surprise you. Now a great many say it cannot be helped. This may be true in some cases, but ninety-nine times out of a hundred it is the toolsmith's fault when he cracks a piece in hardening, especially if he has done the forging and annealing on the piece.

Now the idea of cursing the steel every time you crack a tool is not just the thing, for a great many times toolsmiths do this to throw the blame off themselves, and very often they don't stop to think that they have hardened two or three reamers or taps off the same bar, and proved it to be all right.

*Fig. 2.*



SIDE VIEW.

Now when the toolsmith cracks the fourth one, it is almost a clear case against him, for there is not one bar out of a thousand that is poor on one end and good on the other—that is, difference enough to cause it to crack in hardening

I mail you a sample of Crescent steel drill rod, hardened as steel ought to be hardened. You will see that the outside is so hard that it cannot be scratched with a file, while the center is soft enough to drill.

This kind of hardening can be done with any good steel that will refine, and a tap or reamer hardened in this way will stand a lot of abuse because your center is perfectly soft while your edges are perfectly hard, refined, and you need not draw the temper on a tap or reamer hardened in this way enough to change the color

The first thing to do in order to accomplish this, is to test your steel and see if it will refine and is pure of phosphorus, sulphur, silicon and other impurities. The

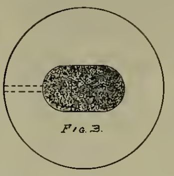
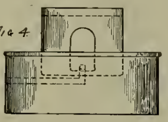


*Fig. 3.*

TOP VIEW.

next is your fire and the fuel you use in it, both for forging and tempering, then the the faculty you have for forging which must be taken into consideration. A forge fire as represented in Fig. 1 and 2 is the best that I have tried or seen, for getting a long heat, either for forging or tempering, as the top can be made of old tank iron any size you want it, the full length of

*Fig 4.*



FRONT VIEW.

the diameter of your forge, by having your tuyere iron the same length as your top, as shown in Fig. 2 Fig. 3 represents the top filled with coal, which I generally fill within $1\frac{1}{2}$ inches from top, so that I can throw a bucket of water on occasionally so as to keep the opening about the same size. Fig. 4 is a similar top, with the opening cut in the sides, and the long tuyere iron left out. This I find to be about as good a forge fire for general work in the line of a hollow fire as I have heard of, or seen, because there is very near as much heat from the top as from the bottom.

This fire can be built on an ordinary forge in fifteen minutes by first building your fire level with your forge; then start your fire with charcoal; then take and set your top so that the center of it will come

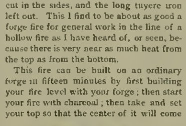


*Fig. 6.*

over the center of your tuyere iron and take a few sticks of wood long enough to reach clear through your top where your opening is represented in Fig. 1 or Fig 4. then fill your top with coal and tamp it down with a hammer, and by the time your wood is burned out your coal will be coked enough to hold itself up, this will only take from ten to fifteen minutes.

A fire of this kind will last you ten hours and will give you coke enough for the next day, while a fire as represented in Fig 6 will last five hours, but makes a very good open fire.

I will try and explain the benefit of these in a future letter.

*Madison, Wis.* W. G. LOITES.

## The Retaining Feature in Air-Brakes.

*Editors:*

This is a subject that I feel should have the strict attention of each and every inspector and repairer of air-brakes.

If this feature is worthy of being placed upon a car, it should certainly be looked after and kept in good repair.

Now, the retaining-valves are to be used only on such gradients as are prescribed by the rules and regulations of the road using them, but they should receive the same rigid inspection at repair shops on divisions which have no use for them as they would if they were repaired at shops in a mountainous country where they were continually used

I find that it costs an enormous amount of money to keep this feature up, as the valves are continually getting knocked off and lost, or if they be of brass they are stolen by petty thieves and sold for old brass.

Now the question naturally arises, which is the best valve to use?

In the first place, I think they should be of cast-iron, and in the second place they should be made heavy enough to stand the knocks and jars to which they are constantly subject.

I believe the new pattern of the W. A B. Co. to be the best for this reason, viz. It is made larger and heavier and can be fastened to the car with lag-screws, whereas the old valve was merely tacked or fastened to the car with the common wood screws.

Of the old pattern, I think that those cast of brass are preferable to those of iron, as the lugs on the iron ones are so frail that a slight wrench or blow will break them

As this is a weighted valve there should be more care taken in placing it upon the car. They should be placed in a perpendicular position.

I find them reclining at all angles, and have found a few that were fastened in a horizontal position under the end sill.

The train crews should receive a little instruction as to the usage of this valve, as there are a number of them that sometimes make costly errors by wrong usage.

As an illustration I will cite the following

"A train has pulled into a station, and a brakeman in passing along the train discovers air blowing from the retaining-valve, said leakage probably due to an imperfect emergency-valve or other defect in the triple-valve. He immediately sets his brain to work to ferret out a scheme whereby he may stop this leak without cutting out the car. After thinking a while he decides to break that little pipe at the triple-valve and stop up that hole with a plug. Sure enough, he stops the leak, and they are ready to proceed. (They are running on a time order.) They make one stop at a crossing, and in starting again the engineer feels something dragging.

He throws his valve-handle into release position again, but it does no good, and he finally drags on to siding at the next station "with four pairs of flat wheels" under the car with the plugged exhaust port.

I find many such cases as this, although the wheels are not always slid flat, but as I said in my illustration, I have seen four pairs of wheels taken from under a car for this reason.

By taking an interest in these minor details an employé goes a great ways toward saving a heavy expense for the railway company, and at the same time makes himself invaluable to them.

Giving one's views and having comments passed upon them, and receiving other's ideas in exchange, must surely be conducive to good results, as it assists each one to elevate himself in his craft.

CHAS. S SHALLENBERGER.

*Ft Madison, Ia.*

**Calendar for 1893 Free.**

The Chicago & Northwestern Railway has just issued an attractive calendar for 1893, which is one of the best we have seen for practical use in the business office as well as the home. A copy of this desirable calendar will be mailed free upon sending your address with a two cent postage stamp to W. A. Thrall, G. P. & T. A., Chicago.

### Common Air-Brake Disorders.

*Editors :*

The equalizing discharge valve is all right if properly cared for and properly handled. The men who use them are responsible to a very great extent for their condition. One of the principal causes of annoyance to me is the gum that accumulates in the valve, the result of too much oil in lower cylinder of pump. I sometimes get out of "sorts" trying to convince the men that the air cylinder of the pump requires but very little oil, for too much is worse than none. I find that the substance we call gum gets under or between rotating valve and its seat on the part having the greater surface. This causes the valve to wear uneven, and leak under, sometimes bad enough to prevent excess pressure in the drum as well as letting off brakes when the valve is on lap.

SAND IN TRIPLE VALVE.

Another cause of valve working bad, and which many times causes an emergency application of the brakes, is the sand that is deposited in chamber 18, under piston 17. Men will wonder how sand could get in their brake-valves and triple-valves. I think it easy to explain how it gets there. It gets there by letting the hose on tender and on cars hang down while running over the road; the couplings catch up the sand, and when they are coupled up again the circulation of air takes the sand direct to brake-valve and triple-valves. It don't require much of an effort to hang up a hose in its proper place, but it does save a great deal of trouble sometimes.

SUDDEN APPLICATION OF BRAKES.

I have often had engineers come to me and say: "I tried to set my brake to-day by service application until I reduced the pressure on train line twenty-five or thirty pounds, then all at once it would go 'bang.' What was the trouble?" Well, the trouble is that piston 17 gets gummed up and sticks, and instead of reducing train line pressure, the pressure is reduced on top of piston 17, and to that extent that when the piston moves up it moves very suddenly, causing such a sudden reduction of train-line pressure as to make an emergency application Now all of this trouble and annoyance can be obviated by the exercise of a little judgment on the part of engineers and trainmen. Engineers and firemen, don't put so much oil in the air cylinder of your pump.

HANG UP THE AIR HOSE.

Trainmen, hang up the air-hose on cars when not in use; if you do this you will find that the brakes will work better because the triple-valves and engineer's brake-valve will be kept in better condition The heads of most all departments of railroads have organized themselves into associations, which is of great benefit not only to themselves, but also to the companies by whom they are employed. What's the matter with air-brakemen forming an association? Speak out my brother dispensers of wind.

*Syracuse, N. Y.* W. F. RELYEA.

### Early Locomotives.

*Editors :*

A great deal has been said from time to time about old locomotives and their builders. While the names of Baldwin and other famous builders have become household words, we must not lose sight of the fact that many good engines were built by men whose names never appeared in print, and of whose existence a great many readers of railroad literature are not aware. In speaking of early locomotives we must keep in view the early productions of builders who afterward became famous, and notice the improvements made from time to time.

Our scenes are laid on the old Philadelphia & Columbia Railroad, at that time owned by the State of Pennsylvania, at present the Philadelphia division of the Pennsylvania Railroad. This road was a double track road from the beginning, and is understood to have been operated by horses at first, being eighty-two miles long. Who built it, or where the first engines were built, deponent sayeth not, but I used to hear the old-timers often speak of the "crabs," referring as they did to the "grasshopper" class, and have often heard the "John Bull" spoken of and have seen the name-plates of "Gray Eagle" and "Black Hawk" lying around the shop where I served my time; wish I could get hold of one of them now, also two old headlights, one to burn candles, the other for lard oil, with an immense flat wick.

The earliest locomotives coming under the writer's notice were the little two-wheeled machines, without cab, pilot, sandbox, headlight or cylinder-cock rigging. Some of these early engines are well shown in the Joseph York reminiscences in the July number of LOCOMOTIVE ENGINEERING. A majority of the engines were the Baldwin half-crank type, inside connected, drivers in rear of firebox, the main rod passing between the side of firebox and inside of drivers, the whole machine being surrounded by an outside frame of wood about 4 x 10, covered with iron. These engines had a single fixed eccentric, one on either side, with a top and bottom drop-hook but no starting bars, only a reverse lever. The Norris engines were outside connected, with the drivers forward of firebox and with a wrought-iron frame. By this arrangement of the drivers more weight was carried than by placing them in the rear of the firebox, putting the drivers forward of the firebox was adhered to by all the builders except three engines built by Eastwick & Harrison, of Philadelphia, and Baldwin of same place. The E. & H. engines had a fixed eccentric connected to rocker by rod and strap, the reversing being produced in the steam-chest. These engines had two reverse-levers, or one for each side of the engine. They were flyers in forward motion, but not much account backing up.

All the other engines had two eccentrics and the ordinary drop-hooks and starting bars on the foot-board. There were about a dozen of the Baldwin engines, five or six Norris, three Eastwick & Harrison, two Campbell (built in Philadelphia I think) one or two built by Pennell, Leonard & Harmon, of Lancaster, Pa., and one or two by Dotterer & Co., of Reading, Pa., and one or two with no builder's name on them. These old engines had the dome type of boiler with a smaller dome on the top of the large part, over the throttle. These small domes were made of copper or cast-iron, and polished. The boiler had no jacket, but was lagged with tongue and grooved, beaded strips painted alternately green and black, with flat brass bands, and looked very neat when clean.

Amongst the early Baldwin engines were two outside connected with wrought iron frames and cast-iron jaws. In speaking of drop hooks, they must not be confounded with V hooks; of course they both served the same purpose, only the V hooks did not require starting bars to have them engage with the rocker, they were simply jammed down, and when the throttle leaked they were jammed hard. Any of the readers of LOCOMOTIVE ENGINEERING—and they are legion—who have had experience with hook motion engines know how it is themselves.

The business of the road began to grow with the building of the P. R. R., and heavier engines were required.; then Baldwin built the first multiple connected engines on the road, six-wheelers (no trucks), and with balloon stacks. Then Norris sent the first four-wheel connected engine (no cabs) with independent cut off (hook motion), these were followed by Baldwin with two four-wheelers with independent variable cut-off (hook motion). These, again, by some fine engines from Paterson, New Jersey, built by John Brandt, with the link motion, the first on the road; it was a long time before the writer could understand the connecting of the forward and back motions eccentric rods together; but when it came to taking up lost motion by fitting new dies in the old hook or yanking our arms off on a solid link-block we choose the books.

What a change on that part of the road between the past and the present! Then there was no time card for freight trains—burden trains they were called—and they did not run at night. Two passenger trains left Philadelphia (8th and Market) every day, and two left Columbia. Switching was done with horses. Through freight between Philadelphia and Pittsburgh was carried over the road in canal boats, or section boats, as they were called; if a burden, or freight train, got on a passenger train's line, the passenger came up and pushed the freight until a switch was reached, when they could run around the freight.

This early road had a Jonah, as all modern roads have, or in other words, an engine that was always in trouble or breaking down. She was one of the Baldwin half-cranks, called the Octorora; this engine would break more crank axles than all the rest of the engines put together. But these are all things of the past.

W. DE SANNO.

*Pan Handle Shop, Indianapolis.*

### Blacksmithing and Crystallization.

*Editors :*

I saw in the last paper an article by G. F. Hinkens, of Gladstone, Minn., on blacksmithing, in which he says that he believed that blacksmiths were afraid of being criticised if they entered into print, and that he was of the opposite sort,—he was afraid that they would not criticise. Now, it is a great deal easier to criticise than to inform, and if you just keep on trying to inform you need not lose any sleep fearing that you will not be criticised. Now, Mr. Hinkens wants to know what is the cause of the tenth mishap; now, if an engine rolls down an embankment, or strikes a car on a side track that did not clear, or gets into a collision and breaks a side-rod, would you blame the man that did the forging, or the material, or either? Or would you lay it to crystallization? You say you never saw a side-rod broken in the weld. I have, and more than one. I put the question: "How often do we hear of a side-rod breaking in the weld?" I did not say anything of those that break from crystallization.

You say, "However good the weld is it is always the weakest point; at least tests have demonstrated such to be a fact; consequently, it is a matter of vital significance to locate your weld. Keep the weld from the terminus of vibration lest the rod will break before the proper time, and that time will arrive when the constituent particles at the end of shock or vibration become crystallized."

Now, when you get a broken side-rod to weld, do you weld it where it was broken, or do you cut out a piece and put in a new one so as to keep your weld from the terminus of vibration?

You put the question · "How are we to avoid crystallization?" and answer "Select suitable material, which should be fibrous and hard; hard, because soft iron will crystallize quicker than hard iron."

Now, how would you go to work to crystallize a piece of good nail rod, which is certainly a soft iron, to any great extent, or a piece of Norway iron, which is more apt to crystallize than the nail rod?

Wishing you A Happy New Year, and hope you will accept my criticism as I do yours—as a favor. W. G. LOTTES.

*Madison, Wis.*

### Why Did this Engine Limp When at Work?

*Editors :*

A new locomotive from Pittsburgh Works is taken out on trial, is all right without any train, but with a full train is so lame she will not handle the train. This is an 8-wheeled engine, the eccentrics are keyed on shaft, the blades, links, rockers, valve-stems, valves, tumbling-shaft, reach-rod, reverse-lever, quadrant and everything pertaining to the motion work is as good as it can be made. This engine is always square when working without train and always lame with a train; where and why the trouble? TOBY.

*Vandalia, Ill.*

### That Lame Exhaust Puzzle.

*Editors :*

In your December number I notice a lame exhaust puzzle.

Traveling Engineer says he examined the valve motion carefully, and also the exhaust nozzles, and found all O. K. He does not say he examined the valves or the tram marks on valve stems, but taking it for granted that he did and found everything all right from the eccentrics to the valves, the only place left would be for a broken tram ahead of the main jaw which would act the same as a slipped eccentric or a slipped eccentric blade.

*Topeka, Kan.* A MACHINIST.

*Editors :*

Answer to lame exhaust puzzle If valves and gear were all right, I should expect to find piston-rod broken and piston forced to front end, showing steam passage. If there were three clear exhausts, I don't think it was necessary to examine nozzle. If three exhausts could escape all right how could the nozzles stop the fourth? The trouble would necessarily be in the passages or cylinder, providing valves and gear were all right.

*Cleveland, O.* S. WOOLMINGTON.

*Editors :*

In answer to Traveling Engineer, from San Francisco, California, regarding a lame exhaust, would say that I would not have given up as soon as he did. Before doing so would have removed cylinder-head to see if packing was all right. My impression is that if it was not a solid piston-head with snap-rings, that the follower-head had become loose, rings displaced and that the steam from the initial end was going through and out with the exhaust of other end of cylinder. If this was not the trouble it was in steam-chest between the point trammed and the valve.

W. H. APPLE, M.M.,

*Ashland, Ky.* A. C. & I. R. R.

THE ANSWER.

*Editors :*

The engine that had the lame exhaust was afflicted with a loose lifting-arm on the tumbling shaft. This let the engine work square when down, but when working cut-up close, the arm moved up and down causing the limp.

TRAVELING ENGINEER.

*San Francisco.*

### Kellogg's Air-Brake Puzzle.

*Editors :*

In answer to H. W. Kellogg's puzzles 1 and 2, December issue, page 441

First—The reason he could not keep pressure in main reservoir while in running or release position was because packing ring on piston 17, was left out when valve was put up.

Second—Air-passage, between chamber D and equalizing reservoir, was choked, or there was a blind washer put in pipe connection, consequently his brake acted like lightning.

M. C. GLEME.

*Wilksboro, N. C.*

### Watts' Trouble.

*Editors :*

I should say there was a leak some place in the gauge-pipe or pipe to small drum or the space above piston in engi-

neer's valve itself. This would reduce the pressure when brake-valve was on lap and apply the brake. JOHN STEADMAN.

*Waco, Texas.*

THE ANSWER.

*Editors:*

In answer to my letter that was published last month, would say there was a leak in one of the small pipes that lead from the brake-valve to the air-gauge This reduced the pressure above the piston in brake-valve, allowing it to raise, thus reducing pressure in train-pipe and applying brakes M. E WAITS.

*West Nanticoke, Pa.*

A shocking railroad disaster happened on the Great Northern last month by which eight men were killed and several others severely injured. As most of the victims of this accident were laborers we are not likely to hear much indignation expressed about the carelessness that caused the disaster. A very heavy freight train with no power brakes on it was flagged on a descending grade to stop on account of a wrecking train being on the main line. The train could not be stopped and crashed into the end of the wrecking train with the result noted The press dispatches make the comment that the accident was due to the carelessness of the men in charge of the wrecking train. We do not wish to condone the carelessness that neglects flagging, but in this case we think that the blame was not confined to the trainmen referred to. All the transcontinental lines except the Great Northern have the greater part of their freight cars equipped with air-brakes. The Great Northern is the most conspicuous example of one-man management in America, and that man is James J. Hill, the president. The principal cause of the accident was want of air-brakes and Mr. Hill alone is to blame for that means of safety being absent. Mr. Hill ought to be held responsible for the death of these men.

We want to call especial attention to the interesting article on war-time engine-running by "Old Soldier." Of all the interesting things he has told us, the incidents related in this number are the best. As is shown by the present paper, "Old Soldier" is Mr. E. A. Campbell, general master mechanic of the H., E. & W. T. road at Houston, Tex. Last winter, while the junior philosopher was on a visit to Texas, he saw the original orders and many other interesting war-time papers at Mr. Campbell's home. At the time Mr C. writes about he was a young married man, and had and still has one of those kind of wives that won't stay at home when her husband is in a dangerous location—wherever Campbell went she went also. On every pretext and on every occasion he would send her North out of the lines, but just when things got interesting she showed up again, bag and baggage, rode on the engine, kept house in a box-car, or slept on the ground. Mrs. Campbell's reminiscences are as interesting as those of any soldier at the front.

Regarding the question that appeared in LOCOMOTIVE ENGINEERING as to who was the inventor of the steam whistle, Mr. R. J. Dill, Grand Island, Neb., writes "A man by the name of John Lodge, of Magnolia, Kent Co., Del., was the inventor. I do not know if he patented it or not, but he was the inventor of it. He was a little bit of a hunchbacked fellow. He got drunk and gave his invention to some fellow for a pint of whiskey. I knew him well, he was a foreman and lived a half-mile from us. He is dead now, I think"

If there are any technical school graduates who are anxious to enter railroad service they might obtain employment from Mr Johnstone, mechanical superintendent of the Mexican Central Railroad. Mr. Johnstone is anxious to employ a few well-educated young men who would be capable, after a time, of filling official positions.

### Thatcher's Dumping Car.

The engraving herewith was made direct from a photo, and shows the Thatcher car in dumped position on each side of the track

As is plain, the air-cylinder shown in the center of the car lifts and dumps the car. When it is desired to dump on the other side the car is turned around.

There is a small air-cylinder that locks and releases the car automatically, so that there is no danger of its dumping in transit, nor can it be dumped by an ignorant or malicious person releasing the lock This must be done from the engine.

The cars shown will carry ten cubic yards of dirt.

They are built by the Thatcher Car and Manufacturing Co. of this city.

### A Good Blow-Off Valve.

One of the worst things on an American locomotive, or any other kind, is the common taper plug-valve used as a blow-off cock.

They leak and fill up and stick; in anything like bad water you must loosen the set-nuts on the plug before you can use it, and then it gives you a shower bath when you try to close it up again. This well-known fact prevents their being used a good deal too often.

On many of the Southern roads they are using an improved valve that has many merits and is just as cheap as the plug. We do not know just who originated it, but it is in use on the L. & N. and several other roads. We got our drawing from the South Carolina road.

This cock has an internal opening valve much like a whistle valve, and operated in the same way, as plainly shown in our engraving. The body of the valve is a straight plug with a pair of lugs to carry the operating bell-crank, and a hex head for turning it into and out of the boiler, the outer end being threaded to attach a pipe to carry water and steam away from the engine.


The valve has a long-winged stem with a recess for the end of the lever, as shown, the stem is partly cut away next to the valve, so that this shall be the weakest part, and if the plug should get knocked off the stem would break there, leaving the valve in place, held there by the pressure.

One advantage of this valve is that it must be held open, it cannot be left open, and when you let go it shuts itself.

### From Start to Finish.

BY EUGENE V. DEBS.

I am persuaded, from such information as I have been able to obtain, that LOCOMOTIVE ENGINEERING is read chiefly by practical men. I know that the publication is owned, controlled and edited by men whose ambition prompts them to disseminate that kind of knowledge which will aid men who toil to accomplish the most satisfactory results. In reading LOCOMOTIVE ENGINEERING, as I am in the habit of doing, I discover little that is speculative or theoretical, the fanciful and imaginative being discarded to make room for bed-rock facts and principles upon which to rear fortresses, in the construction of which, reason, logic, common sense, argument, more enduring than granite and iron, furnish an impregnable retreat for thousands who by their brain and brawn are required from start to finish to build their own fortunes or die poor and obscure. The name, LOCOMOTIVE ENGINEERING, is eminently suggestive of practical problems which only sturdy men care to wrestle with. The sentimental namby-pambyisms, whims and crotchets of the period, of which there is a superabundance, are not lassoed and corralled for exhibition in the pages of LOCOMOTIVE ENGINEERING.

I am not unmindful of the fact that to say "The locomotive is a wonderful machine," and that "It is revolutionizing the world," are exceedingly trite expressions, long since worn threadbare, notwithstanding the fact that the first locomotive was built within the memory of men now living, and not so far advanced in years as to be retired from active pursuits, and yet to multiplied thousands the locomotive remains a mystery, an explained enigma, and strange to say, a truth stranger than friction, there are thousands of men known as "runners" to whom the locomotive has never yielded up its secrets I am aware that the plea is put forth that locomotive engineers and those who aspire to the responsible position, are not required to know as much about a locomotive as its builder, that their business is to run and not to build engines. I do not care to engage in much controversy, except to say that the more an engineer knows about a locomotive from start to finish, the better he is equipped as a "runner," and when assertions to the contrary are made, their effect, if they exert any influence at all, is in the line of promoting and perpetuating unfortunate conditions. And this leads me to say that when men at all capable survey the field of railroad employment, they discover at once that the supreme need is incentive to studious habits, that there may be more mind development, larger brain growth and grasp, in the ranks of the men who operate railroads.

Of late years we hear much about physical education, and our colleges and universities are devoting great attention to the subject Every institution of learning of high degree has its gymnasium where students are trained in athletics, it being acknowledged that a healthy, vigorous body is essential to the achievement and maintenance of high intellectual development, but it so happens that with railroad trainmen, firemen, engineers, conductors, switchmen and brakemen, whose *alma mater* is the railroad cab, caboose, yard or car, find a gymnasium all along the line, the development of their muscular manhood being a concomitant of their employment, their vocation affording them all the athletic exercise which health demands, hence I am not required to discuss physical education with regard to the requirements of trainmen, to whom reference has been made.

Shakespeare is credited with saying

> There is a tide in the affairs of men,
> Which, taken at the flood, leads on to fortune

And that

> There is a divinity which shapes our ends,
> Rough hew them how we will

Such expressions, no doubt, are im-

mensely poetic, and are accounted by many as the acme of wisdom. I do not doubt that there is a tide in the affairs of men; indeed, I am confident there are in human affairs numerous tides—flood and ebb—which lead on to fortune or down to unpleasant conditions. I object to the intimation of the one flood-tide which must be caught, else, by a decree of fate, all is lost. I prefer the kindergarten philosophy;

> If at first you don't succeed,
> Try, try again.

I do not believe that the first or the second failure settles a man's destiny; such is not the logic of experience. Nor do I take stock in any end-shaping divinity, if by the term "divinity" the man himself is to be denied the privilege of participating in the discussion which shapes his ends, his destiny. In such matters I am in favor of free speech, a free ballot and a fair count; of anything and everything that educates men up to the exercise of all their faculties, to win and maintain their independence, and I antagonize any creed or dogma that so much as squints at any interference with man's high prerogatives to start right, to advance along the main track and finish his career crowned with success. Anything else reduces men to mere machines to be operated by millionaire divinities, who have "wipers" forever wiping engines, and firemen forever breaking and shoveling fuel, and brakemen forever at the brake, and engineers forever at the throttle, unable, if they would, to take any tide at its flood, because some divinity had shaped their ends, put them in a hole from which they could be extricated only by a miracle.

Taking the world as we find it, difficulties arise when one is required to determine what conditions are really the most fortunate under which a youth may start in life and finish his career crowned with victory over "the world, the flesh and the devil." Dismissing extremes of great poverty and wealth, I am convinced the grandest achievements in human affairs are to be credited to those who were born neither very poor nor very rich, but occupied at the start that happy medium where there was an imperative demand for the exercise of the faculties to secure success. Still, instances are numerous and luminous of men starting far below the average and rising by virtue of their own efforts to independence and distinction. It is the testimony of all history that progress, such as the world may boast of, should be credited to men who have started in life neither the victims of squalor, nor yet the inheritors of riches; but rather those who were required by the exigencies of conditions to be self-reliant at the start and to work out their own emancipation from embarrassing environments by their own brain and brawn, by a miserly husbanding of their resources of time and opportunities, by habits of study, close application to duty, rising above temptations and their debasing influences, and with steadiness of purpose advancing, regardless of obstacles, along the line of success.

I could, were I so inclined, and space would permit, enter all the domains of human endeavor and name men who, starting at the bottom rung of the ladder, finished their career by standing securely at the top. These examples of obscure starting and victorious finish would be found in every profession and vocation, and in every instance the propelling forces would be found to have been practically the same, always from start to finish hard workers and laborious students, always broadening their mental vision and strengthening their mental grasp. They did not go up like a rocket, flame and fall; with them it was years of patient toil. The world admires such exhibitions of pluck and perseverance, but few there are who know or care to investigate the silent but potent forces to which society is indebted for all its progress.

I confess to profound admiration for such men. My historical readings, such as they are, lead to the conviction that the useful, the ornamental, the luxurious things that mankind has possessed since the dawn of creation, have been the product of the world's toilers, its wage workers. They were the builders of the seven wonders of the world, aye, of the seventy-seven thousand wonders, from the pyramids to the Columbian Exposition buildings. All of the cities, buried and above ground, from the first which Cain built, to Chicago, are so many monuments of their skill and toil, and should their brains and hands be paralyzed, the earth would be remanded to pre-historic conditions, when man was something less than a savage.

Taking this view of the subject, we come down to the present and inquire if men who build all the monuments of our civilization are true to themselves? At the start they have before them the problem, what shall the finish be? I do not believe that in the past there was such an inquiry. Workingmen, like the coral, have built and died. Others standing upon the graves of their predecessors worked on in the old grooves. There is a new dispensation for those who seek to comprehend its mission. Skulls are no longer the raw material with which to build thrones and steps to thrones. Man is something superior to a machine, if he so determines. It is a great mistake to find fault with an inheritance of work. Work, as an inheritance, taken into consideration with the elevating, redeeming, emancipating power the humblest possess, is a benediction, if, at the start, the finish is considered, if the worker reflects that he and he alone, is to be the architect of his fortune and that it will be in vain for him to call upon others to supply the material with which to build the superstructure. Starting poor and obscure, he will remain the victim of poverty and seclusion at the finish, provided he elects to let his mental faculties remain inert. If, however, he resolves to be a student in the line of his work, the gates to all the avenues of progress and high ambition will swing wide open at the touch of the charmed key he carries. Day by day, as the years speed on, he determines what the finish shall be. No toiler on the rugged road leading to final success must "lay the flattering unction to his soul" that chance, a flood-tide, some fortuitous circumstance, is to make the finish to his career such as is wrought out only by the faithful employment of mental and physical faculties in holy alliance to win victories from the iron jaws of fate; anything else is a vagary, a will o' the wisp of the brain, always and inevitably leading to disaster.

The times in which we live are fruitful of illustrations of such conclusions, and in no development of industrial enterprises are they more numerous than in the railroad service of the country. They include, at the start, office-boys, switchmen, firemen, brakemen, conductors, telegraphers, engineers, clerks, etc. Their name is legion. They start poor and obscure and by degrees win positions of influence, power, independence and opulence. They were in every instance and in the best sense of the term, students. Their motto was work, watch, study. The fortunate tide came every day to move them on toward the goal of their ambition. Their zeal, their fidelity, their ever-increasing knowledge, were divinities that shaped their ends and sent them forward to achieve victories, each in proportion to his talents, but all moving on an upward grade to goals of success.

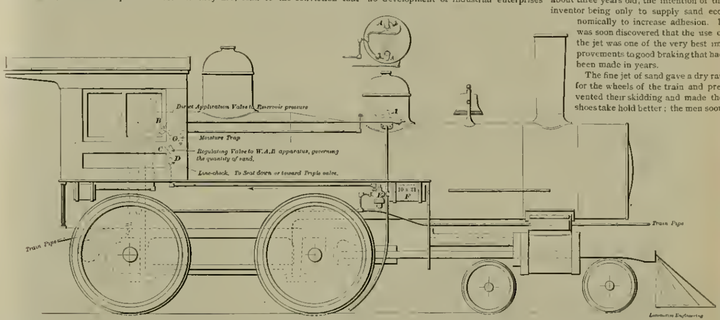
It would be in the line of supporting the argument to introduce notable examples of men now living and at the head of great railroad systems in the United States, as for instance, Mr. S. H. H. Clark, president and general manager of the Union Pacific system and vice-president of the Missouri Pacific system of railways. He began his railroad work on a New Jersey gravel train and advanced steadily to his present offices. As also, Edward Turner Jeffery, president and general manager of the Denver and Rio Grande Railway, who started at the very bottom and is finishing his career, as is Mr. Clark, with the most eminent distinction. There are numerous other instances of living men who are now in active employment, who started poor, obscure and unknown, whose equipment was brains, strong bodies and willing hands; who saw the need of vigilance, the study of books, men and their chosen calling; who placed a proper value upon time and opportunities and who shaped their ends to meet emergencies, so that when a man was wanted for a higher position, they could say, "Try me!" Thus it will ever be. The industrious, the studious, the alert, the courageous, who from start to finish are always adding to their equipment, will always be found moving on an upward grade to stations of greater power, influence and usefulness in the world, while the sluggards, the victims of ignorance and apathy, with stolid indifference and unconcern, will stand aside and see the procession, keeping step to the music of progress, march on to still higher achievements.

### An Automatic Sand-Feeding Attachment.

It is wonderful how a new invention finds other uses than the inventors sought, and how one improvement brings out another.

The air-jet sand-feeding device is only about three years old, the intention of the inventor being only to supply sand economically to increase adhesion. It was soon discovered that the use of the jet was one of the very best improvements to good braking that had been made in years.

The fine jet of sand gave a dry rail for the wheels of the train and prevented their skidding and made the shoes take hold better; the men soon came to use the jet as much for this purpose as to help start their trains.




Charles W Sherburne, of 53 Oliver street, Boston, Mass., has recently patented a device for automatically starting the air jets when the brake is applied. he does this without any new parts, simply using a Westinghouse air-brake auxiliary drum and a plain triple.

These he locates as shown in the cut, the triple acting with the other valves in the train, but instead of sending air to a brake cylinder the air goes through a pipe to the jets.

In the illustration the jets are in the base of the sand-box at *A*, the old hand-feeding valves being still there and ready for use. All the other valves are marked and their use told on the plate.

The engineer can use his old "free-for-all" valve, he can start the air-jets and let them operate as long as he wants to, or he can set the automatic sander and then regulate the amount of air it shall supply.

All the pipes are ¼-inch in diameter, and all the Westinghouse equipment used is a No. 1 triple-valve (Plate D 19) and an auxiliary reservoir (Plate D, 20).

Sand-feeding jets are a great improvement in service; they save tire, prevent slipping and stalling, and insure better braking and are economical of sand, at no time supplying enough to have the wheels throw it over into the link motion and other bearings.

### In Krupp's Steel Works.

[EDITORIAL CORRESPONDENCE.]

It is hardly fair to say that Krupp's works are located at Essen, Prussia; Essen is located at Krupp's works.

All there is of importance is owned by Fried Krupp, the third head of the concern and the grandson of the founder. There is no company or corporation, shares, or stock—it's all Krupp's.

It would be entirely impossible for me to describe the works; they are very large and extensive and somewhat different from anything in America.

As a rule the buildings are good, the machinery is good, that in the gun works being especially fine.

Some idea of the magnitude of the place can be had when I tell you that in the works alone they employ 16,000 men and in the mines 8,000 more. There are employed about the works sixteen standard gauge locomotives and twenty-four narrow gauge ones.

The product of the Krupp works represents almost everything made in steel.

Guns, the largest in the world, wheels, many kinds, tires, building material, armor plate, parts of men-of-war, springs of all kinds and sizes, tool steel, etc.

When I went through their works early in July, I saw the inner tube of the great gun that is coming to the Chicago exposition. In the gun shop they were making cannon for many countries and the foreign inspectors in their uniforms looked rather unique. There are only three countries of any size that Krupp has not made heavy arms for, these are France, Great Britain and the United States.

They have an immense shop for turning off and boring out car wheels, and hundreds were being thus made ready for service.

All European countries use wrought-iron car wheels of large diameter, and plans for forging these are numerous.

I was much interested in the process of making the Krupp No. 1, or "Ribbon" wheel; the center of this wheel is a plate, but it is made by rolling up a strip of metal as you would roll up a tape line.

This is done by powerful machinery, but the metal rolled is not thin like a ribbon; the center is composed of three pieces of metal of different sizes welded together; one end, which forms the rim, is heavier than the center; the whole not over 15 feet long. After being rolled up red hot, the coil is placed in a furnace and heated almost to the melting point and then welded into shape between huge dies on an immense steam hammer.

But Krupp makes excellent cast-steel wheels, and these are coming into use very fast, although they say they can not be produced cheaper than wrought-iron wheels.

I saw some of these wheels tested under a hammer; some were set on edge and the wheel flattened out—they were spoked wheels—until the rims were only 3 inches from the hubs, the spokes distorted and bent, enlarged in some places and stretched in others, and yet showing no cracks.

Then they blocked up under the rim of a wheel and drove the hub down, forming a cone of the entire wheel; no break in material. Another wheel was hammered into a twist and without a flaw in the metal being developed.

At Krupp's they don't cast steel that can not be forged, and all have some part that is finished in that way. I saw an immense casting weighing many tons—this was the beak or ram of a man-of-war, it was to be forged into finish.

The most interesting part of the plant to me was the tire-making shop. And to watch a tire from ingot to lathe room tells you the reason why Krupp's tires are so uniform. Poor metal can't stand that test.

In the first place a piece is cut off the bottom of the ingot; this is done under a hammer and in such a way as to leave a round chunk of metal.

This is heated properly and placed under a hammer and flattened out—looking for all the world like a small cheese.

It is now inspected, and if the edge has cracked under the flattening-out process it is thrown away. If it stands it is reheated and a pointed punch driven through it, forming a rough ring—again it is inspected; if it has stood this test it is considered good tire steel, and it passes to the hammers, where it is drawn out by slow hammering all around. One hammer has an overlapping die and bead that form it into the correct shape, with flange; the hammering is done very close to size, the rolls merely taking out the hammer marks.

This is a slow way to make tires, but it is pretty sure to get good ones.

The gas works are as big as you will find for many cities, and beside these there is an immense electric-light plant.

A uniformed fire brigade are on duty all the time.

Everywhere you notice the number of men; they seem to be in the way of each other.

In the spring department they were making hundreds of long, half-elliptic car springs, every process being a hand one.

They make crucible steel for tools, and make the finest and largest crucible castings in the world.

The workmen average less than $1 per day, and, I thought, did about 75 cents' worth of work. They are faithful and sure, but they plod; they plunk around in their wooden shoes and do their tasks mechanically. Herr Krupp employs mechanical engineers, chemists and specialists to do the thinking.

Near the center of the works is carefully preserved a little stone cottage, once, nearly a century ago, the humble home of the parents of the founder of the great works. Here he experimented, here his first forge was erected, and here he first made steel. This little seed, from which grew the greatest steel works in the world, has been cared for by the great and the rich Krupps, and it is said that they are proud of their humble origin and the brains and energy that made them a name and a fame as wide as the world. In a country where people are supposed to be born either with blue blood or canal water in their veins, this was refreshing to me, and I went away from Essen with far more respect for Herr Krupp than for the Kaiser,—or anyone else. J. A. H.

The useful books on "How to Run Engines and Boilers," and the "Corliss Engine," by E. P. Watson, the accomplished editor of the *Engineer*, are now handled by Spon & Chamberlain, New York.

Remember we pay cash commission to club-raisers.

### The American Balance Slide-Valve.

The engravings shown herewith will serve to make clear the details of construction of a balanced slide-valve that is making some friends in the West, it being a Californian invention and for some time in use there.

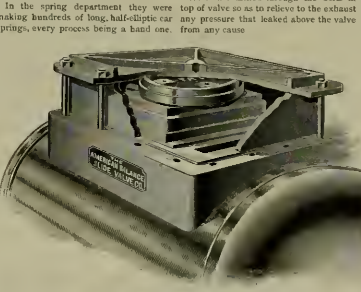
There is no balance plate, packing strips or springs used. The balancing device is simply bolted to the top of an ordinary slide-valve and the inside of the chest cover faced off for the packing-ring to wear against.

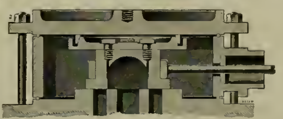
A circular disk is bolted to the top of the valve and on top of this disk there is a beveled boss, upon the outside of which a beveled packing-ring sets.

This ring is cut square across, but has a joint strip on the outside.

The pressure of steam in the chest tends to compress this ring and this forces it up against the cover. Any tendency of the valve to lift also tightens the balance packing; still the valve can lift.

Holes are drilled through the bolts in top of valve so as to relieve to the exhaust any pressure that leaked above the valve from any cause.



It has been found that the proper angle for this packing-ring depends upon the size of the circle and the pressure, and a number of angles have been worked out for the different sizes.

Where the chest is too short for one large plate two smaller ones are used. The general office of the company making these valves is in San Francisco, with a branch office in Chicago.

### Test of Turnbuckles.

An interesting test of four of the leading types of turnbuckles was recently made by Professors Gray and Brown at the Rose Polytechnic Institute. The four buckles tested were the Providence, the Cleveland, the Brooklyn and the Brazil. In tensile strength the Brooklyn proved to be the weakest of them all, breaking at 53,600 pounds. It failed by splitting open at the thread at the end. The Providence buckle broke at a strain of 62,000 pounds, the failure occurring at the bend. The Cleveland buckle, when subjected to a strain of 68,000 pounds, broke on one side. The Brazil turnbuckle, manufactured by the Central Iron & Steel Co., of Brazil, Ind., stood a strain of 85,000 pounds, and then the steel stub ends which were screwed into the buckle for the purpose of testing were broken without any apparent damage to the buckle itself. We do not know the size of the turnbuckles used in testing, but all the buckles were of the same size and took the same size rod.—*Railway Review.*

### No Cranes Needed.

"Speaking of appliances for transporting heavy weights," remarked F. W. Johnstone, superintendent of machinery of the Mexican Central, "I found some methods in Mexico that surprised me. You know that all the laborers we employ about the works are Mexicans, and good laborers they are. One day we had a consignment of anvils, each weighing over 600 pounds, that had to be taken to a place about half a mile from the shops where there was no track. I directed that barrows be used to carry the anvils on, and some of them were conveyed that way, but the men did not seem to take naturally to wheeling barrows. Presently one of them got an anvil on his shoulders, resting on a pad they use for bearing heavy weights. He started off with this enormous load and soon was followed by several other laborers, each with an anvil on his shoulders. All the anvils were transported in that way. If a load is under half a ton the average Mexican laborer will prefer taking it on his back to loading it on a wheelbarrow."

The Central Iron and Steel Co., of Brazil, Ind., are not complaining of trade being slack. On the contrary, they say that orders are keeping them as busy as their capacity is equal to, but they are hustling to increase their means of production. They are adding new wings to the rolling mill, one part being 35 x 222 feet, the other 56 x 170 feet. Into this they are putting a new engine, gas furnace and bolt-cutter made by the National Machinery Co., of Tiffin, O. There is also a new train of 8-inch rolls, a heavy steam hammer of the Morgan Engineering Co.'s make. Another addition to the works is a nut, bolt and rivet department, which comprises a forge room 55 x 96 feet, a screw-cutting room 55 x 75 feet and a boiler-room 30 x 40 feet.

Through the courtesy of Mr. William Smith, superintendent of motive power of the Chicago and Northwestern, we have received a statement of the iron ore shipped from Escanaba during the year passed, and carried there by the Chicago and Northwestern trains. The total amount is 4,008,900 tons. This ore-hauling business is very systematically done by the railroad company handling it. Special ore cars are employed that have air-brakes and vertical plane couplers. The cars carry from 25 to 30 tons each. The quantity of ore named would fill 160,356 cars with a load of 25 tons. If each train consisted of 25 cars, the business would call for over 20 trains a day for 300 days of the year.

The genial general superintendent of the New York & Northern, H. H. Vreeland, has been promoted to the position of general manager. Vreeland is said to be the best natured railroad officer in the country, yet he is a hustler in his line. His friends will all be glad to hear of his lift. He came up from the ranks, and has not forgotten how it seems to sit out on a box-car all night with his hand on a brake-wheel and his eagle eye full of cinders.

Among the railroads that have had compound locomotives lately built by the Baldwin Locomotive Works are Central of Brazil, New York, Lake Erie & Western, Philadelphia & Reading, Pike's Peak, Richmond & Danville, Norfolk & Western, Jacksonville, Tampa & Key West, Missouri, Kansas & Texas, Lehigh Valley and several others.

### Baldwin Mountain Climber for Italy.

Baldwin's have recently built the locomotive shown herewith for Count Telfener, of Florence, Italy.

As can be seen, the engine is for a rack railroad. She has cylinders 11 x 16 inches, and her toothed driving-wheel is 37.59 inches in diameter, total wheel base but 8 feet 2 inches, and total weight 33,000. The gauge of the track is 3 feet 3⅜ inches.

This mountain road is about six miles long (8 kilometers), having very sharp curves; one-third of the road has a grade of 8 per cent. one-third is 8 to 18 per cent.,


Mountain Climber for Italy.

and the other third averages from 18 to 22 per cent.

The engine has a brake on the crank wheel, as shown; a hand-brake on the leading axle, and the La Chatelier water-brake on cylinders.

### To Make Men Loyal and Contented.

BY SAM SHORT.

Ever since General Manager Wartmouth intimated to me that my services as master mechanic of the N. & Y. were no longer wanted, we have been good friends and he frequently gives me orders for supplies. The real trouble between us was that Mr. Wartmouth likes to be his own master mechanic, just as he persists in being the chief engineer, and road master, and train master, and train dispatcher. When either of these officials does not quietly agree to the general manager stepping in and running the details of his work on any and all occasions, there is going to be a change in the office.

I have always believed that Mr. Wartmouth had a covert admiration for the decided way in which I objected to his interfering with my department. The day that I told him I would not tolerate his going into the shop and dictating to my foremen, and he retorted that my resignation could not be sent in a minute too soon, ended a fight that had been going on for two years.

Every time I go there now Mr. Wartmouth is eager to tell me about the tanks of wrath which he has been pouring upon something. His road is dominated by the Brotherhoods, and it is torture for him to deal with any power which interferes with his strong, sour will.

"Railroad interests are going to the dogs; hounded to hell by unions," mildly remarked Mr. Wartmouth, after passing the courtesies of the day on my last visit.

"What is the latest agony in this line?"

"Why, I've been for the last three days wrestling with a set of fools all because I dare to run my own business in my own way."

"What were the particulars of the trouble?"

"Well, it was this way. The flyer was pulling through the yards at Smiths and that lunkhead, Bill Warner, whom you sent back to switching because he could not read train orders, pushed some cars so they did not clear the main line. Jim Wantz, who was running the 73 on the flyer was gaping along, not attending to his business. He was close to the cars before he saw they did not clear, and tore the side off five first-class coaches. It was by the greatest good luck that nobody was killed."

"I don't see why that should give you very much trouble."

"You don't, don't you? That's because you don't realize the villainy of Brotherhoods. You may not call it trouble, but I was never so near having a strike on my hands."

"I can't see how the men should want to strike about that accident. None of them were much to blame as far as I can see."

"None of them to blame, eh? I just consider they were all to blame, and bounced the whole of them, the whole of the switching crew and Wantz and his fireman."

"That is what I would call indiscriminate guillotining. Did poor Warner push the cars without orders?"

"No; of course he pushed the cars by the switchman's signals."

"Do you give orders now that a switching engineer will go back to see that the main line is clear when a train is due?"

"No, but discipline must be maintained."

"Weren't you a little severe at Wantz pulling that train you are so particular about making time, through a crooked yard filled with cars, and no signal to protect anything?"

"I don't look at it in that light. If you let these fellows ram into trains every time they feel in a reckless mood, the road could not meet the repair bills."

"What kind of trouble came out of the case that has given you so much annoyance?"

"These fellows were not satisfied with the way I am running my business. They all came and protested that they had been badly used, but I gave them a piece of my mind. That did not close the matter, for the miserable Brotherhood took it up and threatened to strike unless the men were reinstated without loss of pay. You know that the chairman of our board cares more for Wall street influences than the dignity of his subordinates, and I had to make the best settlement I could."

"Was that the putting of the men back to work?"

"Yes; but give these fellows an inch and they compel an ell. They put a toil to that part of the settlement and said that since they were about it they must have an agreement that men shall not be suspended without investigation."

"Don't you think that is fair?"

"No; it's an imposition. Something must be done to prevent labor organizations from interfering with the management of railroads. The country is going to ruin anyway, but a little good management could save it."

"What would you propose doing, Mr. Wartmouth?"

"I am not ready to announce my plan just yet. We must arrange it so that men cannot strike on the least provocation without being losers themselves. I have a scheme of a mutual benevolent association, into which every employé must pay so much a month. He will be cared for during sickness and will receive a pension after so many years' service. That would make the men interested in the welfare of the company, and is my remedy against strikes."

"How do you think treating the men fairly all the time would work? Take care, for instance, not to punish a man unless he deserves it, and you will have no trouble."

"Why, Short, you must be turning Socialist. You know that no men could be better treated than those on the N. & Y."

"I don't know anything of the kind. You are accustomed only to seeing things as they are done on your own road. You have your own notions about discipline, and believe that what you think is right must be fair. But I am in the position to compare your ways with the ways of other managers. I know that rewards and punishments have always been given in an indiscriminate fashion under your system, and also know that the road is honeycombed with discontent and disloyalty, although you pay more than roads where men are contented, harmonious and loyal. On roads where this state of good feeling exists, the officers are not constantly on the watch for excuses to punish men. Punishment is looked upon as a necessary evil and never indulged in recklessly. On these roads the officers do not require to sit up nights forming schemes of benevolent associations that will keep their men in subjection. On some of these underpaid roads you could not drive the men into a strike because they realize that the management is treating them as well as circumstances will permit."

"You astonish me, Short. I must look into this thing. No man is more anxious to be fair than I am, but I may have made mistakes. I don't like the way you talk, but you may be right. Good-day, Short; you always liked to make a man feel that he was a ruffian. Don't apologize, for I know you mean to make the case as black as you can. That's all right. I shall specify your goods for the new locomotives."

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A correspondent writes "J. A. H. I notice you were made a member of the French Society of Inventors and was offered the medal. I was also *offered* the *gilded* medal *for ten dollars*. Men claim distinction in the late war. I claim the distinction of doing the *last work* on the first *Monitor*. It was some work to her turret engine, about two weeks before she was lost. Was detailed from my ship, the new *Ironsides*, for that purpose."

### Local Etiquette.

In some parts of Texas the people are intensely particular about forms of etiquette. There may be rudeness, not to say brutality rampant in some departments of the social fabric, but every white female must be called a "lady." The division superintendent of a certain railroad operating in Texas was looking after the erection of a new depot in a small way town and through ignorance of the social rules of the place he put the word "women" on the lavatory of the ladies' waiting-room. Now these natives were as touchy about the significance of the word "woman" as was Mr. Bardell in the famous case Bardell vs. Pickwick. A deputation of citizens immediately waited upon the superintendent and requested that the offending word be changed to "ladies." The superintendent was from the North and was obstinate. He intimated that the building belonged to the railroad company and he had the right to put anything on it that he pleased. The following day another department waited upon the superintendent provided with a rope and other conveniences for giving offenders against the habits of the place short shrift. They invited the superintendent in their most cordial fashion to accompany them to a convenient telegraph pole and form the principal figure in an act that was popular in the region. The superintendent was now ready to come to terms. The terms offered were that he decorate the telegraph pole or quit the country. He went North and stood not on the order of his going.

### A Hose on Wheels.

In a French engine-house I watched a little, bow-legged boiler-washer walk off eighty or a hundred feet with his hose following him, and he did it so easily as to call to my mind the picture of our boiler-washers pulling and dragging a 3-inch rubber hose on the floor.

The French hose was made of 8 or 10-foot sections of 2½-inch pipe mounted on casters, as shown in sketch; these pipes were connected by pieces of leather hose 1 foot long, the nozzle end of the line having 12 or 14 feet of hose. I have given the dimensions of the wood-carrier and casters; the block has to be long enough to

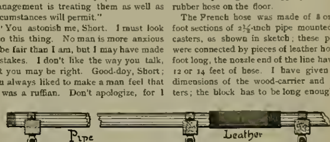
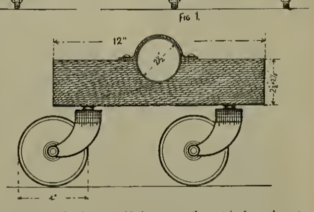



Fig 1.




prevent the cart it forms from tipping over every time it makes a turn.

It is remarkable how much of this kind of hose a man can pull around, and how it must last as compared to rubber hose dragged over the pits, scrap-iron, etc.

On the asphalt streets of Paris a hose of this kind is used to sprinkle with, and each section of the street is cared for by a man who sprinkles all the time. There are lots of places in our shops where this little kink could be used to advantage.

J. A. H.

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G. H. Fairchild, engineer of the N. P., has been promoted to the position of road foreman of engines.

### Improved Brake Apparatus.

The Westinghouse Air-Brake Company have effected improvements on several of the brake appliances. We illustrate the new air-pump, engineer's brake and equalizing valves and the governor.

NEW PUMP.

The principal features of this pump, as differing from those of the 8-inch pump, are as follows:

*First*—The 8-inch pump was designed at the time when very much lower steam pressures were used in the boilers than at present, and, in order to insure a sufficient pressure of air at all times, the steam-cylinder was made 8 inches in diameter while the air-cylinder was but 7½ inches, so that the area of the air-piston was only ¾ that of the steam-piston. Since that time, the steam-pressures of all locomotives have been so much increased that, in designing this new pump, the steam and air-pistons are of the same diameter, *i. e.*, 9½ inches each.

*Second*—In order to make the air-valves more accessible, they have all been placed in separate chambers, and to avoid the necessity of carrying a stock of different sized valves, but one valve is used, and all the air-valves are thus interchangeable, the lift of the valves being regulated in such a way as to permit this.

*Third*—The steam-valve gear has heretofore been placed in the steam-cylinder casing, necessitating the removal of several parts in order to get at the steam-valves. In the designing of the new pump, this objection was avoided and the steam-valve gear much simplified by placing it all in the upper cylinder-head in such a manner that the valves could be removed without the removal of the head; or the entire valve gear may be taken off by removing the upper cylinder-head and put into repair without removing the pump from the engine or disconnecting the steam and air-pipes, as has been necessary with the former pumps. The same form of reversing valve, No. 72, is employed as formerly. The valve controlling the admission of steam to the steam-cylinder of the pump, is now also a slide-valve (No. 83) which is operated by the differential pistons 77 and 79. Steam enters directly between these pistons, forcing them to the position shown. The pump piston then rises until the washer, 69, strikes the shoulder, *j*, of the reversing stem, when it moves the reversing-valve, 72, upward, admitting steam through the passages, *s* and *g*, to the chamber, *D*, at the right of the piston, 77.

Chamber *E* is always in communication with the exhaust passage. Piston 77, then having steam pressure on both sides, and piston 79 having steam pressure on the right side only, the differential pistons move to the left, carrying the slide-valve, 83, with them and thus reversing the pump. The piston then moves down until the washer, 69, reaches the button at the lower end of the reversing-valve stem, carrying the reversing-valve down to its present position, where the steam is exhausted from the chamber *D*, and causing the differential pistons to move back again to the position shown in cut.

The advantages claimed are, briefly, simplicity of construction, greater accessibility of both air and steam-valves, greater ease for repairs and an increased capacity for furnishing air, of about 60 per cent over that of the 8-inch pump in the same length of time.

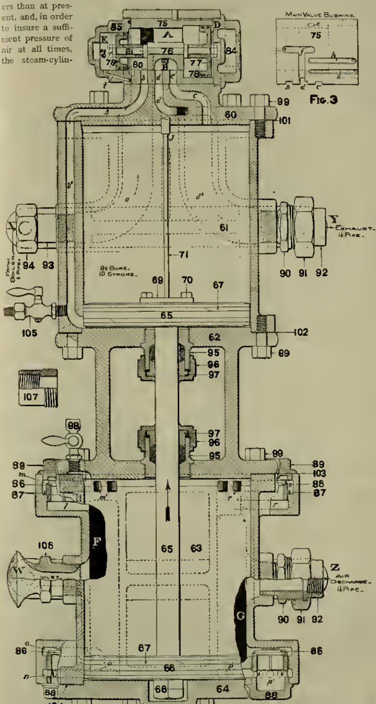



Fig. 1

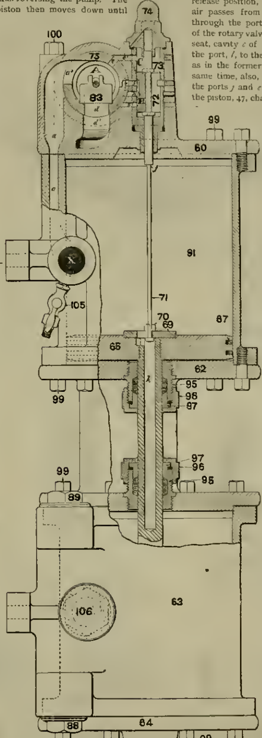


Fig. 2

IMPROVED ENGINEER'S BRAKE AND EQUALIZING DISCHARGE VALVE.

Several advantages are claimed for this valve. Its operation is, generally speaking, the same as that of the former construction, and the construction of all that portion shown in the lower case, 34, is unchanged, the piston, 47, and its functions remaining the same.

In the operation of this valve the brakes are released by placing the handle in the release position, No. 1, by which the air passes from the main reservoir, through the port *A*, the supply port *a* of the rotary valve, cavity *b* of the valve seat, cavity *c* of the valve (Fig. 4), and the port, *l*, to the train pipe—the same as in the former construction. At the same time, also, the air passes through the ports *j* and *e* to the chamber above the piston, 47, charging the small reservoir connected thereto.

When the handle is brought to the running position, air passes to the train pipe, from the main reservoir, only through the port *j*, the port *f* (Fig. 3), under the valve 63 and thence, by the dotted feed port *i* (Fig. 2) to the port *l* leading to the train-pipe.

When the pressure in the train-pipe has attained the maximum (70 pounds), such pressure upon the upper face of the diaphragm 72 (Fig. 3) forces the piston, 66, downward, compressing the spring, 68, and allowing the valve, 63, to seat itself and prevent further passage of air from the main reservoir to the train-pipe. The other functions, of applying the brake, both for service and emergency stops, are precisely the same as with the older form of construction.

The essential difference between the operation of this improved valve and the old one is the use of the feed-valve attachment, consisting of the valve 63, piston 66, spring 68, and diaphragm 72, instead of the excess-pressure valve formerly used and shown as it may be attached to this style of construction (instead of the feed-valve) in Fig. 5.

It will be observed, therefore, that the only difference in the operation of the two valves is when the handle is in the running position. With the old valve, when the handle was placed in the running position, after having been in the release position, the air could not flow to the train-pipe from the main reservoir until the pressure in the latter had become greater than that in the train-pipe, by such an amount as is necessary to open the excess-pressure valve 77 against the spring 79. This spring was so adjusted as to require a pressure in the main reservoir about 20 pounds in excess of that in the train-pipe. The objection to this form was that upon long trains the brakes of the forward cars

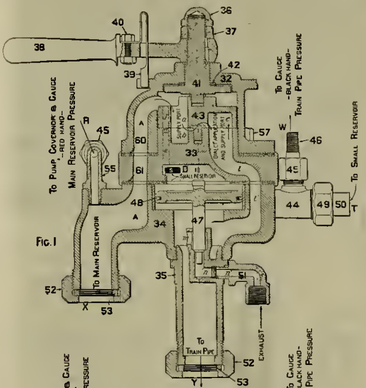
might apply slightly upon the removal of the handle from the release position to the running position. This is due to the fact that, in releasing the brakes and recharging the auxiliary reservoirs throughout the train, the friction which the train-pipe presents to the flow of air through it is not inconsiderable, and also to the fact that the recharging of the reservoirs, at the forward end of the train, is reducing the supply of air in the train-pipe as it passes toward the rear end of the train. The result was that the pressure at the rear end of the train-pipe was somewhat lower, at such times, than at the forward end of the train-pipe, especially upon long trains. When, now, the handle of the brake-valve is then brought to the running position, the train-pipe is cut off from communication with the main reservoir until the excess pressure is pumped up; in the meantime the air pressure in the train-pipe becomes equalized, feeding into the auxiliary reservoirs at the rear end of the train, until the train-pipe pressure is below that of the forward auxiliary reservoirs, thus causing the brakes to apply at the forward end of the train. The construction of the feed-valve attachment is such as to obviate this difficulty.

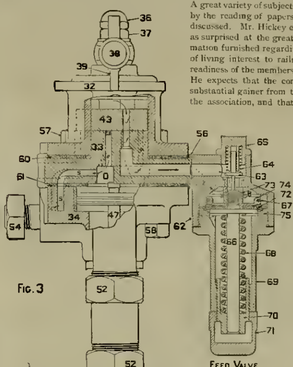
When the handle of the engineer's valve is brought to the running position, the air of the main reservoir has still access to the train-pipe through the feed-valve, 63, which is held open by the spring, 68, and thus the train-pipe is supplied with air until the pressure reaches 70 pounds, when the feed-valve gradually closes, so that equalization throughout the train-pipe takes place before the feed-valve is fully closed.

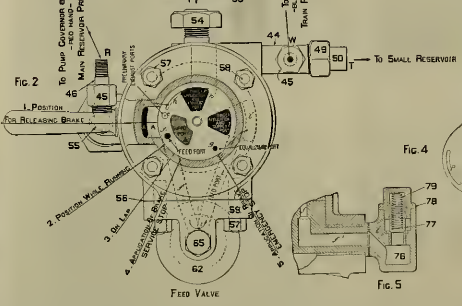
The new construction, therefore, removes the source of the only legitimate excuse for the very bad and too largely prevailing habit of leaving the handle in the release position while running. A small port, not shown in the drawings, is now also provided, so that, when the handle is placed in the release position, there is a small escape of air, producing a hissing sound, which calls the engineer's attention to his negligence to return the handle to the running position. The noise from this warning port will be a sufficient reminder to the engineer who is simply neglectful, and will make it disagreeable for the engineer who insists upon leaving the handle in the release position, in violation of his instructions.

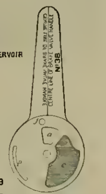
The advantages in construction are as follows. The case of the engineer's valve, instead of being made in two pieces, with a cap screwing in at the top, as formerly, is now made in three parts. The lower part, 34, has all the pipe connections, so that the valve may be easily taken apart and cleaned without disconnecting the lower case, 34, from its fastening, or disconnecting any of the pipes, also, the upper portion of the case, 32, may be removed, leaving the portion 33 exposed, and thus offering ready access to the seat of the rotary valve, 43. It was, with the old construction, necessary to reach down into the case to scrape this valve-seat, which is now readily accessible; also the valve, 43, is of brass, while the seat, 33, is of cast iron, instead of brass as formerly, so that the wearing surfaces are brass upon cast-iron instead of brass upon brass.

A description of the new pump governor will be given next month. We will say here, however, that, with this new engineer's valve, the governor is connected to the main reservoir, while with the old engineer's valve, with the excess pressure valve, the governor is connected to the train pipe.




Chicago suburban railroads are beginning to experience some of the tribulations that owners of stock in the elevated railroads in New York have suffered for years. The Supreme Court of Illinois has awarded damages to a property owner for the nuisance of noise and smoke caused by the trains of the Chicago, Milwaukee & St. Paul Railroad. There has been no end of fraudulent imposition put upon the New York elevated railroads on this kind of pretense, and we know no way in which a rogue can so successfully steal from railroads. Surface railroads will next become victims.

### Northern Pacific Mechanical Association.

We have been informed by Mr. John Hickey, superintendent of motive power of the Northern Pacific, that a highly useful Mechanical Association has been formed on the Northern Pacific system. The members are composed of master mechanics, master car builders, shop foremen and road foremen of engines. Mr. Hickey had just returned from a meeting of this association held in Tacoma, Wash., and he described it as being as good as the meetings of the Western Railway Club in its best days. The meeting lasted five days. A great variety of subjects were introduced by the reading of papers, and thoroughly discussed. Mr. Hickey expressed himself as surprised at the great amount of information furnished regarding topics that are of living interest to railroad men and the readiness of the members to discuss them. He expects that the company will be a substantial gainer from the work done by the association, and that the benefits will be indirectly shared by the members. There are similar associations on the C., B. & Q. and a few other roads.

We have frequently heard the question asked, during the last few years, What is the use of the Eastern and Western Railroad Associations? The critics keep saying that the associations are sink holes into which the railroad companies throw a great deal of money and receive next to nothing in return. We are not informed of any good that railroad companies have derived from belonging to the associations named, but we have a firm belief that certain men interested in the associations find the connection very comfortable and lucrative.

When sheriffs' officers are after train robbers it is wise not to stand on etiquette in making arrests. The soundness of this advice was illustrated lately in Montana. A sheriff, with a posse, found gambling in a saloon six robbers who had gone through a Great Northern train, and committed other depredations. Instead of overpowering the men and equipping them with handcuffs, the sheriff began reading a warrant for the arrest of the robbers. Instead of quietly yielding the robbers jumped for their rifles, and the sheriff's posse was at once the pursued instead of pursuers.

The lighting of railroad cars with Pintsch gas is making very rapid progress. It is the cleanest, clearest and safest method of lighting cars that seems practicable, and it is highly popular with the people who ride in railroad trains. Within the last few months new plants for the manufacture of Pintsch gas have been established at Kansas City, Council Bluffs, Chattanooga, Philadelphia, Toledo and Buffalo. This indicates that railroad managers are abandoning the dangerous oil lamps as fast as they can.

*The Railway Carmen's Journal*, official organ of the Brotherhood of Railway Carmen, has gone into magazine form. It looks much like the *Firemen's Magazine*, and is a big improvement over its former self. It is printed at Minneapolis, Minn.

# Car Shops and Car Builders.

### A Long Freight Car.

The engraving shown herewith is from a photograph of a 60-foot freight car, one of an order recently turned out by the Mt. Vernon Car Manufacturing Co. of Mt. Vernon, Ill., for the American Car Co. of St Louis, builders of street cars.

This is a very strong car despite its great length; it has 20-inch sills and stiffened by eight 1¼-inch truss-rods.

As it will be used for carrying empty street cars there is not much danger of overloading.

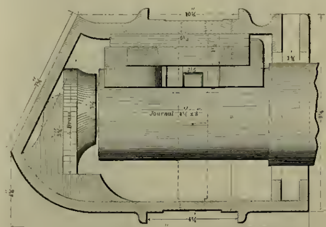
### New Draft Timber Arrangement.

The sketch shown herewith illustrates a form of draft timber recently patented by the firm of Rover & Rover, of Lima, O.

As will be seen, no bolts are required to secure draft timbers to car body.

With this plan of draft timber a broken draft gear can be taken out of a loaded car without any trouble, as all the nuts are where they can be reached.

The device has been in use some time on the C., H. & D. road.



### Colorado Midland Oil Box.

The annexed engraving shows the form of axle-box designed by Mr. A. L. Humphrey, master mechanic of the Colorado Midland, and used very successfully on the cars and tenders of that road. The Colorado Midland is about the crookedest railroad on this continent, and the cars are a great part of the time running on such a steep angle that collars cut with amazing rapidity and cause no end of annoyance from heating. The ordinary end-stops in use were too weak to stand the heavy thrusts put upon them on sharp curves, and Mr. Humphrey devised the form shown, which proved a perfect success. It is a simple form of stop, easily made and very durable.

### Philosophy on a Car's Running Gear.

In giving testimony in a law-suit at Cincinnati involving patents on electric motors, James W. See, the well-known engineering expert, author of Chordal's Letters, gave the clearest evidence we have ever seen of the operation of an electric motor. In the course of his evidence he thus describes the relation between a car and its running gear

"The two axles of a car must be capable of all manner of motions with reference to each other. As a car rounds a curve, the two axles must tend to take a position somewhat radial to the curve instead of parallel to each other. Railroad tracks are never in a true plane, and the action of the two axles with reference to each other as the car proceeds over the inequalities of the track, is as if two mighty giants, each at one end of the car, were seeking to twist the car into the form of a rope. The movements of the car axles are small, but of almost irresistible power. If the two axles of a car were mounted unyieldingly with reference to each other, the car would be hammered out of shape, past all possibility of maintenance. Therefore the two axles of a car are always arranged for perfect freedom of motion with reference to each other, and care is taken that the rigidity of the car body shall not negative the desired condition."

### Playing with Fire.

The excitement that existed a few years ago in regard to the danger of cars getting set on fire in railroad accidents and burning up the passengers stimulated railroad companies to adopt safe methods of car-heating, and all first-class railroad companies have now adopted steam or hot water for the purpose filled by the cast-iron stove only a short time ago. This change has made railroad travel decidedly safer, and the agitation has effected a reformation that might never have come had the railroad companies been left to follow the bent of their own inclinations.

One of the most horrible accidents that can be conceived is the burning up of shattered cars and the cremating of unfortunate human beings, dead and alive, trapped in the debris. The winter months, when accidents are most common and when the causes of fires are most actively in operation, naturally turn our attention to the sources of danger which are still present in passenger cars. Traveling will not be so safe as the public reasonably requires as long as lamps with huge fountains filled with highly inflammable oil are hung in the middle of the cars. Many persons whose views are entitled to consideration and respect maintain that the oil lamp has always been more dangerous than the stoves that are now so rapidly disappearing.

It is certain that the mineral oil sprinkled over the splintered wood-work of cars has done much to quicken the conflagrations that followed numerous collisions made celebrated by their fatal records. While the stove was there to start the fire, little blame was directed to the lamp that fed the flames. A change has taken place now and the lamp will have to bear its own blame when a cause for reproach comes round. If new lessons are needed to place before railroad managers the lamp in its true and dangerous light, we hope that the lesson will not be pressed in the emphatic fashion that the lesson of the car stove was put upon railroad men and travelers alike.

When the dangers of the car stove were under discussion and the agitation was going on for a change, we noticed that railroad companies generally abandoned the dangerous practice of packing the opening between the timbers with shavings, and that mineral wool and other non-combustible materials were specified for that purpose. We regret to notice that in some specifications lately sent out for new cars the safe material is not mentioned, and car builders are left to apply what they choose. This, of course, will be cheap inflammable material. It looks as if some railroad companies would never profit by experience.

### How I Lay out Boiler Work.

BY JAMES HERON.

Figs. 21 and 22—*A* shows how to lay out dome, when placed on one side of boiler; the sheet-iron worker is often called on to make a piece like this. Draw the radius of the boiler or pipe, as the case may be; describe the diameter of dome in the required position; describe the semi-circle with radius of dome; divide semi-circle into any number of equal parts—I use eight parts—square lines down from points of division. I never use a square, but put small center marks at points of division on semi-circle and take distance of spaces with compass and transfer distance found to line marked *H* 8, working both ways

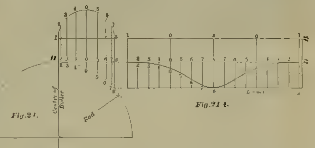


Fig. 21. Fig. 21 A.

from center of dome; then strike lines with short straight-edge, cutting all lines to radius of boiler. Now, take the plate of which dome is to be formed as Fig. 21 *A* and square plate to length required, allowing for laps at ends of plates. Strike a line the full length of sheet; distance from top of sheet must be the same as from 1 to *H* or 8 to 8, Fig. 21, and as at *BB* Fig. 21 *A*. Divide plate into four equal parts from center of holes at ends of plate, quarters are marked 1 0 8 0 1. Divide quarter into same number of parts as shown on semi-circle, Fig. 21 Now, by setting your compass at points marked 8–8, 7–7, 6–6, etc., and transferring lengths found at these points on Fig. 21 to points with corresponding numbers Fig. 21 *A*, or flat plate; this will give you your line of curvature. You must now allow for flange and your job is complete The rule to lay out Figs. 21 and 22 is the same as shown in last paper, Fig. 18 and 19, and I would not have gone into such lengthy details but I got mixed up in numbering the pages in last paper and got the cart before the horse. Note where it reads, "Now roll up a plate to form a dome with all edges square with each other, and put it on top of boiler." Now comes the mistake. To

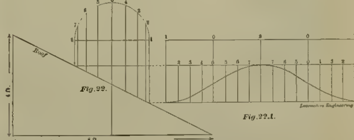


Fig. 22. Fig. 22 A.

make this read properly you must go down the column to where it reads, "square sheet at center of boiler, plumb the sides, etc.," and you will solve the mystery.

Figs. 22 and 22 *A* are the methods I use for laying out jack for roof or man-hole on sloping water tank.

The general railway agents of Lukens Iron and Steel Co., Messrs. Coolbaugh & Pomeroy, report a steadily increasing railway trade. The Penna. R. R. have been furnished steel by this company for twenty-five engines. It is also specified on the seven Fitchburg engines building by the Rhode Island Locomotive Works. Orders have recently been booked from several new roads. There are forty-one roads using this material.

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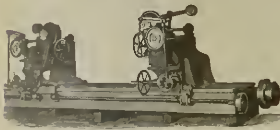

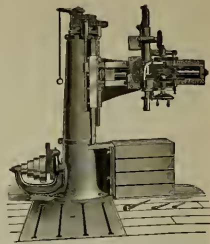

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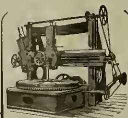

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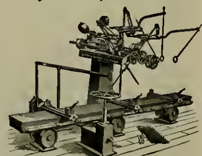

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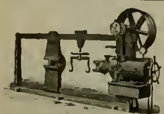
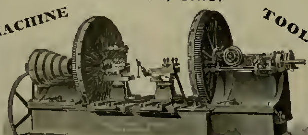
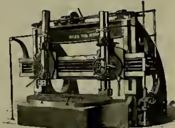


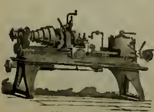
HYDROSTATIC WHEEL PRESS.



DOUBLE DRIVING WHEEL LATHE.



BORING AND TURNING MILL.



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# ? A. What You Want to Know. ? A.

**Don't ask questions that simply require a little figuring to determine; make each question separate. No notice taken of anonymous questions.**

(1) J. J. T., Buffalo, N. Y., writes

Please say in your next number how much the slide-valve of a perfect engine will move by throwing the reverse lever from full gear forward to full gear backward when the engine is on the dead center? *A.*—It will not move at all.

(2) Apprentice, Huntington, Ind., writes

Suppose an engine runs 400 revolutions per minute and you want your main shaft to run 120 revolutions. Please give rule for size of pulleys. *A.*—We answered this question from the same man on page 339 of last year's paper.

(3) B. P., St. Louis, Mo., writes

In a book that I was reading lately mention was made of the Le Chatelier brake as if it were a successful thing. Where is the brake in use, and who was the inventor? *A.*—Le Chatelier brake is the water-brake in use on some of our mountain roads. The inventor was a French scientist.

(4) M. A. S., Milwaukee, Wis., asks:

How is the horse power of a revolving shaft measured? A transmits power to a shop by a cable, and there is a question of how much power is transmitted. *A.*—The best way to measure the power is by using a Prony brake. This is a device which is clamped to the shaft and shows by a lever and weight how much power there is exerted in revolving the shaft.

(5) R. M. Y., Elizabeth, N. J., writes

I find that some locomotives have the rocker arm made with one end out of line with the other. I see no sense in the thing; why not make the two arms in line? *A.*—The offset is on the lower arm, and is made to put the lower arm at right angles to the center line of motion. The adjustment of the valve-gear requires this arrangement in some engines.

(6) L., Chicago:

Asks a variety of questions mostly relating to the proper procedure with compound locomotives in cases of failure. *A.*—We have repeatedly given notice that we will not answer communications that have not the name and address of the sender. The names are held confidential, but we must receive them. People who write anonymous letters do not deserve attention.

(7) Learner, Sioux City, Ia., says

I should like to get a plain definition of a heat unit on a practical basis. *A.*—A heat unit is the amount of heat required to raise one pound of water at its greatest density one degree Fahrenheit. If you light a spirit lamp and put it under a glass flask containing one pound of water, and it is found that the temperature of the water is raised five degrees Fahrenheit every minute, the lamp has practically a capacity of five heat-units.

(8) L. W. T., Nashua, N. H., says

Suppose an engine stood on the forward center with the steam-chest off, and the valve showed a port opening of $\frac{1}{16}$-inch. Now, if I file off $\frac{1}{16}$ more, not moving anything, and I do the same thing on the other end, and afterward move the eccentrics to give the engine the original $\frac{1}{16}$-inch lead, what will the effect of the change be? *A.*—You have reduced the outside lap $\frac{1}{16}$-inch, which will slightly reduce the scope of the engine for working steam expansively.

(9) Mr. G. A. Griffin, Biddeford, Me., asks:

How the air-gauge is arranged for the black hand to show one pressure and red one another, and this with one pipe. I have "Sinclair's Locomotive Engine Running and Management" and "Forney's Catechism," but cannot find it in either? *A.*—There are two gauges in one case and a pipe to each.

(10) M., Frankfort, N. Y., writes:

1. Will you inform me if there is a rule for locating the pin of the link-saddle, or must we cut and try? *A.*—There is no rule. When the motion is laid down on the drawing-board the proper point of suspension for the link is found by trial. 2. Why will an injector not throw water against its own pressure of steam when the water is below the check? *A.*—The injector will throw water against the pressure of steam when the water is below the check. That it will not do so is a common delusion.

(11) A. B., Sydney, N. S. W., says:

1. What lubricating oil is mostly used in the United States? *A.*—Mineral. 2. How is it applied, by worsted trimmings or needle feed-cups? *A.*—Needle feed-cups. 3. What is the Beaumé scale? *A.*—This question was answered in LOCOMOTIVE ENGINEERING a year ago as follows: The gravity or weight of oil is reckoned by the Beaumé scale. In this water is put down as 1, and as all oils are lighter than this, their specific gravity is a decimal of 1. Oil of 32° gravity has a specific gravity of .8641 as compared with water. The degrees are established arbitrarily.

(12) W. O. M., Chicago, asks:

Can you give me a short rule for calculating the weight on the drivers of an eight-wheel American engine? I don't mean the weight necessary for a given size cylinder, wheel, etc., but when certain dimensions are given on a drawing how to find how much weight the engine has. You understand, the weights now-a-days are somewhat in excess of what is absolutely necessary to keep the drivers from slipping under ordinary circumstances. *A.*—There can be no *rule* for guessing at the weight on drivers of a locomotive. The usual practice in eight-wheeled engines is to put about two-thirds of the weight of the engine on her drivers. We do not know that the last statement is true.

(13) D. O'B., Mancelona, Mich., writes:

Being a constant reader of your most valuable paper, I concluded to ask for information through your columns. 1. Why is it that steam of 150 pounds pressure, when cut off very early in the cylinder, does not expand enough to fill the cylinder and destroy the vacuum when it is claimed to have a volume of 169 times that of the water from which it is made. *A.*—If you mean locomotive practice, there is no vacuum to destroy. If you mean a condensing engine, the vacuum is on the opposite side of the piston from the entering steam—in other words, the exhaust is open to the condenser instead of the atmosphere. 2. What is the cause of drumming in an locomotive? *A.*—Believed to be caused by miniature explosions in the fire-box, when the conditions are exactly right for it—the supply of air, etc. Nothing very accurate known about it.

(14) C. H. M., Joliet, Ill., writes

I have been trying to study out the working of compound engines and I can not get it through my head how they work. If you exhaust steam from cylinder *A* into cylinder *B*, the back pressure will be sufficient to obstruct the piston in *A* cylinder to the extent of the positive work done on the piston of *B* cylinder. Where is the gain? *A.*—The piston in the low-pressure cylinder has from two to three times the area of the piston in the high-pressure cylinder, which permits the exhaust steam to perform a margin of useful work after the drawback of back pressure is considered. For instance: The high-pressure cylinder exhausts steam at 90 pounds. The area of the high-pressure piston is 314 square inches, so we have $90 \times 314 = 28,260$ pounds pressure against the piston. The low-pressure piston has an area of 707 square inches. Then $90 \times 707 = 63,630$, the positive work done by the low-pressure piston, giving a margin of 35,370 pounds after the amount of back pressure is deducted.

(15) A. E. H., San Marcial, N. M., asks:

1. Can or cannot the brakes be released on a train when the 10-pound pressure cock or retaining-valve is in use? *A.*—No. The brake can be released *except* the 10-pounds which the pressure retaining-valve prevents from getting out. 2. After making a service application of the new W. A. B. engineer's valve, what effect does it have to place the valve around to emergency, say when having used 10 or 12 pounds at service application, and why does it have the effect? *A.*—The only usual result is to apply the brakes full. Sometimes the emergency will work, but if the application is made before the pressure in the brake-pipe is nearly restored the service application with a 12-pound reduction will have used so much air from the auxiliary that the further reduction will not move the piston of the emergency-valve. 3. What is the difference between a direct and indirect engine—I mean engine, not valve motion? *A.*—An indirect engine would be one not connected directly from the cylinder to the crank—one with a rocker, for instance, like the recent engines built for Pike's Peak. 4. Where is the center of motion of a locomotive? I do not mean the center line of motion we hear so much about. Also, where is the center of motion of a stationary and the center of power of each when working? *A.*—We don't know what you mean by center of motion. We should say that the center of *power* was in the boiler.

## Bad Feed Water.

The cause of the deplorable condition of the water supply of many railroads is very plainly set forth by Mr. William McIntosh in a paper read before the Northwestern Railroad Club. He said:

"During the construction period water syphoned from a slough or borrow pit is regarded as all sufficient. As the line progresses permanent water stations are established about every twenty miles, and their location is largely determined by the cheapness by which an abundant supply of water may be obtained regardless of its quality. Deep wells are often sunk at stations which supply water highly charged with incrusting matter, while but a few rods farther on is a running stream of much purer fluid. The expense of pumping the latter to the station would not be thought of, yet the advantage of using the better water might run into thousands in one year. The departments responsible for the establishment of water tanks, wells and reservoirs as a rule have no direct interest in the motive power department, and are apt to think that the best interests of the company are served when a sufficient supply of water is obtained at a nominal outlay. And it is only after the water at a certain point has proved notoriously bad by years of injury to boilers, that the adequate pressure can be brought to bear to effect a change. Those answerable for the maintenance of locomotives in sections where the water is comparatively free from incrusting matter cannot realize the advantages they have over those occupying similar positions in the bad-water regions of the West where the best water contains as much as 2 pounds of incrusting matter per 1,000 gallons, and the poorest as high as 20 pounds. This will give six pounds and 60 pounds per ordinary tank of 3,000 gallons. It was necessary to use the last mentioned water for years before it was possible to provide a better quality."

The remedy proposed by Mr. McIntosh was the well-known methods of feed-water purification, mechanical and chemical.

## Dressing Cold Chisels.

BY OLD JOUR.

In your November number I saw an article on "Tool Steel, Smith and User." Two machinists bring one chisel each, and the tool-smith dresses and tempers them carefully, but he makes a distinction in the temper—he forecasts the users. One chisel is tempered to a purple, or a dark straw, the other is left a low blue. Both men work on the same class of work, with very different results.

The two machinists, I think you will find, grind their chisels like the accompanying sketch. The machinist who cannot get a chisel dressed to suit him grinds his chisel a little concave, which is a common way for such men to grind them. He strikes the chisel one or more blows with the hammer. Both corners are gone off the chisel. He concludes at once that it is the tool-dresser that is at fault. The other machinist grinds his chisel a little convex. The strain on his chisel is al-

ways toward the center of the chisel. He can chip with it all day. The tool-dresser can dress a chisel for the last-named machinist, but there is no tool-dresser this side the Golden Gate can dress a chisel for the concave chisel grinder and expect it to last more than three or four blows.

We have received from the Consolidated Car Heating Company, Albany, N. Y., part 4, which is the first issued, of their new catalogue. It deals principally with the multiple circuit system of car-heating, and is an excellent treatise on that subject, well illustrated. This catalogue, when completed, will form an exhaustive compendium on car-heating. The many men interested in the care and handling of car-heating apparatus will find this catalogue a most useful object of study, not only for details of special apparatus, but of the broad principles on which the successful system of car-heating are founded. The catalogue can be obtained free on application to the company.

We have received the Columbia Desk Calendar for 1893; it is a very neat and handy affair, having a memoranda for each day; it sells for 20 cents, and can be had of the Pope Manufacturing Company, Boston, Mass.

### A Real Telescope.

Once upon a time a consolidation and a mogul met "by chance," and the mogul being slightly the smaller of the two shoved her front end inside that of the larger engine.

The pilots, buffers, front frames, cylinders, etc., were crushed, and the two big shells shoved together in the manner shown. So well was this job done that they could not be pulled apart, and were actually hauled to the shops in this firm embrace.

A REAL TELESCOPE.

A local poet thummed the following verse (after Tennyson) on the dust of one of the jackets.

> "They met as friends who meet in pain,
> And, meeting, hope to part again."

### Promotion by Seniority.

A correspondent on the Pacific coast writes us:

A line or so in the September number of LOCOMOTIVE ENGINEERING attracted my attention. It related to the promotion of firemen according to seniority, and the resulting consequences as seen by an S. P. fireman. Well, he is partly right and partly wrong. The rule of seniority is strictly enforced on this road—by agreement with the Brotherhoods. The same rule prevails on all far western roads, not by any means from the desire of the companies. Promotion according to time of employment, in any given service on any particular division, is strenuously insisted upon by all the Orders. I know one case where a strike was barely averted because a proposed schedule said promotions should be made "according to seniority, *with the approval* of the *master mechanic*." This final clause was looked upon as a loop-hole for favoritism. In another case the schedule read, "Promotion shall be according to seniority, other things being equal." The latter phrase was always a dead letter. In still another case a deputation of "old" men in the service of the company went to the general manager's office with a request for the discharge of "new" men during the dull season. To the spokesman of the party the manager expressed surprise. "If you don't want to work, why don't you quit? Why do you want me to discharge you?"

"I don't. I want the 'new' men laid off. I've worked for the company five years."

"Oh, yes," said the manager, "on the southern division, but you have been *transferred* to this northern division since these other men were hired. According to the schedule, you are the youngest man on this division." The new men weren't "laid off" that time.

The men argue clamorously that absolute seniority, without exception or limitation, is their only protection against partiality and "pulls." However, I notice that when a director's relatives are promoted over their heads, they generally submit to the inevitable.

On the other hand, master mechanics and superintendents, at least so far as my knowledge goes, are strongly in favor of some sensible limitations of the "seniority rule." They are willing to submit to some restriction of their own authority, but they point to long lists of cases where rigid insistence on the rights of the "oldest" man had a disastrous or ridiculous ending.

I would not like to subscribe to all the complaints your correspondent may have made about promoted firemen on the S. P., for that company has been in the business for twenty years or more, and some of its oldest and best men were "made" here. Seniority does not put the worst men always at the head of the list.

We had a funny illustration here of the "rights" question. After eight years' service on the S. P., an engineer quit (not by request) on account of his health and went North, where he "ran" most of the time on mountain divisions. On returning to the service of the S. P. this fall, he ranked, of course, as a "new" man, and an engineer of *three days'* experience promptly put in a "kick" against the "new" man getting any "rights" over *him*. Now, according to the agreement with the company, this fireman (or engineer?) is perfectly right, but the impartial public is likely to think such agreements detrimental to the service.

I heard an old grievance committee man from the East expound his way of enforcing the rule of seniority. It was a pretty good way for a compromise, too. He said he insisted always on the "oldest" man being given a fair trial, then the master mechanic's man; a comparison of results to decide, and the best man to take the run.

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The East Tennessee, Virginia & Georgia people have converted one of their consolidated engines into a compound of the Pitkin type. The engine has cylinders 20 and 30x24 inches. One of their ten-wheelers is in the shops undergoing the change to the compound pattern. This engine had cylinders 19x24 inches and the only change to be made is putting a 28-inch cylinder on one side and adding the intercepting valve. Compound locomotives are highly popular on the East Tennessee, Virginia & Georgia and those in use show a decided saving in fuel.

### Improvements at the St. Paul Shops of the C., St. P., M. & O. Ry.

A new carpenter shop and storage room, 50x150 feet, was erected this summer just south of the main machine shop and office building, and an addition of 60x100 ft. made to the boiler shop, as well as ten new stalls being added to the roundhouse, which closes up the circle entirely. All of the above buildings are built substantially of brick, to correspond with the other buildings, all being covered with slate roofs. The boiler and carpenter shops have skylights to add to the numerous windows, which make them rate with the best lighted shops in the country. The power for the carpenter shop is received from the main-line shaft in the machine shop, communicated to a main shaft between both shops. This shaft is supported by an iron truss, 33-ft. span, and is run by a 14-in double belt, which transmits power enough for a circular saw, cut-off saw, dimension planer, band saw, jig saw, mortiser and boring machine, lathe and grindstones. A novel feature of the pattern storage room is the shelving, which runs 20 ft. high, with galleries between the shelves every 7 ft. 6 in., so that any pattern can be reached without the assistance of step-ladders. This room is especially built so that changes in the atmosphere will not affect its contents (which is the great trouble with all pattern rooms) in warping and pulling apart the glue joints. It has an elevator to run the patterns up to the top gallery. The carpenter shop and pattern room is separated by a brick wall with iron door, making pattern room fire-proof.

The boiler shop has an overhead crane which runs over the engine pits, and can lift any of the largest boilers and carry or turn them in any position for working upon. A large reverberatory furnace is built in the new addition, 12x20 ft., so that all boiler sheets can be properly treated after they are finished, to put into their place; a convenient gib crane swings the sheets from the flange fire to the flange-block, or into the furnace.

All the new buildings are heated by the hot-air process, in a convenient place; the exhaust fans and radiators are placed so that the old method of steam-pipes being placed in the pits and around the walls is done away with. A large 35-ft. drop pit has been added to the machine shop that will take in the longest engines with dispatch. All the buildings are lighted mornings and evenings with the Edison incandescent system, and the yard outside is lighted with the arc system, a separate engine furnishes the power for the dynamos. It is anticipated to put a dynamo on the transfer table, and smaller ones in other places, for a cheap and convenient portable power.

All the power at present is centered at the boiler house, where a new 72x16-in. return tubular steel high-pressure boiler has been added. This, like all of the improvements, have been constructed by the company themselves.


SUMMIT OF PIKE'S PEAK—SHOWING IMPROVEMENT ON MODE OF TRANSPORTATION.

### On Top of Pike's Peak.

Our illustration gives a view of the very summit of Pike's Peak, in the Rocky Mountains, showing the government signal station, a pack "burro" and the engine and train of the new rack-rail road.

## Locomotive Running Among the Bushwhackers.

BY OLD SOLDIER.

After pulling General Grant to Nashville I got a couple of days' rest and resumed my old run on passenger without any very serious mishaps. About this time we had some changes in the machinery department, but do not remember the dates. Elijah Benjamin took charge of the motive-power department. He brought Harry Elliott with him as assistant; he also brought Ace Daniels and James McCormick. Daniels and McCormick were made division master mechanics, Daniels being located at Chattanooga and McCormick at Stevison. I think he was sent from there to Huntsville.

I will here have to relate a little story connected with Mr. Elijah Benjamin and myself which occurred in 1859. Mr. Benjamin was then master mechanic of the New Albany & Saline road, which had shops at New Albany, Indiana. E. Brooks at that time was master mechanic of the Ohio & Mississippi road at Cackron, Indiana. I had been working for Mr. Brooks, but hearing so much said about young men learning so fast under Mr. Benjamin at New Albany, I pulled up stakes for New Albany and applied for a job to work under instruction; I got it and went to work for "Ben," as the boys called him. I found my rabbit-foot, and never was there a place where one could learn so fast. M. T. Carson was an apprentice there; he is now superintendent of motive power and machinery of the Mobile & Ohio road and a man of considerable reputation.

After I had been to work for Mr. Benjamin some four or five weeks, I found out they did not have any pay-day but that all men who were discharged could get their pay. Well, I worked along about four months. I had spent all the money I brought with me for board and washing, and tried every way I could think of to get some money, but it could not be done, nor could I sell my time, so one day an idea struck me and as I was a young man I put no particular valuation on my reputation. I had fired three and a half years and had run an engine about a year. I concluded to give up shop work and hunt other fields, and so I carried my plan out and lost the respect of Mr. Benjamin, never thinking I would ever encounter him again in a business way; but, boys, don't any of you do the same thing, but always command the respect of your bosses.

I did nothing very serious, but it was enough to condemn me in the eyes of any master mechanic or foreman. I was working on a little old dome-boiler engine called the "Tippecanoe." She was an old hook engine and had two bearings for her rocker-boxes. She had an outside frame the out end was held in a box with two small brasses I was closing them up by filing them off I had a parallel vise which was quite well worn on the jaws; it would not hold good, so I screwed it up as tight as I could. I then took a big stick for a lever, put it in under the bench and came down on it and broke the brass. I stooped down and picked up the two pieces, stuck them together, looked at them a little, ripped out a big word and threw them through the window. Mr. Benjamin was standing behind me and saw the whole performance. He stepped up, tapped me on the shoulder and told me to go to the office and get my time.

I never expected to see him again after I left Albany, but I did, for he was made master mechanic of the military road where I was a passenger engineer. I was out on the road about seventy-five miles from headquarters when I heard of it. I was a married man then, but I telegraphed in my resignation to him at Nashville; he did not answer me, but came to the depot and met me on the arrival of my train. He came up to the engine and shook hands with me and asked what I meant by that telegram.

I told him I did not want to get discharged, as I knew he could get plenty of men to take my engine.

He said "No, no; I have heard all about you and I feel proud to know you have built up a reputation, and your job is good here."

He then handed me back my telegram and told me to tear it up—and I did, and kept my run. He made no changes in the running department of the roads but did change a good many petty bosses.

As I had been considered a very faithful servant, Mr. Benjamin thought I deserved a better job, so I gave up my run.

The government concluded they would build the Nashville & Northwestern road so as to connect Nashville with the Tennessee river, which was about ninety miles of road. This road was contemplated to be built before the war, and the company had several boat loads of iron at the river end; they intended to build from both ends, so the government carried out this idea. Mr. Benjamin told me I could have the job at $150 a month, so I took the engine and train down the Cumberland River and up the Tennessee River and built up from that end. This iron had been buried by the rebels when they retreated ftom the river. Colonel Floyd, of St. Louis, was sent down ahead of us with his regiment. He was colonel of the first Missouri engineer corps of sappers and miners; he built eighteen miles of this road with his regiment. I ran the engine that did the work. Jack Johnson was the conductor. Wilson Davis and his brother Mike ran the engine and train that built the other end, Bill being conductor and Mike the engineer. In this chapter of my military career I could relate a great many little incidents and scares that happened but it would take up too much valuable space and my time is too much occupied by my old scrap heaps, so I will try and confine myself to the important parts.

A man named Huff was sent down to take my engine and I was ordered back to Nashville. This man Huff had just been on my engine about one hour when he had eleven bullet holes put through him. He was killed on the engine; the bushwhackers made up their minds that we could not run this road; they killed about six engineers and three or four firemen and several train hands before the government got it stopped. Of course many trains were wrecked. I was down there four months building the road and I was only fired into three or four times; my fireman was killed on the engine; he was a colored man that in slave times belonged to the Nashville & Chattanooga road. He went by the name of Bill Marshall. About this time we were ready for the last spike.

I went to Nashville as ordered and reported to Mr Benjamin, master mechanic. He told me to report to Mr. A. Anderson, who was superintendent at this time. Col. D. C McCullom was general manager. Now, some time ago I saw a discussion in your paper about a machine shop at Columbus, Ky., on the Mobile & Ohio road. There was a machine shop there and I here send you a copy of my orders to remove it. I have the order well preserved and can forward it to you if necessary. The order reads like this:

UNITED STATES MILITARY ROADS,
OFFICE OF GENERAL SUPERINTENDENT,
MILITARY DIVISION OF THE MISSISSIPPI.
NASHVILLE, May 26, 1864.

*Mr. Engineer:*

SIR—You will proceed at once to Columbus, Ky., attend to taking down, packing and shipping the engine, shafting and tools in the railroad shops at that place to Nashville. You will come with the articles or send some reliable man in charge. The tools to be brought away are those only which are moved by power; all hand tools will be left. On your return you will report in full what has been done. Inclosed is a copy of an order for the removal of the machinery for the information of those whom it may concern.

Yours respectfully,
(Signed) A. ANDERSON,
*Gen'l Supt. U. S. Govt. Rail Roads, Mil. Division of the Miss.*

This letter with my orders will convince the most skeptical that there existed a machine shop at Columbus, Ky., at this time, because I employed the men working in those shops to pull down the machinery and load it aboard of government transport boats to take it to Cairo, Illinois, then I had it transferred to a packet boat and took it to Nashville, and from Nashville it went to Chattanooga. I took all the men that wanted to go to Nashville. I think they worked about thirty-five or forty men; about one-half of them went to Nashville with me; on my arrival at Nashville, I staid there about one month.

I had orders to report to A. Anderson's office every morning, which I did, but he seemed to have nothing for me to do except running on the road, and I made up my mind I would not go on the road any more as I had been honorably relieved, and I told Mr. Benjamin so. About this time the government located and set up thirteen saw mills at the Tennessee River. The terminal of the Nashville and Northwestern road was call Johnsonville, and it was a great point for distributing supplies to the army of the Cumberland and Tennessee, as the Tennessee River is navigable all the year. A lieutenant by the name of Cherry was put in charge of this post as assistant acting quartermaster. In July, 1864, he came to Nashville and requested me to accept the position of master mechanic. Well, of course he did not have to pull any buttons from my coat to get me to accept it, so I went to Johnsonville and took charge of all saw mills and machinery in the master mechanic's department. We built a warehouse 600 feet long and 400 feet wide for government stores. We had tracks running down to the river and little cars to unload the boats, but we never got it into good operation. I will explain later on why we did not.

Lieutenant Cherry and myself went up to Nashville to get the machinery. They did not run any passenger train on the Nashville and Northwestern road, all the people that travelled on that road had to travel in the caboose and they only ran one train a day each way. Mike Davis pulled one of those trains with his brother Bill as conductor. Mike also ran an eating-house eighteen miles below Nashville; he had stopped off on his up trip at his eating-house and got some one to run his engine to Nashville. The train left there at 7 A. M., but Mike's man failed to put in an appearance, so I was asked to run the eighteen miles, and then Mike was to take her, which he did. Lieutenant Cherry rode on the engine with me to the eating-house and seemed to be overjoyed with his ride. We all went into Mike's house and ate dinner, but do not imagine we had pie and cake or that we lingered long eating fruit or cracking nuts. Mike told us that beans and salt pork were good enough for people traveling in those times.

After we finished eating we all got on board and started for Johnsonville; all of us reached there except Lieutenant Cherry. When we came out of the eating-house, Mike asked me to come on the engine as he wanted to talk with me, so Lieutenant Cherry went back in the caboose. There were a couple of ladies in there and one of them had a six-months-old baby. Captain Coleman, Lieutenant Tanner and Lieutenant James Newhart and Private Fredmann were in the caboose. About fifty boxes of cartridges were in it, and the tops of the box cars were full of private soldiers. Everything went smooth until we got eleven miles from Johnsonville, I was sitting behind Mike, on his side, when I felt the train jerk; we had about thirteen cars. I looked back and saw the cars turning over and soldiers and guns flying in the air in all directions. I hollered to Mike to shut her off for God's sake and to reverse; we were making about twelve or fifteen miles an hour. I jumped off the engine and ran back; the first sight that met my eye was Lieutenant Cherry laying on the dump with the upper part of a side-door frame holding him down. He was a portly man; he was literally cut in two about the center of his body; I grabbed and raised his head, he tried to look up but could not, and only said, "Oh! my poor family!"—the last words he ever spoke. The two ladies and baby were unhurt, but one of the ladies had her dress nearly torn off. Captain Coleman was seriously hurt; his collar bone and three ribs were broken. Lieutenants Tanner and Newhart and private Fredmann and about twenty-five or thirty soldiers were badly hurt. When the end door was opened the little baby was lying down in the lower corner of the car on its little back, kicking up its heels and laughing as loud as it could. We had to pry up the car to get Lieutenant Cherry out. Nothing but the flesh held the two parts together as his back was broken.

That was a horrible sight to witness, but as this was only one among the many I had to see I could well stand it.

This car wreck was caused by the car next to the caboose dropping a brake beam which threw the caboose off on a fill, and it turned over and carried five other cars with it before we could stop. We gathered up the dead and wounded and took them to Johnsonville.

Captain B. F. Coleman was post commander at Johnsonville, and Lieutenant Cherry was post assistant acting quartermaster, so I was left without a boss until such time as they could send a man. I carried out the work as we had planned it, and it seemed to please all who had any connection with it, but it never did the government any good, for about the time we got it completed the Johnnies came in and whipped us out, burned down the warehouse after we had laid up about $100,000 worth of army stores, and now comes a pretty hard yarn for some of my Yankee brothers to swallow, but nevertheless it is true.

We had about 2,000 men at Johnsonville, and three gunboats, seven transports, and five canal boats for Chicago loaded with pork. The rebels came in there one night about 800 strong, with some six-pound cannon, and cleaned us out. We had one regiment of colored soldiers, and this is one time when the colored troops did not fight nobly, but they ran splendidly—you bet they got away that night. Everybody seemed to be on the lookout for himself, so we all got away as fast as we could. Now remember, they captured those three gunboats, burned them up with the seven transports and the government warehouse and all my saw mills, and now you can readily see how this good job of mine went to pieces. I left on the last train. When we were about ten miles from Johnsonville, the engineer, conductor and agent cut the engine loose and left us at this place. I had my wife's little brother with me. I had put him in the caboose and went back to bring some of my effects, which I did not get; this boy was about fourteen years old, but had gone through lots for one of his age. I had to run back to the caboose to catch on; just as I got up in the side door a six-pound cannon ball struck the end of the car, but we were standing on a fill and their battery was on the other shore, so the ball passed up through the roof of the car. I lost my hold and fell. I thought at first I was struck by the ball, but I was not, nor was I hurt; but, oh, Lordy! when I found out that the engine had gone and left those cars my heart went down into my boots. I just bought an old mule and saddle and bridle from an old negro, got my boy on behind, and away we went for Nashville; but in the meantime I saw the engine that had cut loose coming back with three other engines and trains bringing troops to drive the rebels out, which they did.

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# LOCOMOTIVE ENGINEERING

A PRACTICAL JOURNAL of RAILWAY MOTIVE POWER AND ROLLING STOCK.



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## The First Consolidation Locomotive.

The picture here shown was sent to us by a friend of the paper to add to our collection of historical locomotives.

The only remarkable thing about this engine is that she was the first of a class that has since become the most popular locomotive for heavy freight service.

This engine was designed in 1866 by Mr. Alexander Mitchell, now Superintendent of M. P. of the Lehigh Valley Road, then master mechanic of the Lehigh & Mahoning road—now a part of the L. V.—at Delano, Pa. Mr. Mitchell has tried a great many experiments with locomotives, and is the man who first designed the "Decapod," or ten-coupled class.

The name "Consolidation" was suggested by the consolidation of the Lehigh & Mahoning with the Lehigh Valley, that had just then been consummated. Little did her designer think he was naming a class that would be known the world over.

The old half-stroke pump will be a curiosity to many of the younger enginemen, still they are not all extinct yet, and were, all in all, a better pump than those run from the crosshead.

From the original drawings at the Baldwin Works we get the following dimensions, which, for twenty-six years ago, was very large and nearer the present dimensions than any other engine we know of built so long ago.

Boiler, wagon-top, with waist 50 inches diameter.

Firebox, 108 inches long and 34 inches wide; combustion chamber, 16¼ inches long.

One hundred and seventy-nine flues, 2 inches diameter, 11 feet 11 inches long.

Cylinders, 20 x 24 inches.

Driving-wheels, 48½ inches diameter.

Driving-axle journals, main, 6½ x 8 inches; others, 6 x 8 inches.

Feed-water, two iron pumps, and one No. 5 injector.

Engine truck, a Bissell plan, with 30-inch wheels and journals 5 x 8 inches.

Tender, 2,000 gallons capacity, on eight 28-inch wheels, with journals 3¼ x 5½ inches.

The weight was about 90,000 pounds, which is rather light for the class.

THE FIRST CONSOLIDATION LOCOMOTIVE.

## Slamming Car Doors.

The New York, New Haven & Hartford, the Old Colony, and several New England railroad companies are putting automatic door closing devices upon all their passenger cars. This is an improvement which ought to be adopted by all railroad companies. We do not know of a single reform that would conduce so much to the comfort of passengers. The slamming of car doors that goes on in some trains is simply torture to all the passengers who have nerves or ears. In certain kinds of weather every passenger who enters a car takes care to slam the door with all the force possible, and the door crashes like the report of a pistol. We have watched nervous persons sitting near the door who would recoil as if struck with a whip every time the door was slammed. The cost of closing cylinders is trifling and ought to be incurred by every railroad company taking any interest in the comfort of patrons. We should imagine that the outlay would soon be returned by the saving in locks and other fittings that get destroyed prematurely by door-slamming.

## Jim Skeevers as Traveling Engineer.

Bolton, the regular man, took a ninety-days' leave awhile ago to go East, and Jim Skeevers was appointed traveling engineer, *pro tem*.

Skeevers' principal duty seemed to be examining firemen for promotion and going out to buck snow.

They have a new general superintendent and he is a terror on examinations. He ordered all the engineers, old and young, examined on time-card, and if one of them wavered he sent him to the master mechanic for a mechanical examination.

Finally he turned this around and ordered Skeevers to examine all the engineers, and if any of them wavered in the mechanical line to send 'em to him.

The day after the order came out the Stove Committee were discussing it, when Skeevers came through the roundhouse.

"Skinny Skeevers fired for me ten years ago," said Si Lapan, "and I don't guess he'll monkey examining me much." Here he saw Skeevers and continued

"Say, Skinny, do you intend givin' us

old timers the same questions to answer you do these young ducks?"

"Yes What's the use of doing a thing 'less you do it right? If you know the answers better than the young fellows, so much the better for you "

"It's all poppy-cock, ain't I run here twenty years?"

"Yes, but the new management have made many changes and are going to adopt a new book of rules, trains are getting thicker we have some signals we're using joint track, and, all in all, a fellow has to be pretty well posted to keep out of trouble The fault with you old fellows is that you don't keep posted—you learned how once but never kept track of improvements '

"I'll bet you I kin answer more questions than you can, come now."

"Oh, I'm not setting myself up for an example You will pass on your merits no doubt Now there has been two dozen young fellows examined, and the same question is asked 'em all first You don't keep track of the run of things, and I'll bet you can't answer it now "

"Bet you the cigars "

"All right for the crowd, Si "

"For the crowd "

"Well Si What is a time card '

"Oh Lordy What's a time card? Why, wal a time card is a—well, it's the thing to run trains by "

"No it isn't '

"Well it's the thing that tells the first-class and second-class trains apart and which has the right of the road and where to meet and where to stop and when."

"Not much, you're thinking of the book of rules, we're talking about time card only

"Well, it governs the running of trains."

"Say, Si, if you were out here at Dodd's on No 1 and 22 wasn't there, what would you do '

"Go ahead, No 1 has the right "

"Suppose you were on 22 "

"Well, if I couldn't get there, I'd lay back at Somers "

"Yes, but the time card makes you meet No 1 at Dodd's "

"But if you couldn't get there—"

"Then how does it govern the running of trains? The book of rules does that. Si, you don't know Well, I'll tell you, as this is no regular examination. A time card *is a list of the stations and the time at which it is proposed to have the trains arrive at or leave such stations.*

"I smoke *Perfectos*, don't you, boys?"

There is a certain class of men at large who bear the outward stamp of respectability, but are given to habits which unfit them for surroundings more polished than the walls of a back-country barn Such men are sometimes thrown out of their natural sphere far enough to be found riding in sleeping cars instead of hog cars, and then they are a nuisance to all who come near them They chew tobacco and miss the cuspidors when expectorating their cud. They annoint seats and floors with the drippings from their jaws They leave the dirty water in the basin after washing, and they scratch the glossy mahogany panels in lighting matches There ought to be a separate compartment provided for the hog traveler, furnished in rough boards, and carpeted with three inches of sawdust.

The mechanical department of a railroad that intends trying some locomotives with Wootten boilers has proposed that the firebox be changed to the Belpaire form That is, they will use the Wootten to give the great increase of heating surface and grate area and the Belpaire form to strengthen the firebox as a whole. Skillful mechanical engineers are engaged working out the details

Some railroad companies are using a modification of Baird's stay-bolt cutter to good advantage in the cutting up of old cars.

## Biographical Sketch of E. D. Worcester—The Man Who Once Owned the New York Central Railroad.

The annexed engraving is an admirable portrait of Mr E. D. Worcester, Vice-President of the Lake Shore and of the Michigan Central railroads, and an officer of most of the Vanderbilt lines. Mr. Worcester was born at Albany, N. Y., sixty-four years ago, and belongs to a family that came from England to Massachusetts in 1640 His father was a lawyer, and the first work done by the boy was in his father's office, copying law papers. Those were days when American boys had to begin work early, and Mr Worcester was no exception to the rule His father died when he was fourteen years old He knew what work was before that time Then he went into the store of an uncle in Albany The boy had the characteristic American sympathy for me-


E. D. Worcester

Once Owned the New York Central Railroad

chanical pursuits, which was not gratified in his first occupations But the tendencies asserted themselves later, and when he was nineteen years old he entered a foundry and machine shop, to learn the business. Two years later the gold fever of California drew away the manager of the shop, and although he was not yet twenty-one years old, Mr Worcester was put in charge The position was highly responsible, the mechanical and clerical business of the firm falling upon the young manager.

He appears to have gained a high reputation for ability at this early age, for three years later he was appointed discount clerk of the Commercial Bank of Albany. About a year after he accepted this position, Mr Corning, who was the leading railroad magnate of the day, attempted to consolidate a number of small railroads into the New York Central There was no precedent for the organization of large railroad companies, and great difficulty was experienced in putting the affairs in manageable shape Mr Worcester had devoted great attention to accounting, and he was called in by Mr. Corning to put the business of the consolidated company into proper shape, and the work was done satisfactorily. Mr. Worcester, by cautious, tentative efforts, formed the system of railroad accounting now generally in use He was appointed treasurer of the company and was closely associated with the principal railroad men of the time.

From 1853 to 1867 the New York Central had a chequered career, but Mr Worcester held on as treasurer and had unlimited faith in the future value of the property. He displayed his faith by putting his all in the company, and fourteen years after entering the service of the road he was the principal stockholder and was practically owner of the most important railroad in America

As it was highly important that the Central should have part of its stem reaching to New York City, Mr. Worcester in 1867 sold enough of his interest to give Commodore Vanderbilt control of the road. Mr. Vanderbilt was previously the principal owner of the Hudson River road. This connection led Mr. Worcester into very close relations with Commodore Vanderbilt, which continued until the latter died. His relations with the son and the grandsons of the old railroad magnate have been the ties of friendship and personal regard united to business interests

Mr. Worcester took a leading part in carrying out all the most stupendous financial operations performed for the New York Central & Hudson River Railroad. He conducted the negotiations with the government that resulted in putting on the first special train for mails between New York and Chicago, and went to Cleveland practically in charge of the first train.

The present agitation for improved rapid transit in New York City recalls similar agitation twenty years ago. In 1872, the New York Legislature having granted to Commodore Vanderbilt a charter for the construction of an underground railroad from City Hall to the Grand Central station, the details of the enterprise were put in Mr Worcester's charge and he devoted years to the work. Local opposition, and the terror so marked among the politicians of New York City that a corporation might receive benefit from the enterprise, prevented the scheme from being carried out although it had been the Commodore's expressed intention to present the plant to the city when completed.

Mr. Worcester is a thoroughly representative American. He has risen to fame and fortune by his own unaided exertions His success in life has been achieved by the means which every young man ought to emulate. His methods have been industry and strict integrity guided by sagacity, foresight and keen intelligence What he has done is within the reach of every young man in this country who starts in life with the same natural qualifications and directs them to the attainment of the same high aims. He is to-day an active, vigorous gentleman, with beautifully clear complexion and bright blue eyes. He takes a very warm interest in mechanical matters, and is always ready to discuss railroad machinery of the most modern type, or to give reminiscences of the forms in use when the railroad age was in its infancy

## Death of Isaac Dripps.

Isaac Dripps, the man who first bore the title of Superintendent of Motive Power on an American railroad, died in Philadelphia on December 28th.

A portrait with a sketch of this old veteran's life appeared in this paper for January, 1892.

Mr. Dripps was born at Belfast, Ireland on April 17, 1810. He was the first man to run the "John Bull," the first engine to go into regular service in this country. He made the first single propeller for steam boats. He built the first diamond truck for freight cars, and was the first master mechanic in the country.

Long years ago, when Mr. Dripps went out to Fort Wayne, Ind., to take charge of the motive power of the P., Ft. W & C road J. N. Du Barry, late fourth Vice-President of the P. R. R., was employed as assistant superintendent, and H. Stanley Goodwin, late General Superintendent of the Lehigh Valley, was resident engineer of the line. These three men were the heads of their respective departments and stayed to see the road become one of the principal lines in the country. It seems remarkable that all of these men died within ten days of each other. Mr. Du Barry, who was born at Bordentown, N J and was but eleven years old when Isaac Dripps ran the "John Bull" on her first trip in that town, died on the 17th, Mr Goodwin on the 25th, and Mr. Dripps on the 28th.

If there ever lived a railroad mechanic in America who deserved a monument, that man was Isaac Dripps.

A company has been formed at South Bend, Ind., for the purpose of manufacturing locomotive whistles of a novel and unique design, patented by Mr B F Stockford. The whistle gives the time of day or night when it is blown and also records the stopping and starting of trains It is particularly designed for use in accidents, where cases of litigation arise, to indicate whether the whistle was blown on time or at all

The Old Colony Railroad people are putting the Fox pressed-wheel truck under a number of freight cars This truck is giving much satisfaction under cars belonging to the New York Central.

## The Finest Two-Cylinder Compound in Europe.

The handsome engraving shown herewith was taken last summer, just as this fine engine was ready to leave Edinburgh for Newcastle with the famous "Flying Scotsman."

This engine is one of ten of the finest that Mr. Worsdell has turned out, and, freight engines and all, he had built at Gateshead shops 259 compounds up to the time the writer visited the works last August.

This compound has a 20 and a 28 inch cylinder and a single pair of drivers 7 feet 6 inches in diameter.

The boiler dimensions were not given us, but the pressure is 175 pounds.

There is more cab than on any other engines in England, but Mr. Worsdell was once on the Pennsylvania, and probably took the notion home with him. There is no glass in the openings of the cab, however.

This engine carries about 19 tons (2240) on her single drivers and uses a very small driving-box, as compared to other engines in that country, being only 9 x 7 inches.

One of these engines pulling eighteen passenger carriages, at eighty miles per hour on a dead-level line, developed an indicated horse power of 1,068. The average coal consumption for the class, ten engines, last year was 28½ pounds—a remarkable showing.

The engine has the Craven steam sanding jet, the air-pump exhausts into the water tank, and she is fitted with Joy valve-gear.

In order to get between the frames two such large cylinders, they had to place one slightly above the other and somewhat over it. One cylinder inclines back from the front toward the axle, and the other up from the front toward it.

Both cylinders, both chests, both chest covers and both back-cylinder heads are cast in one piece. The chests have two small covers each, as shown, one in front and one on the side.

If one part breaks the whole thing has to be thrown away. Indeed, there was one of the class getting a new set of cylinders when we visited the works, on account of a broken flange on one of the cylinders.

This engine has to have a special design of frame to allow them to use side steam-chests, and putting in a new pair of cylinders means just about taking the engine apart and re-assembling it.

The engine is finished splendidly, a great deal of bright iron about her and lots of green paint.

The tank holds 3,900 gallons of water, something unusual there, but this road does not use scoops and track tanks. There is what they call a "well tank" under the main frame and between the wheels; this comes down within about 8 inches of the axles and holds a great deal of water, allowing the use of a shorter tank with a bigger coal space, and the weight of water is better distributed on the wheels than usual.

The engine and tender—ready for the road, just as shown—weigh 87 tons (2,240) or 194,880 pounds.


THE FINEST TWO-CYLINDER COMPOUND IN EUROPE.

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The great ocean racer, the "City of Paris," uses forced draught to make the furnaces generate the vast volume of steam used up by the engines. When the vessel was built an English blowing plant was put in, but it proved unsatisfactory. This has now been removed and a plant made by the Sturtevant Co., of Boston, substituted. This gives entire satisfaction.

An item of news which we recently noticed in a daily paper was that the Norfolk & Western had ordered the construction of 400 *copper-bottomed* cars.

## "To Improve the Locomotive Engine Service of American Railroads."

The heading of this article is at once the motto and the object of the Traveling Engineers' Association, organized in the editorial rooms of this paper on January 9th. If that motto does not enlist the sympathy and support of every railroad officer in the country it will be because that officer ought to go off the road and into the ice business.

The new association is modeled after the Master Mechanics', the meetings being open, the discussion free but limited to the work of the members. We publish in this number the complete constitution, which is brief, simple and to the point—a mighty good thing in constitutions.

The meeting lasted three days, the first day being given to the adoption of the constitution and other routine work. The election of officers resulted as follows

*President*—C. B. Conger, C. & W. M. Railway.

*First Vice-President*—J. W. Sheldon, P. R. R.

*Second Vice-President*—W. R. Davis, Ill. Cent. R. R.

*Secretary*—W. O. Thompson, L. S. & M. S.

*Treasurer*—W E. Miller, Vandalia Line

The above officers, together with the following members, constitute the Executive Committee A. S. Work, Nickel Plate; J. D. Vantwood, Mil., L. S. & W. Ry.; W. T. Hamar, E. T., Va. & Ga. R. R.

The association starts off with fifty-three charter members; this membership will doubtless be made 100 before the regular annual meeting, which will occur in Chicago on Tuesday, September 12th.

The second day was mostly given to discussion about the objects and aims of the association and informal talk on road and locomotive subjects. After the meeting the members visited the works of the Nathan Manufacturing Company, by invitation.

The third day the discussion turned entirely on mechanical matters, and was lively and interesting on the subject of front ends, poor steaming engines, hot box delays and the examination of firemen.

The president announced the following subjects for discussion at the annual meeting in September.

"The Economical use of Oil and Supplies." Committee—M. M. Meehan, D. S. S. & A. Ry.; J. S. Bauder, L. S. & M. S. Ry.; W. E. Miller, Vandalia Line.

"Examination of Firemen for Promotion to Engineers, and Examination of New Men for Employment as Firemen." Committee—J. D. Vantwood, M. L. S. & W. Ry., N. M. Maine, C., M. & St. P.; W. A. Murdock, C. & N. W. Ry.

"How can Traveling Engineers Improve the Service where Engines are Double-crewed or Pooled?" Committee—W. T. Simpson, C. & G. T. Ry.; D. R. McBrain, M. C. R. R., W J. Anthony, C. & N. W. Ry.; J. W. Sheldon, P. R. R.; W. T. Hamar, E. T. Va. & Ga. Ry.

"What are the Best Methods for Instruction of Men for the Safe and Practical Handling of Air-Brakes in all Kinds of Service?" Committee—J. E. Goodman, N. P. R. R.; M. M. Dodd, Seaboard Air Line; Geo. H. Brown, C., M. & St. P.; J. W Shannon, Westinghouse Brake Co.; A. S. Burditt, N. Y. Brake Co.

The president also stated that he should announce other subjects by letter later on, and that he should be glad to hear from members about subjects for discussion.

The infant association is fortunate in its selection of officers, all are good, but the president, C. B. Conger, of the Chicago & West Michigan, is a bright engineman and a worker. W. O. Thompson, the secretary is the father of the association and has been for the past three years carrying on a correspondence and "sub-soiling" for the crops. These two men will never rest while there is work to do to further the ends, increase the membership and broaden the influence and standing of the association.

Traveling engineers are made from what the head of the motive power departments consider the best engineers, as a rule. These men are in constant contact with the work and the men; they know better than any one else just what can and cannot be done with the power, they know the road, they know the men. We have always contended that the men on engines could show more economy than any compound, if they try. And we honestly believe as well that a live, progressive, fair traveling engineer can show more saving of dollars to his company than any other officer; he does it by improving the service, by watching for and rectifying small troubles that lead to worse ones by being the eyes and ears of the department and standing up for honest service from the crews and fair treatment for them; he decides when engines need repairs, prevents waste—and takes a goodly share of the "kicking."

The new association does not propose to decide on the merits of this or that invention, to adopt standards of power or what not; they propose to discuss the subject of doing the best and most economical work with the appliances at hand, and they deserve credit for their energy and all encouragement from the master mechanics and superintendents as well as the enginemen—the T. E. often stands between them and injustice—they have been in the ranks and know the right from the wrong.

For a long time enough men have been interested in forming this association, there was strength but lack of a foothold—the largest ship is useless without a dock—ways and means for a start were needed. LOCOMOTIVE ENGINEERING furnished these, got the meeting called and saw it housed. The future is assured, a good start is half the race.

On the evening of January 9th the association were the guests of the paper and a banquet was served at the Engineers' Club, and a neat souvenir of the occasion distributed. The constitution of the new association will be found on another page.

PORTION OF THE D., L. & W. RAILROAD WHEN BEING OPERATED AS A KINDLING WOOD FACTORY.

### Dirty Shops.

You do not act up to the principle that "cleanliness is next to godliness," we remarked to a master car builder, as we stumbled with him to and fro about an establishment that was macadamized with fragments of timber, bricks, greasy waste, worn out air hose, tatters of cushions, broken bolts, old brake shoes, dilapidated axle-boxes, lumps of broken wheels and no end of other litter. "The company is too poor to employ men to clean up the place," was the answer and it looked to the writer as if the condition of that shop alone was enough to help the company rapidly toward the hands of a receiver.

When we see an establishment remarkable for its untidiness and squalor, we are always sorry for the man in charge because the place is bearing testimony to his incompetency. Where shops and their surroundings are strewn with litter that ought to be converted into some useful purpose instead of obstructing the operations of workmen, it may safely be concluded that the whole establishment is in the condition of confusion. "A place for everything and everything in its place," is the condition under which all successful shops are run. The finding of places for everything and seeing that they are kept there is an essential element in the make-up of a good foreman or manager. When this practice is not followed we find workmen searching all around the shop for tools and mining through strata of rubbish for bolts or some article wanted which has no established resting place. The loss of time that results from this unorderly way of running a shop largely increases the cost of work and would often pay the cost of cleaning up ten times over.

Another objection to squalor in and around a shop is that it seems to demoralize the workmen. There is a listless, lazy air about such a place that imparts itself to most of the men coming within its influence. If you stand and watch the men in a clean, orderly shop you will notice that all hands are active and all minds devoted to the work on hand. There is vigor and energy in every movement. In the dirty shop the reverse picture prevails. Filth seems to dissipate the magnetism which spurs men to exertion. It is not hard to understand why men in charge of shops run on the never-pick-up-anything plan come to imagine that the company is too poor to bear the expense of cleaning up. The first operation in reform ought to be on the man in charge.

### Gas Lighting of Trains.

The following extract from the Report of the Railroad Commissioners of New York State shows where they stand on the car-lighting subject:

"Success has attended the effort to light passenger cars by gas. Last year the Board set on foot inquiries as to the practicability of the various systems in use, and the answers were assuring in both respects. Indeed so practical, and so successful are the systems, and so widely have they been adopted that a car in one of the first-class or limited trains lighted by oil, would be regarded as a relic of a past age. A sufficient reason why every passenger car, whether palace car or ordinary coach, should not be lighted by gas, cannot be given. Economy should not be the prevailing consideration. Aside from the increased security from fire, the annoyance of dripping oil from the lamps is avoided. The lighting of all passenger cars by gas is in line with the progress which has led to heating by steam instead of by stoves, and which is leading to automatic couplers instead of the link and pin, coupled by hand, and automatic brakes set from the engine rather than by men on the tops of cars at the risk of their lives. The prohibition of the use of oil by legislative enactment is desirable."

At the January meeting of the Western Railway Club Mr. G. W. Rhodes read a highly interesting paper on wheel flanges. He thought that there was too much expected of the small rim of iron constituting the wheel flange. It performs the required duty with extraordinary success, considering all the abuses to which it is subjected, but sometimes too conflicting work is put upon the flange and then it is liable to cause derailment. The existence of two gauges of track puts fearfully hard work upon wheel flanges. He considers that the M. C. B. Association made a mistake when they established the present standard of 4 feet 5¼ inches between the backs of the flanges of wheels and allowed a variation of ¼-inch. When the distance between flanges was the maximum allowed and the flanges happened to be cast a little thicker than the proper size, it made the gauge of the wheels so wide that the flanges could not pass a switch or guard rail without danger.

The Q. & C. Company have got control of the Standard Cattle Guard, one of the best of the pitless guards that have lately come into favor.

### Invention of the Barometer.

A correspondent asks us "What is the Torricelli tube and what is Torricelli?" The answer necessarily calls for particulars about a great discovery and a highly important invention.

The ancient belief was that water rose in a pump because nature abhorred a vacuum. About the year 1640 a deep well had been sunk in Florence, Italy, and it was found that the pump would not raise the water from a depth greater than thirty-two feet. The celebrated astronomer, who was then a teacher in Italy, was called upon to explain why nature displayed no abhorrence of the vacuum when the water got more than thirty-two feet below the pump-valve. Although Galileo had first established the value of the vibration of the pendulum as a means of measuring time, and had discovered the law of falling bodies and made other scientific discoveries which entitle him to be regarded as the father of modern scientific methods, the failure of a pump to raise water more than thirty-two feet was beyond his comprehension.

The investigation of the mystery was then taken up by Torricelli, a friend of Galileo's. To experiment conveniently he employed a long glass tube and used different fluids, and discovered that the height of the column depended upon the specific gravity of the fluid. He closed the tube at one end and filled it with mercury. Then he placed his finger on the open end and dipped it in a basin of mercury and, holding it vertically, permitted the contents of the tube to settle. It was then found that a column of mercury 27½ ins. stood in the tube. On comparing the height of this column of mercury with the height of the column of water raised by the pump it was found that the heights agreed in an inverse ratio of the specific gravities of water and mercury. It was then natural to reason that both columns were suspended by the pressure of the atmosphere.

Further experiments proved that the height of the column diminished when the apparatus was taken up a mountain, and also that it varied slightly with changes of weather. The inference of the latter was that the pressure of the atmosphere varied at the same place. To show this varying condition Torricelli made a barometer of a glass tube charged with mercury. This is the Torricelli tube. It is closed at the top and open at the bottom end, which is immersed in a cup of mercury. All barometers are modifications of this invention.

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The freight agents of the railroads leading out of Pittsburg, have lately been wrestling with the puzzling question, what is a steel billet? Steel billets are rated low for freight on account of being a sort of raw material, and certain parties have been shipping finished iron and steel under the denomination of "billets," and thereby obtaining cheaper transport. There is no doubt at all about what a steel billet is, but freight agents trying to "deceive" for competition's sake may display great density of comprehension about the meaning of the word.

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The Chicago, St. Paul, Minneapolis & Omaha have ordered five locomotives from Schenectady.

### A Glimpse of the Swiss Alps and the Brunig Railroad.

The handsome engraving on this page gives the reader a scene at the summit of the Brünig pass.

The Brünig railroad is one of the many rack railroads in Switzerland, built principally for tourist travel.

The road starts from Lucerne, climbs to the summit of the pass, and then down to Interlaken. The heaviest grade is 1 in 10, but most of the line is a much easier grade.

The scenery is grand, as the road skirts the side of the mountains, and magnificent views of green valleys below and white peaks above greet the sightseer at every turn.

The road is exceptionally well built, the bridges massive and the road bed as permanent as rock will make it.

SUMMIT OF BRUNIG PASS, SWISS ALPS. GRADE 1 FOOT IN 10, OR 528 FEET PER MILE, ALTITUDE, 1,064 FEET.

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The Great Northern has recently put in service four new dining cars.

### How they Keep Down the Surplus of Men.

The report of the Interstate Commerce Commission for 1891 is ready for delivery, and contains a great deal of information. Under the head of "accidents" we cull the following

"The casualties during the year ending June 30, 1891, are greater than in any previous year covered by reports to the Commission. The number killed during the year was 7,029, and the number injured was 33,881. Of these totals, the number of employes killed was 2,660 and the number injured was 26,140. The number of passengers killed was 293, and the number injured was 2,972. A classification of casualties according to the kind of accident shows 415 employes were killed and 9,431 injured while coupling and uncoupling cars; 598 were killed and 3,191 injured falling from trains and engines, 78 were killed and 412 were injured from overhead obstructions; 303 were killed and 1,550 were injured in collisions, 206 were killed and 919 were injured from derailment of trains, 57 were killed and 319 were injured from other accidents to trains than collisions and derailments already mentioned; 20 were killed and 50 were injured at highway crossings; 127 were killed and 1,427 were injured at stations; the balance which makes up the total of 2,660 killed and 26,140 injured, is due to accidents which do not naturally fall in the classification adopted for report. Referring to passengers, 59 were killed and 623 injured by collisions; 49 were killed and 837 injured by derailments, 2 were killed and 34 injured by other train accidents; the balance, making up a total of 293 killed and 2,972 injured, being assignable to accidents at highway crossings and at stations and to other kinds of accidents. Not only are the accidents of the year covered by this report greater than those of previous years, but, when compared with the increase in employes, it is observed that they are relatively greater than those of the previous year. Thus, during the year ending June 30, 1891, 1 employe was killed for every 296 employes, and 1 employe injured for every 30 men in railway service. The corresponding figures for the previous year are, 1 man killed for every 306 employes, and 1 man injured for every 33 employes. This same fact is also presented in another manner. The increase in the number of employes killed during the year covered by the report over the previous year is 9 per cent., and the increase in the number injured is 17 per cent., while the increase in the number of men taken into employment is less than 5 per cent. The corresponding comparison for casualties to passengers shows that, while there has been a relative decrease in the number of passen gers killed, the number of passengers injured shows a much greater increase than the increase in the number of passengers carried.

### Snow, Snow, Beautiful Snow.

The day of real snow bucking when a string of engines drove, or tried to drive, a wedge-plow through drifts and filled-up cuts, are, we hope, about over.

Machine plows now cut out and remove snow without danger to the engine and crews behind them, and do lots more of it and do it better than the old "strong and ignorant" plan of working

There is a certain amount of fascination in running a snow-plow engine. There is enough excitement and enough danger to make it interesting, and the writer of this owns to having always delighted to get "the plow engine" to run

While most of the big roads have rotary plows, many of them still buck snow by main force.

The pictures shown herewith were made from photographs of wrecks caused by snow—most of them happened last winter The last wreck shown happened some years ago in Western New York


IN THE CUT—SNOW TOO HARD

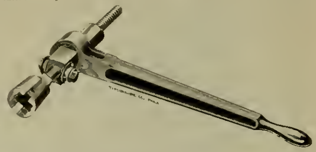
The banks of snow that our locomotive engineers will attack—nine times out of ten with success—without any kind of plow, simply the engine pilot, is appalling to European enginemen A few winters ago eight inches of snow tied up half the roads in Great Britian, and twelve inches is counted a blizzard

Four feet of the beautiful don't scare enginemen of the Northwest, unless you mix trees, sand or rocks in it, and if they think it's clear snow they will get back far enough and "take a run for it" at anything lower than the stack—and go through it with a hurrah, with something of the same feeling, we imagine, that a soldier feels when he goes over the breastworks and sees the coat-tails of the enemy as they take to the woods.

FIRST ENGINE STUCK—SECOND ONE [illegible] DOWN

### O'Brien's Flue Beader.

This machine is designed to make the bead on the end of the boiler tube without the labor ... of cracking the end
The machi ... steel, the rollers are
tool steel, ... t and sliding head of
mild mach ... l case-hardened, and
the ratche ... of cast-steel. Each
machine u ... l to take two sizes of
tubes, tha ... ll expand a 2-inch or a
2¼-inch tube. To operate machine have the tube ends well annealed and have the ends project $\frac{3}{16}$-inches, then expand them with a Dudgeon tube expander, have the sliding end run back, insert the ends having the expander pieces into the tube just back of the tube sheet, give it a quick pull when the taper end is drawn into the expanding parts, then push up the rolls against the end of tube, tighten with the nut on the screw of shank and slip the ratchet handle on, and proceed, following up and keeping a pressure with the nut. The ratchet and pawls are made to work



either way, allowing work to be done in cramped places over to the outside rows of tubes on either side of the boiler. The rolls are made the right shape to commence to flange outward and gradually expand and form the bead quickly and without injury to the tube; should by any means a tube project too far, a cutter is furnished to trim the end off the desired length of $\frac{3}{16}$ inches.

This tool was designed by G. W. O'Brien, master mechanic of the Central R. R. of Ga., at Atlanta, Ga., and is being built by Pedrick & Ayer, Philadelphia, Pa.

### A Puzzle on a Trestle.

Locomotive engineers, as is well-known, are subject to many and various experiences of every nature during their trips This was fully realized on a passenger engine on the Southwestern railroad a few days ago The evening train from Montgomery, due at Macon at 4 30 o'clock P. M., while on its way along the road from Montgomery, approached a trestle and had almost reached it when a mule and a horse were seen just ahead. The mule, frightened at the rumble of the train, ran on to the trestle, followed by the horse, but soon fell through between the cross-ties, catching by the body, and was hardly down, when the horse was in the same predicament, down between the ties. The engineer applied his brakes and stopped at a safe distance. He could have run the stock down, but it would be at a great risk, even if his engine was not derailed it would have been badly damaged. So the next consideration was to find some plan to get them off the trestle. The passengers, by this time, were all on the scene, and many were the plans proposed and discussed for clearing the road. But all were unavailable, until a passenger asked if there was a rope about the train. A bell-cord was procured from the engine, and the gentleman proceeded to carry out his plan. The horse's feet were tied fast together, after considerable resistance, and they were then pulled from between the cross-ties and his body laid broadside on the track. A rope was tied several times around his body and a dozen stout hands soon pulled him to the embankment at the head of the trestle. With the mule a more difficult experience was had, owing to the stubborn nature of the brute, but finally he was secured in the same manner, and the track was cleared with only a slight delay to the train—*Savannah News*


SNOW BUCKING ON THE LEHIGH VALLEY.

The mechanical department of the Erie have been very much interested in the process of whitewashing shops by an air pressure arrangement as described in the December issue of LOCOMOTIVE ENGINEERING The practice originated on the Central Pacific and is very successfully followed all over the road. We understand that the Erie people intend not only to adopt it for shop whitewashing but that they intend using a modification of the plan in the painting of freight cars.

In the Ditch—New York Snow.

Forsaken—Track Built Around Wreck.

A Bad Mess—View from Track.

The Pennsylvania Railroad shops, at Altoona, finished last month a car which is reputed to be of the largest capacity ever built. This car will be used to transport from Sparrow's Point, Md., to Chicago the 124-ton cannon now being made at the works of the Krupp Gun Company, in Prussia, for exhibition at the World's Fair. The car practically consists of two cars with eight pairs of wheels each, joined by an iron bridge, thus presenting the appearance of one long car with 16 pairs of wheels.

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Not long ago a couple of engines on the D. & H. "got together" and into the ditch. One was on its side, twelve feet from the track, the other simply off the track. H. C. Smith, master mechanic, and J. R. Skinner, master car builder, arrived on the scene and cleared the wreck up in just one hour. The engine the farthest away was back on the rails in just forty minutes. This is lively work.

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We have received a number of letters from "the boys" asking if we were not "off" in the answer to Question 1 in the January number. The valve would *move*, but would come back to the same place on the seat.

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A somewhat novel form of spark arrester for locomotives, has been patented by John E. Zimmerman, Trinidad, Col. An open stack is used and an iron rod is secured in the middle, extending from the base to the top of the stack. Around this rod and extending to the walls of the stack, is fastened a spiral of perforated wire netting. The gases from the smokebox are required to make five rounds of the smokestack in their way to the atmosphere—they will get tired.

A Bad Mess—One Side of the Wreck.

A Bad Mess—The Other Side.

"Didn't git back fur 'Supe'"—Don't Happen every Day.

## Moon-Struck Writing.

When we find an article in a paper that is otherwise in apparently sane management telling of locomotives that are bewitched or get balky, we conclude that the writer is some moon-struck blockhead. The idiots who write the nonsense of this kind have lately been excelled in their own line by a writer in the *Plumber and Decorator*, under the caption, "Effect of Sun and Moonlight on Steel." We are told "It is not generally known that the light of the sun and moon exercise a deleterious effect on edge tools. Knives, drills, scythes and sickles assume a blue color if they are exposed for some time to the light and heat of the sun; the sharp edge disappears, and the tool is rendered absolutely useless until it is retempered. Purchasers should therefore be on their guard against buying tools from retail dealers and peddlers which, for show purposes, have probably been exposed for days together to the glare of the sun. The unserviceableness of tools acquired under these conditions is generally wrongly attributed to bad material or to inferior workmanship. A similar prejudicial effect has been exercised by moonlight. An ordinary cross-cut saw is asserted to have been put out of shape in a single night by exposure to the moon."

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There are in the United States, for each 100 miles of road, 20 locomotives, 17 passenger cars and 714 freight cars.

LOCOMOTIVE ENGINEERING
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*We will illustrate proprietary devices that are novel or interesting and that properly come within the scope of the paper. This will be done without charge, and without reference to advertising considerations.*

*The editors reserve the right to use or discard matter for the reading columns entirely on its merits. The reading columns will not be sold.*

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### Notice.

Fred S. Hill will hereafter act as general subscription agent of this paper. He will form agencies and appoint agents where there are none, help club raisers wherever found, advertise the paper, and in every legitimate way extend its circulation. Mr. Hill will pay particular attention to placing valve motion models in lodge rooms, and will personally aid in forming clubs for lodges that want a model without cost. In all matters concerning subscriptions he is authorized to act for SINCLAIR & HILL.

## Responsibility for Acts of Fellow-Servants.

A member of the Illinois Legislature has prepared a bill which abolishes that part of the old English law which prevents employes of railroads from collecting damages for injuries due to accidents which have been caused by the fault of a fellow-servant. This ancient law is a direct inheritance of barbarism and ought to be repealed in every State not given up wholly to agricultural pursuits. Like many other laws inherited from ancient codes, this act never was based on justice or equity. It was one of a species of laws which the strong made for the legal plunder of the weak. When society was in a more elementary form than it has been for the last century, the law did not inflict much injustice because men were nearly all well acquainted with the habits of fellow-servants. If one servant was reckless and dangerous in his methods of doing work, his fellow-servants easily became aware of the fact and could protect themselves by refusing to be subjected to the danger, or they could call for his removal. At the time this law became operative, it was evidently understood that every servant was familiar with the habits of every fellow-servant and could act to protect himself. This state of affairs has long been changed. Persons in the same employment are so numerous in the present condition of industrial operations that it is impossible for a man to know when dangerous persons are his fellow-servants. The employers or their authorized agents are in the best position to judge of the habits and efficiency of the complex human elements forming the working force of a railroad or large manufacturing concern, and these employers alone ought to be held responsible for damage done by reckless or incompetent members of the force. That they should be held responsible is only asking what is reasonable and just.

The absurdity of the present law may be graphically demonstrated by an illustration given from an actual occurrence. Engineer Burns and Fireman Hoffman were employed by the A. B. & C. Railroad. They were reputed to be careful and competent men, and they were engaged operating locomotive No. 27, pulling freight trains. In following their business, it was necessary for these men to receive train orders at Springfield from a telegraph operator named Breem. This Breem was a fellow-servant of this engineer and fireman and the law presumed that they were aware that Breem was a no-account plug discharged by another railroad company for carelessness and hired by the A. B. & C. company on a salary of $30 a month. The law presumed that the engineer and fireman, knowing the careless habits of Breem, would protest to their employer, and until there was time to remove the source of danger, exercise care that he should not jeopardise their lives. These were the presumptions of a law established in the infancy of civilization. The facts of the case were that Burns and Hoffman had no means of knowing anything about the habits of Breem or of his history. It happened that this Breem received an order to hold train No. 39, conductor Nixon and engineer Burns, for an east-bound extra, which he carelessly failed to deliver. Burns did not know about this order and it was not required that he should stop at Springfield. But the law presumed that knowing the careless habits of Breem he should stop at Springfield and find out for himself if a holding order had been given. Instead of doing this he ran past Springfield as usual, and two miles farther on came in collision with a train and was killed, together with his fireman, Hoffman. As he had not done anything to obtain the discharge of Breem for carelessness and incompetency, he was deemed by this barbarous law to be guilty of a contributory negligence, and his heirs were debarred from collecting damages, since the man's death was caused by the carelessness of a fellow-servant and his own combined. The retention of this law on the statute books of States having railroads or manufacturing enterprises is an outrage on common sense.

## Changed Time of M. C. B. Convention.

A curious thing was done toward the closing hours of last Master Car Builders' Convention, which has evidently attracted little attention, owing to the parties most interested having been ignorant of what was done. For several years members of both the Master Car Builders' and Master Mechanics' Associations had been advocating that some arrangement should be made which would shorten the time required to attend the two conventions. When the meetings took place in 1890 a motion was made in the Master Car Builders' Association which resulted in the appointing of committees from the two associations, which were instructed to meet in joint conference and arrange some means of bringing the two conventions closer together. This joint committee duly met and had a very cordial and harmonious session. The deputies representing the two associations decided to recommend that an agreement be entered into for the Master Car Builders' Convention to meet on the second Wednesday in June, and the Master Mechanics' on the Monday following. They also recommended that the selecting of a place of meeting be delegated to a joint committee of the two associations.

The whole of these recommendations were agreed to when submitted to the conventions in 1891, and last year the Master Car Builders met on Wednesday and the Master Mechanics on the following Monday. The arrangement appeared to give satisfaction, and enabled some of the members to attend both conventions with little loss of time. Yet when the Master Car Builders' Convention wes in the closing hours, the report of a committee was adopted recommending that the day of meeting be changed back to Tuesday. In accordance with this decision the Master Car Builders' Convention meets this year on Tuesday.

As the arrangement for meeting on Wednesday was made on the recommendation of the joint committee, we think that it ought not to have been abrogated without the consent of both associations. It would at least have been nothing more than courtesy to give notice of the proposed change for one year, since it was understood that the Master Mechanics could not change their constitution that regulated the time of meeting without a year's notice. The Master Mechanics had the worst of the arrangement originally, in agreeing to meet on Monday, for that required that most of the members should travel on Sunday. We cannot possibly see any good reason for the Master Car Builders going back to Tuesday, as Wednesday was a convenient day to meet, and there was plenty of time for all the sessions necessary during the remainder of the week.

## Want of Co-operation Between Purchaser and User.

Railroad companies are large users of tin plates for car roofing, the roofing of buildings and the numerous tin utensils employed for office and train service, using up an immense number of such plates annually. Dealers in tin plates say that railroad companies are noted for using the worst qualities of this kind of material, the question of price almost always leading to the choice of an inferior article. This is attributed to the vicious system of purchasing by parties who have no knowledge of the quality of tin plate, and care for nothing but cheapness in first cost. This no doubt accounts for the short life of many tin car roofs and for the disrepute of tin plates as covering for car roofs. This is another illustration of the dear cheapness indulged in so much by railroad companies. There is said to be extraordinary ignorance among railroad men as to the different qualities of tin plates, an inferior article being accepted as readily as a good one.

The real difficulty, we suspect, is due to the idiotic system of purchasing followed by railroad companies. The men who do the purchasing are not in close enough communion with the men responsible for the use of supplies. A master car builder, a master mechanic or an engineer puts in a requisition for a supply of tin plate for roofing purposes. He wishes to have the best quality and may say so, but he has no assurance that the cheapest kind has not been ordered. When the delivery takes place the user has no resource but to accept the plates, no matter what the quality may be. Railroad companies doing business in this way are entirely dependent upon the honesty of dealers, for the user has no means of telling whether or not the quality paid for has been furnished. There is no doubt that in this and other lines of goods, dealers have delivered an inferior article after being paid for the best quality, and the user had no means of detecting the fraud. Private firms that attempt to do business in this fashion soon reach bankruptcy.

## Wooden Brake-Beams for Passenger Cars.

We have been much surprised to learn that the common wooden brake-beam has been specified for some twenty new passenger cars under construction for the Central Railroad of New Jersey. This is a very stupid piece of business, to say the least of it. Placing wooden brake-beams on cars that have the quick-action brake is a reckless proceeding, and magnifies the danger of travel in a fashion that no railroad company has a right to indulge in.

The dangers arising from this weak brake-beam are two-fold. When the brake is applied the beam yields so much that very little wear of the shoe lets the piston strike the cylinder-head without putting any braking power upon the shoes. This accounts for the long distance often required to make stops. The officials of the Central Railroad of New Jersey have been boasting that their trains have reached the highest speed ever attained on a railroad, and several of their trains are run at exceptionally great velocity. It might be supposed that under these circumstances the very best known appliances would be employed to give the engineer complete control of the train. But, no. To put on a weak brake-beam is to vitiate in a great measure the action of the power available for stopping the train properly.

The second source of danger from a weak brake-beam is its liability to break when the emergency brake is applied and to fall down before the wheels. These are no imaginary dangers. Repeated tests have demonstrated that the wooden beam is too weak for emergency stops, and numerous breakages of the beam in service have proved the figures of testing experts to be reliable.

An iron beam costs a little more at first, but it is cheaper than wood in the end. To specify a wooden brake-beam for any kind of car that is to use air-brakes is a conspicuous case of dear cheapness for which railroad companies are so notorious.

## Hard Usage to Business Men.

Suppose a large shipper of railroad freight, such as Armour, of Chicago, were to invite all the railroad managers in the country to meet at his office for the purpose of settling rates and routes. Suppose they gathered there from the East and the West, from the North and the South, and were kept hanging round the offices of the shipping magnate for three or four days, and then told that Mr. Armour was not ready to settle on rates and routes, and that it would be as well for all of them to return home. Would there not be rage and indignation among the crowd? Would they not heap curses and profane sayings upon the head of Armour and protest that they had been scornfully used?

Now, suppose that one of these railroad managers sent word to all the points of the compass that he intended contracting for the construction of two thousand cars on a date mentioned, and that he wanted to have all the car-builders who were prepared to build the cars come to his office on the day specified. That he also wanted to see at the same time and place all the men who were prepared to sell attachments for the cars. Suppose the day duly came round, and from all directions came car-builders, and wheelmakers, and car-coupler patentees, and grain-door agents, and roof artificers, and a great many other men ready to supply some useful member of the car corporate. Suppose, when all this host was gathered with the expectation of seeing the business promptly settled, the general manager intimated through the mouth of a messenger that he could not do anything about the cars that day.

Suppose that he sent out the same information on the morning or noon of three or four successive days, and on the following day intimated that he had changed his mind and that no cars would be ordered for the present. Are we to be surprised if the business men who went to meet the manager by invitation came away mighty wroth? Have they not as much right to courteous treatment as if they had been general managers?

This is not exactly a parable. Men have been repeatedly invited of late to bid on cars or locomotives and after days of waiting received intimation that the bids were not wanted. Next time we hear of a case of this kind we will roast the parties at fault by name in a fashion that will let them understand the popular estimate of their action.

### Compounds Improving the Simple Locomotive.

At the last Master Mechanics' Convention, when the subjects suitable for investigation during the current year were under discussion, a suggestion was made that a committee be appointed to inquire into the best means of improving the simple locomotive. The suggestion did not receive much attention, evidently because it understood that the labors of the Association have been principally devoted to the finding out of means of improving the locomotive as a whole by improving its details. The experience of the last year, however, demonstrates that the simple locomotive is capable of very decided improvement, and that influences are at work which are carrying into practical effect all the possibilities. For years the builders, designers and operators of locomotives have been contented to follow the beaten path with little change. Boilers were made a little larger, the proportions of working parts were improved and minor details of design were altered for the better, but there was little reason for believing that the locomotive of 1892 was decidedly a more efficient motor than the locomotive of 1882. The new factor which has come upon the scene with great accelerating influences is the compound locomotive.

There are now a great many compound locomotives at work on our railroads, and there is so much diversity of opinion about their utility that it appears still to be an open question whether or not the compound is destined to have a prominent place in railroad motive power. But there is no question that this form of engine is exerting great influence in improving the simple locomotive. When one or more compound locomotives are placed upon a railroad where none of that type of engine had been previously used, the reception extended to the stranger is not generally cordial. If it becomes a favorite, pure force of merit is the sole cause, for nearly every one concerned in its care, maintenance and operation is more inclined to search for faults than to accord good qualities. The usual course appears to be the comparing of the compound with some of the best engines on the road, and the striving to make the simple engines excel the compounds in all the qualities most desirable in a good locomotive. The race for merit between compound and simple locomotives is notable for the efforts made to favor the simple engine. This spirit is stimulating our mechanical men to study every point where the simple engine can be made more economical, and the compound is having a more difficult race to run than it had at first. The movement in favor of compound locomotives is likely to pay railroad companies directly and indirectly.

### Unjust Punishment.

There are two articles in the agreement which the engineers and firemen of the Southern California have with the company (extracts from which are printed in another column) which deserve to be inserted in every agreement of this kind. One affirms that no man will be suspended or discharged without a fair hearing, and the other says that verbal complaints made by engineers against firemen will not be noticed. These are both very sensible and very reasonable provisions against injustice, and their general enforcement would do no wrong to anyone. Those who are not prepared to accept an agreement with articles of these terms are not willing to have plain justice done.

An agreement that would prevent officers from punishing or discharging men, according to the dictates of their own will, would change the prevailing practice on not a few railroads, but it would be much better for the companies, better for the men and better for those in charge. On many roads the methods of investigating the cause of accidents are lamentably defective and one-sided. When an accident happens it is presumed that some one must be punished and very little discrimination is displayed in locating the blame upon the right shoulders. Every month there are hundreds of men punished for things they were not guilty of and the effect is the demoralization of the service. Men get to believe that justice cannot be obtained in case of anything blameworthy happening to them, and they naturally turn to the combinations that have the power to demand justice. To the practice of blind indiscriminate punishment is due the rise and triumph of the Grievance Committee.

There is a sort of wolfish man who frequently reaches a place of authority on railroads, and his leading sentiment is a desire to punish. He is never happy unless he is torturing some unfortunate. We all know this type of man. He is found in some place on nearly every railroad, and he is the worst kind of a curse to his employers. The higher he rises the more pernicious is his influence. When a trainman makes a mistake that calls for punishment it is good policy to treat him as lightly as the circumstances will warrant, for wisdom is often built on the foundation of mistakes. The company that habitually discharges men for every blunder lose the benefit of the prudence and caution taught by hard experience.

In regard to the rule which requires engineers to put in writing every complaint against firemen, we feel that it is calculated to prevent much injustice. There are some engineers who are always in hot water with their firemen, and the common practice is to make secret complaints to foremen or others to the effect that the firemen are no good. Some men who will not say a word openly against a fireman habitually make requests for changes, and try to put on foremen the onus of punishing when no punishment is deserved. A complaint that will not bear the light of writing is not worthy of consideration.

### Good Locomotives are Scarce.

There was an unusually long list of serious railroad accidents reported during the month of January, many of them due to the severe weather which prevailed all over this continent. Snow blockades have caused delays and much suffering on some roads and the increased resistance due to cold made trains unusually late. In connection with the severe weather the scarcity of locomotives suitable for pulling heavy passenger trains was made very apparent. The writer went into Chicago on a train six hours late, and the engine was so badly adapted for the work that slack had to be taken several times at every stopping point before a start could be made. On returning by another line similar experience was gone through.

Putting small locomotives on heavy trains in severe weather is trifling with the passenger business of a road, but suitable locomotives are so scarce that the master mechanics have no other recourse. The policy which brings about this condition of affairs appears to be very short-sighted, but it appears to be general at present.

A compound locomotive was built by the Old Colony Railroad people two years ago, and it is working so satisfactorily that they intend building another for passenger service. Mr. Lauder, the superintendent of motive power, is working on the design of the new eight-wheel of this type. She will be equal to a simple engine of 19 x 24 inch cylinders with boiler carrying steam of 180 pounds pressure. The driving wheels will be about seven feet in diameter. The intention is to put the firebox between the frames, and the driving wheels will be spread so that the side rods will be 9½ feet long. It is calculated that this length of rod will be safe with the slow rotation due to the large driving-wheels.

There have been two serious collisions on the Pennsylvania Railroad during the past month due to clear signals being given before trains were off the protected section. In one case the signalman presumably to blame alleged that he received notice that the train was off the block and that the man at the next tower had been playing with signal notices all day. This is a species of play that kills. The indications are that the signalmen's habits when on duty need investigation.

### BOOK REVIEW.

BUILDINGS AND STRUCTURES OF AMERICAN RAILROADS. By Walter G. Berg, C. E., Principal Assistant Engineer Lehigh Valley Railroad. John Wiley & Sons, New York. Price $7.50.

This work is one that has been much needed by railroad officials and those whose duties it is to design and construct suitable buildings of all kinds for railroad purposes. The book contains upward of 500 large pages with numerous cuts of every description of railroad building from a switch shanty to a union depot. We are of the opinion that with this work at hand there will be less of the slow, tedious and aggravating system of writing to neighboring roads for blue prints and account of the way they framed the last roundhouse. Not only perspectives are shown, but details and plans given. The book will become a standard authority.

POORS' HANDBOOK OF INVESTMENT SECURITIES. H. V. & W. H. Poor, Publishers, 70 Wall street, New York.

This work of 1,000 pages is now issued as a supplement to Poors' Manual of Railroads. It contains a statement of the debt of the United States and each State and county in the nation, besides giving the population, area, history, assessed valuation of property, rates of taxes, etc., etc. Besides this it contains a list of the stocks and bonds of all the railroads in the country, giving their price, earning power, etc. The book is just what it pretends to be—a classified list of all the securities that are on the market. It must be of great value to investors.

ATMOSPHERIC RESISTANCE AND ITS RELATION TO THE SPEED OF RAILWAY TRAINS. By Frederick U. Adams, M. E., Tribune Building, Chicago, Ill. Published by the author. No price given.

This book, a model of typographical art, by the way, seems to have been published to explain the author's inventions for reducing the atmospheric resistance to railroad trains. The author makes a most interesting and readable defence of his case, and cites all the authorities there are. Very little is really known about this important subject. No man who has pulled a train, rode a bicycle, or lived on the deck of a box car, needs convincing that atmospheric resistance is a most important factor in train-pulling, yet there is not the slightest attempt made in American car construction to even reduce this load put upon our locomotives. Any one interested in the subject should write the author. One of the most interesting things he says is the final sentence in the book: "The actual operation of trains about to be constructed will furnish results more eloquent than any predictions."

We can heartily sympathize with the numerous subscribers who have written complaining about LOCOMOTIVE ENGINEERING being late in reaching them. The last of the papers of the January issue were mailed the day before the first of the month. The writer lives in East Orange, N. J., less than one hour's journey from the New York post-office, and the January number was not delivered there till the 7th of the month. The trouble is that the facilities for handling mails in the New York post-office are away behind the requirements.

This is the last call for those calendars of ours. Free.

### EQUIPMENT NOTES.

The Chicago & Northwestern have given Schenectady a contract for fifty-five engines.

The Canada Cattle Co. have ordered one thousand cattle cars from the Ensign Mfg. Co.

The Lehigh & Hudson, for the Central Railroad of New Jersey, have ordered 100 box cars.

The Brooklyn Elevated have placed with Bradley & Co., of Worcester, an order for sixty coaches.

The Pullman Company have taken contract from New Jersey Central for their twenty-five coaches.

The B. & O. Southwestern and B. & O. jointly are still considering the matter of ordering 1,000 cars.

The Rhode Island Locomotive Works have orders for twenty-seven engines from the Brooklyn Elevated.

The Chicago & Northwestern people are considering the propriety of ordering about thirty more new locomotives.

The Pennsylvania lines west of Pittsburgh are letting 2,000 coal cars. No contracts yet closed, however.

The Pittsburgh Locomotive Works are building seven consolidation engines for the Cincinnati, Hamilton & Dayton.

The B. & O. have given the Baldwins an order for 107 engines. This is claimed to be the largest order ever placed with one concern at one time.

The Metropolitan West Side Elevated Railroad of Chicago has ordered one hundred passenger cars from the Gilbert Car Co., Troy, N. Y.

The 1,500 coal cars for the Pittsburgh, Shenango & Lake Erie have not yet been ordered, but are expected to be closed by the 4th of February.

It is reported that the West Side Elevated of Chicago will order, in all, 300 coaches and 100 engines for their line, to be ready by the completion of the road.

The Juniata shops of the Pennsylvania are said to have received orders for the construction of thirty-two Class P locomotives and fifty-eight of miscellaneous types.

The W. & S. Hydraulic Works, this city, have issued their catalogue of hydraulic jacks of all kinds and for all purposes. It includes everything from a little piston remover to a 100-ton machine.

The Richmond Locomotive Works have lately put in one of the Pratt & Whitney heavy milling machines that flute a side rod in one cut. They speak enthusiastically about the fine work done by this tool.

Specifications for the 1,200 coal hopper cars and 100 box cars, to be built by the Wilkesbarre & Hudson River Construction Co. for the New York, Susquehanna & Western R. R., are out and bids are being asked for material.

The Brooks Locomotive Works are building thirteen locomotives for the Wisconsin Central. They have also an order from the Chicago & Northern Pacific for six ten-wheelers, four six-wheel switchers and one passenger engine.

The Chicago, Milwaukee & St. Paul have six trains in service equipped with the Mason Air-Signal System, and the management speak [illegible] highly about its working. The signal is said to be particularly well adapted for use on long trains.

Paul S. Reeves, of Philadelphia, has been obliged to enlarge his plant; this increase the capacity from [illegible] pounds of brass and bronze casting per year to [illegible]. The new works are especially designed for locomotive and car work.

The National Hollow Brake-Beam Company, of Chicago, has leased its entire [illegible], plant and patents to the Chicago Railway Equipment Company. Mr. [illegible] B. Leigh becomes general manager of [illegible] company and Messrs. A. J. Farley and E. C. Burge will be in charge of [illegible] in the West. Mr. F. G. Ely will [illegible] of the Eastern business at 29 [illegible], New York.

[illegible] coaches ordered by the West [illegible] Co., of Chicago, from the [illegible] are to be duplicates of the [illegible] built by Gilbert and Jackson [illegible]. They are to be leased to [illegible] for use during the World's [illegible]. Engines ordered twenty-five [illegible] from Baldwin for this same company [illegible] to be leased to the South Side, [illegible] of South Side engines.

The Rhode Island Locomotive Works [illegible] received an order from the Brooklyn [illegible] for twenty locomotives, three of [illegible] cylinder compounds. They are [illegible] twelve passenger engines for the [illegible] & Albany and three two-cylinder compounds for the Chicago, Milwaukee & [illegible]. Among the order of thirty engines [illegible] the N. Y., N. H. & H. there will be [illegible] with wheels [illegible] feet diameter.

The Lake Shore & Michigan Southern [illegible] are badly in need of about fifty [illegible] motives with cylinders 19 x 24, wheels [illegible] feet in diameter, and with boilers capable of maintaining a good supply of steam [illegible] pounds pressure. We have no in[illegible] that engines of this character [illegible] ordered, but we are certain that [illegible] train service would be in a much better condition if such engines were in [illegible].

Among orders recently placed with the Baldwin Locomotive Works are twenty Vauclain consolidation compounds for the Norfolk & Western. These engines will have cylinders 14 inches and 26 x 24 inches, drivers 56 inches, and will weigh about [illegible] pounds. The Monterey & Mexican Gulf has ordered ten 10-wheelers for freight service and the Metropolitan West Side Elevated Railroad of Chicago has ordered twenty compounds.

The Westinghouse Air Brake Co. announce that they can at an hour's notice fill orders for 1,000 sets of freight car brakes. Their annual capacity is sufficient to equip 250,000 freight cars, 6,000 passenger cars and 10,000 locomotives. There are now 20,000 locomotives and 350,000 cars of all kinds equipped with this brake. Supplying material for keeping all these brakes in order makes an important part of the business done by the Westinghouse Air Brake Co.

A circular has been issued by the Walker Automatic Smoke Consumer Co. of Chicago, saying that they will guarantee to save ten per cent. of the fuel by using the smoke-consumer. The circular says that "a practical mechanic can easily understand how a bright, clear fire will produce more steam in a locomotive than a dull, smoky one; but the higher officials of railroads who have no mechanical training generally require more positive proof." It is a good thing to consume smoke, and the firing necessary to prevent smoke will generally save fuel, but the statements of the circular referred to are rather misleading. The experience of most engineers with smoke-preventing devices is that they increase the consumption of fuel.

The Ways and Means Committee of the House of Representatives had a somewhat extraordinary bill under investigation last month. It was a bill introduced in the interest of what is called the Chicago & St. Louis Electric Railroad and was to permit the importation of material for the road free of duty. The claim is made that trains on this road will be run at a speed of 100 miles an hour, but nothing has been done to show that such a speed is practicable for regular business. In fact, the whole scheme has all the appearance of a stock-selling business with cranks as promoters. The bill to enable material to be imported duty free for this company is a piece of impudent advertising.

Our Texas correspondents inform us that there is much excitement in Southeastern Texas over the rosy prospects of a new railroad being built from Portland, Texas, to Monterey, Mexico. Portland is situated upon the famous Corpus Christi bay, the head of navigation of the Aransas Pass country, and is the gateway of a vast rich agricultural region which remains dormant for want of good means of transportation. The proposed road will make a link in the most direct coast line into Mexico.

A bill has been prepared by the New York Railroad Commission, and is about to be submitted to the Legislature, which enacts that all freight cars moved on railroads in New York State after November, 1898, shall be equipped with automatic car couplers of the master car builders' type. Power will be given to the Board to extend the time one or two years on good cause being shown for the concession. The measure ought to become a law. It is fair toward railroad interests and is short of what humanity dictates.

The *Railway Times* says that the new railroad to the summit of Brienzer-Rothhorn, in the Alps, is the highest in the world, giving its altitude at 2,252 feet, and giving a long list of other mountain lines less than that. What is the matter with Fremont Pass, D. & R. G. Ry., 10,540, and a half-dozen other Rocky Mountain passes more than three times as high as the one they call the highest.

We have received a long letter from A. F. Keffle explaining what he considers the cause of the peculiar indicator diagram shown on page 17 of our January number. Our correspondent attributes the defect to valve being badly set and proceeds to explain the details of how the steam comes to make such a peculiar diagram. As this is not the real cause of the trouble we do not think it necessary to publish the letter.

A patent has been granted to Henry C. Buhoup, Chicago, for a combined car coupler and buffing mechanism for passenger cars. It is a strong, simple arrangement and has every appearance of being a real improvement. The interest in the invention has been assigned to William McConway, Pittsburgh, which means the Janney Car Coupler Company.

We can supply a few more bound volumes of 1892, and a few complete copies for the year unbound. We cannot supply single copies of January, February or March, however. If you want a set order now, as the supply will soon be gone and no more can be had for love or money.

A year ago a change was made reducing the number of meetings of the New England Railroad Club to five a year. The change does not give satisfaction. There is a movement on foot to return to monthly meetings.

A new slack adjusting device for car brakes has been patented by Howard Hinckley, Trenton, N. J. He formerly invented a device of this kind which has been used by several roads.

## PERSONAL.

Mr. M. C. Kennedy has been chosen president of the Cumberland Valley Railroad.

M. M. Dodd has been appointed traveling engineer and air-brake instructor of the Seaboard Air Line.

Mr. L. E. Smith has been appointed superintendent of the Columbia & Puget Sound, with headquarters at Seattle, Wash.

Mr. Clerk Haire has been appointed assistant superintendent of the Saginaw & Mackinaw division of the Michigan Central.

Mr. C. H. Ketcham has been appointed superintendent of the Western division of the West Shore, with headquarters at Buffalo.

Mr. A. N. Molesworth has been appointed superintendent of the Charleston, Cincinnati & Chicago, in place of Mr. H. E. Englesing.

Mr. H. S. Newkirk has been appointed assistant general superintendent of the Long Island Railroad, with headquarters at Jamaica, N. Y.

Mr. Charles Kennedy has assumed charge of the Ewald Iron Works' office at Chicago. He was formerly with the National Tube Works.

Mr. C. Millard, in addition to his duties as chief engineer of the Charleston, Sumter & Northern, has been appointed superintendent of that road.

Mr. J. V. Murray, traveling engineer of the Chicago, Burlington & Quincy, has accepted a position with the Grant Locomotive Works, of Chicago.

Mr. Eyes Randolph, for six months chief engineer of the Newport News & Mississippi Valley, has been appointed superintendent of the road.

Mr. I. E. McCracken has been appointed master mechanic of the Kansas City, Osceola & Southern, with headquarters at Coburg shops, Kansas City.

Henry Horton, formerly of the Florida Midland road, has been appointed general superintendent and master mechanic of the Tampa Street Railway Co.

Mr. J. L. Keegan, roundhouse foreman of the Newport News & Mississippi Valley at Paducah, Ky., has been promoted to be general foreman at Memphis, Tenn.

Mr. John Holland, foreman of the boiler-making shops of the Chicago & Alton, at Bloomington, Ill., has resigned, after a service of thirty-four years with that road.

Mr. R. B. Starbuck has been appointed superintendent of the Peoria, Decatur & Evansville and Chicago & Ohio River roads, with headquarters at Mattoon, Ill.

Mr. J. P. O'Brien, heretofore assistant superintendent of the Iowa Central, has been appointed superintendent of that road, with headquarters at Marshalltown, Iowa.

Messrs. Robert Spencer and Carter H. Fitz-Hugh have been appointed representatives of the Baldwin Locomotive Works for the Northwest, with headquarters at Chicago.

Mr. J. F. Bradfield has resigned as superintendent of the western division of the West Shore road to accept the general superintendency of the New York, Ontario & Western.

Mr. W. W. Smith has been appointed general foreman of the Newport News & Mississippi Valley shops at Paducah, Ky. He was previously general foreman at Memphis, Tenn.

Mr. T. H. Sears, train master of the New Mexico division of the Atchison, Topeka & Santa Fé, has been promoted to be superintendent of the Rio Grande division of that road.

Mr. H. M. Steele, recently assistant engineer of the New York, Lake Erie & Western, has accepted the position of southern agent of the Hall Signal Company, with office at Baltimore, Md.

Mr. J. W. Luttrell, for some time master mechanic in charge of the Illinois Central shops at Water Valley, Miss., has been transferred to take charge of the company's shops at Chicago.

Mr. V. Blackburn, formerly master mechanic of the New York, Lake Erie & Western shops at Susquehanna, has been appointed master mechanic for the Philadelphia & Reading at Buffalo.

Mr. J. R. Sample, who has been superintendent of terminals at Evansville, Ind., has been appointed superintendent of the Louisville, Evansville & St. Louis, with headquarters at Huntingburg, Ind.

After fourteen months' absence J. T. Edwards has again taken charge of the mechanical department of the Birmingham, Sheffield & Tennessee River Railroad with headquarters at Sheffield, Ala.

Mr. George C. Smith, assistant general manager of the Missouri Pacific-Iron Mountain lines, has been appointed general manager of the Kansas City, Wyandotte & Northwestern Railroad and its operated lines.

Mr. P. J. Milan, who has been assistant superintendent of the Matamoras branch of the Mexican National, has been appointed general manager of the Rio Grande & Eagle Pass, with headquarters at Laredo, Tex.

Mr. A. T. Dice, supervisor of signals of the New York Central & Hudson River, has been appointed assistant superintendent of the Hudson division of that road, and will also continue in charge of the signal department.

Mr. J. R. Kingan has been appointed traveling engineer of the Chicago, Burlington & Quincy on the Galesburg division. Mr. Kingan is a machinist as well as engineer and is considered a highly capable man for the new position.

Mr. W. M. Corbett has been appointed superintendent of the Evansville & Terre Haute and associate roads, in charge of the operating, mechanical and maintenance of way departments, with headquarters at Evansville, Ind.

Mr. Rollin H. Wilbur, assistant to the second vice-president of the Lehigh Valley, has been appointed general eastern superintendent of the eastern division of the Philadelphia & Reading, with headquarters at South Bethlehem, Pa.

Mr. George Dickey has been appointed master mechanic of the Illinois Central at Water Valley, Miss. Mr. Dickey was formerly general foreman of the Newport News & Mississippi Valley shops at Paducah, Ky., and had been in the employ of that company for twenty years.

Mr. J. H. Burns, traveling engineer of the Burlington, Cedar Rapids & Northern has been promoted to be assistant master mechanic. Mr. Burns has been on the road about fifteen years, having commenced railroading there as fireman. He has been traveling engineer about five years.

Mr P. A. Murphy, for several years train master of the Burlington, Cedar Rapids & Northern, has been promoted to be assistant superintendent of the same road. Mr. Murphy is an old Erie man and was yard master of one of the roads running into Buffalo before going West.


A Collection of Specimen Car Bodies.

Mr James Macbeth has resigned the position of superintendent of motive power of the Adirondack & St. Lawrence, and been appointed master car builder of the New York Central at Buffalo. Mr. Macbeth was formerly master mechanic of the West Shore at Buffalo and his home has always been in that city.

Mr. H C. Ives, superintendent of the lines of the Atchison, Topeka & Santa Fé east of the Missouri river, has been appointed general purchasing agent of all the company's lines. Mr. Ives was secretary to President Manvel for several years, and is well informed on the supply business, as Mr. Manvel has always been practically his own purchasing agent

Mr C F Lape, for the last ten years master mechanic of the Wabash at Springfield, Ill., has been appointed a railroad commissioner of Illinois. The appointing as railroad commissioners of men with good sense and some knowledge of railroading has been badly needed for years in Illinois The past incumbents have been noted for nothing except imbecility.

Mr. A. A Allen has been appointed general superintendent of the Missouri, Kansas & Texas, with headquarters in St. Louis. For the last three or four years Mr Allen has been superintendent of construction of the Everett & Monte Cristo road in Washington. He was previously on the Wisconsin Central and was for a time general manager of the Northern Pacific terminals at Chicago.

Mr. W K. Niver has been elected vice-president of the Boston & Maine, and he will take charge of the road as general manager. Mr. Niver is a graduate of the Delaware, Lackawanna & Western, and was for eight or nine years general superintendent of that road at Syracuse N. Y Since the Philadelphia & Reading got control of the Lehigh Valley Railroad, Mr. Niver has been in charge of the P. & R interests at Buffalo. He is a personal friend of Mr. McLeod's.

In the course of a discussion at the New England Railroad Club Mr. F. D. Adams mentioned a case which illustrated in a striking fashion the wear of tires caused by the action of brake shoes. His company purchased sets of English wheels for two passenger cars. One set was put under a car used on suburban service, and the other was applied to a car running on through trains. The tires of the wheels on the suburban car wore out with less than half the mileage obtained from the other tires


A Collection of Car Trucks

Mr. Theodore Voorhees, general superintendent of the New York Central for the last four years, has been elected vice-president of the Philadelphia & Reading. Mr. Voorhees is a civil engineer, a graduate of the Rensselaer Polytechnic Institute, of Troy, N. Y., and an accomplished writer on railroad subjects. He began railroading in the engineering department of the Delaware, Lackawanna & Western. He was afterward superintendent on the Delaware & Hudson Canal and went from there to be assistant general superintendent of the New York Central

Mr. A. Dolbeer, superintendent of motive power of the Buffalo. Rochester & Pittsburgh, has resigned. Mr. Dolbeer has been on the road for about five years, having gone there from the Erie division of the Pennsylvania. He is one of the best shop managers in the country, and has gone through a hard struggle on the Creator's problem of making things out of nothing. The Buffalo, Rochester & Pittsburgh Railroad Company is the tail of a coal company kite, and there is very little sustenance reaches to the tail We pity any officer who has to attempt making a record on that road.

A railroad accident that happened in Iowa some time ago has proved that the romance writer who turns the hair of a hero white through terrible excitement is not dealing entirely with the vagaries of the imagination. Ovid Musin, a famous violinist, was in the accident The shock of the collision of the two trains and the nervous strain resulting from fear of permanent injury produced a great effect on his high-strung temperament, the outward sign of which was the sudden transformation in the color of his hair. Before the accident happened the hair of his head and beard were black. Within a few weeks they became white.

Mr. John Ortton, for some years past superintendent of motive power of Toledo, St. Louis & Kansas City, died at Frankford, Ind., last month. Mr. Ortton came originally to this country from England to take charge of the mechanical department of the Canada Southern He received his training in one of the best-known English shops, and was associated with several of the men who have become prominent in railway management in the British Isles. Mr. Ortton's career in America was very much chequered The change of ownership of the Canada Southern, three or four years after he took charge, left him without a position. He was afterward in charge of the New York Central shops at West Albany, and subsequently engaged in mechanical engineering. He was exceptionally well educated, and was an able writer on mechanical subjects.

Mr. N E. Chapman, agent for the Latrobe Steel Company, died at Philadelphia last month. He was one of the best-known among the old railroad officers who have entered the supply business. Mr. Chapman was for years one of the best-known and most progressive master mechanics in the country He was one of the fifty master mechanics who met at Cleveland on June 24, 1868, to organize the American Railway Master Mechanics' Association, and he signed the call for the first regular meeting. At that time he was on the Cleveland & Pittsburgh, now a portion of the Pennsylvania Railroad. When the association was organized he was elected vice-president and held that office for nine years and then was elected president. This office he held for four years. In 1881 he was appointed superintendent of motive power of the Baltimore & Ohio and made a heroic effort to put the rolling stock of that road on a modern basis. He was in the habit of telling amusing anecdotes about the intensely conservative tastes of the managers of that road ten years ago. Two years of a struggle against forces that would not move ended Mr. Chapman's connection with the Baltimore & Ohio and he entered the steel tire business. Three years ago he became a partner in the Latrobe Steel Company.

## The Spiral Tunnels of the St. Gothard Railroad.

One of the most interesting pieces of engineering in the world is the spiral tunnels in the Alps The engineers of the St. Gothard Railroad could not find room in the snow-covered gorges and gulches of the mountains to get the line, with the proper grade, across the range

They got the needed distance and avoided the snow by building crooked tunnels Some of these make complete loops, one end being much higher than the other, thus forming a spiral

The large engraving herewith shows one of these tunnels, where both ends of the loop come out nearly together.

The smaller picture is much more interesting Here some real stair-climbing is done, and enough of it is left out-of-doors so as to be seen.

In the foreground the road can be seen running toward the left, crossing the little stream on an arched bridge, it makes a turn and comes back, crossing the same stream and gorge on a truss bridge, and disappears under the mountain, in the solid stone it makes a long detour and comes out again and once more crosses the stream on the third bridge and runs around a grade in front of the church, makes a big curve and comes into view again behind the church, where, a little to the right, can be seen the white dumps of a long fill, the road curves out of sight again up the gorge, crosses the stream once more and comes into view high up on the mountain side, directly above where it came up the valley A high wall supporting the track can be seen in the upper left-hand corner of the picture

SPIRAL TUNNELS OF THE ST. GOTHARD RAILROAD.



## OUR ENGRAVINGS.

Of late we have had a great many inquiries as to who made the fine half-tone plates shown each month in LOCOMOTIVE ENGINEERING. Credit is due the expert anywhere and we are glad to recommend the engravers of our plates to those wanting good work at reasonable prices. All the half-tones and reproductions we use are made by the STAR ENGRAVING & PRINTING Co., 607 & 609 Sansom St., Philadelphia, Pa. SINCLAIR & HILL.

Our Line Engravings are made by the wax process, a plan securing accuracy and distinct lines on original copper plates. They are made by BRADLEY & POATES, 251 William Street, New York City.

## The New York Railroad Club.

The New York Railroad Club at their last meeting, January 19th, had the largest attendance in the memory of the oldest member, and the discussion of topical questions was interesting and carried on with spirit. Active railroad men are taking more interest than ever.

The question, "Which is the preferable plan for consolidation engines, to make the second or third pair of drivers the main wheels?" brought out the advantages and disadvantages encountered in practice with engines coupled up both ways.

The question, "How can we fasten solid bushings in main connections of side rods in moguls, 10-wheelers and consolidation engines, to prevent their getting loose and turning around?" brought several master mechanics to their feet who gave the question up.

Mr. Dixon, of the Rogers Locomotive Works, gave Punch's advice "Don't" and cited the Schenectady Locomotive Works as having abandoned the use of a bush on the main connection while retaining it for the other pins. The opinion prevailed that the loosening was caused by the heating of the bush and rod and by the want of area of bush for the work done.

"Why have variable exhaust nozzles never come into general use?" was an interesting topic. Mr. Baker of *Engineering News*, who proposed the question, asked that the discussion take the form of answers to the following questions:

1. Is it because little or no benefit would be gained by the use of such nozzles, supposing them to work perfectly and to be properly handled?

2. Is it because no variable exhaust nozzle has ever been invented which is sufficiently moderate in first cost, and durable and reliable, to enable it to be used successfully in regular service?

3. Is it because the engineers and firemen will not take pains to properly regulate the blast through such nozzles, so that the theoretical benefit from their use is not realized in practice?

Mr. Davie, an English engineer, was here introduced, and made an interesting talk on the subject, exhibiting model and photographs of the Macallan nozzle used on the South Eastern road in England. This pipe is a straight nozzle with a hinged ring that shuts down over it when it is desirable to reduce the area of the opening.

There was quite a difference of opinion as to whether such a device would be most successful if placed in the hands of the engineer or made automatic. Some of the members favored putting the manipulation of a variable nozzle in the hands of the fireman.

The general opinion seemed to be that variable nozzles were desirable if they would not stop up so easily and the men could be induced to use them.

Mr. Mitchell, of the Erie, and Mr. Mendenhall, of the Pennsylvania, reported recent petitions from the engineers for variable nozzles for hard coal engines.

Mr. Forney, remarking that he was raised on variable nozzles, told some interesting experiences of the days of Ross Winans, and said he had devoted considerable thought to the subject and as a result had recently taken out a patent on a variable grate bar—which he thought was attacking the subject at the right end of the boiler.

There was a good discussion on the question of driving-boxes, and a great diversity of experience. Mr. Mendenhall, of the P. R. R., reported the successful use of phosphor bronze, while Mr. Mitchell, of the Erie, said they had some engines built with solid bronze boxes that gave them more trouble than any they had.

Mr. Sinclair reported the use of solid Ajax metal boxes under the fast engines of the N. Y. Central, and Mr. Dixon, of the Rogers Locomotive Works, reported the use of malleable iron on some engines built for the Savannah, Florida & Western, had no report, but they had recently ordered engines with the same kind of box, which was taken as an indication that their use was satisfactory.

Mr. Fowler sketched a suggestion as a cure for broken flanges that came from Mr. Gibbs, of the R. & D., which consisted of making a round faced shoe and wedge and a box with a very heavy fillet for the flanges.

Mr. Hill mentioned the cure for broken driving-box flanges used on many roads, which consists of planing out the front and back of the box so that it will fit the wedge and shoe in the center only and be loose at the top and bottom, then when one wheel drops the box can retain its bearing on the axle and cramp in the frame without danger of putting the load on the flange of the box.

On the subject, "The care of foundation brakes," Mr. Jas. Howard read a most able paper which was applauded and voted to the point and all true. After a short discussion the Club adjourned to the basement and partook of a lunch.

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The Thatcher Car and Manufacturing Co. are doing lively business for a new concern. They are having 22 Thatcher dump-cars built at New Decatur for J. W. Worthington & Co. of Birmingham, Ala., 30 are being built at its Bloomsburg car works for the Coney Island Construction Co., and they have an order for 35 for a Western road that the building contract is still open to bids.

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W. T. Small, late superintendent of M. P. of the Northern Pacific, has been appointed superintendent of M. P. of the Buffalo, Rochester & Pittsburgh, in place of A. Dolbeer, resigned.

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The Boies Steel Wheel Company, of Scranton, Pa., have removed their New York offices to the Taylor Building, 39 Cortlandt street. Mr. H. W. Boies, vice-president, and formerly Western representative of the company, will make his headquarters hereafter at the New York offices, in charge of the sales department, Messrs. Coolbaugh & Pomeroy having resigned. The Western office continues at 531 The Rookery, Chicago.

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Coolbaugh & Pomeroy, the well known supply men, have resigned the sales agency of the Boies Steel Wheel Company, and taken the railroad agency for the Latrobe Steel Works, making a specialty of tires.


THE SPIRAL TUNNELS OF THE ST. GOTHARD RAILROAD.

### Metzger's Slide Valve.

A peculiar form of slide valve, shown in the annexed engraving, has been patented by Jules P. Metzger, Paterson, N. J. The valve is formed of two parts, that forming the cavity being separate from the outside and having a sliding movement of its own. The purpose of the invention is to protract the exhaust opening after the main portion

of the valve has commenced to move back. Referring to the engraving it will be seen that the valve is in the position to begin the admission of steam. When the outer part of the valve *A* reaches the end of the travel and begins to return, the inner portion, *B*, remains stationary until the edge *1* is struck by the part marked *2*.

Valves of this form have been tried a great deal, but have generally failed owing to rapid wear. The merits of this invention appear to be the peculiarity of design which cushions the blow when the two surfaces come together. This is done by the admission of steam through the upper casing.

An engine equipped with valves of this kind has been at work over a year on the Minneapolis & St. Louis, and is said to be doing remarkably good work.

### Southern California Enginemen.

There is a peculiar method of running engine crews in vogue on the Southern California. The oldest men are given the preference in the choice of runs, as is common on many roads, but here the choice is confined to the runs and not to the engines. In ordinary circumstances certain engines are kept on the regular runs, but if an engine belonging to a run fails or has to be put on an extra train, the crew do not follow the engine. They go to the station for their own train and take whatever engine has been provided. This gives the extra men much better treatment than the ordinary plan of men following certain engines, and it is reported to work well all round. The company get more service out of the engines than with the old plan, there is no dissatisfaction about men being taken off their runs or missing their engines, and all are agreed that the arrangement is fairer all round for the men and better for the engines.

They are a remarkably bright and intelligent class of men on the road, and a great many of them are orange-grove owners or proprietors of some other form of real estate. During a visit to California we were favored with a complimentary visit from a deputation of these men. When they were ushered into the room at the hotel our better half concluded that the principal citizens of Los Angeles were giving us a surprise party. She was not far off.

The men have a remarkably fair and equitable agreement with the company. The following are a few extracts:

No engineer or fireman shall be suspended or discharged upon any charge without first having an impartial hearing. * * * If charges are not proven, he shall receive full pay for all time off, with the exception of such cases as serious collision or intoxication.

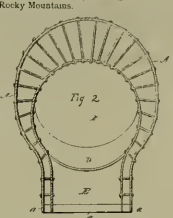
* * * *

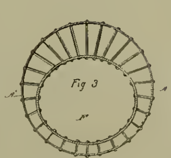
The rating as to the average load to be hauled (by engines) will be fixed from time to time as necessities may arise by the superintendent of motive power. * * *

Engineers and firemen shall be promoted by seniority; oldest men shall have preference of runs. * * *

No fines shall be imposed upon any engineer or fireman for damage caused by negligence, but suspension or discharge shall be inflicted as the case may require. * * * Where engines are required to double hills as regular service, engineers and firemen will be allowed extra mileage at the rate of ten miles an hour. * * * Engineers and firemen, when assigned to regular runs, will not be required to do work not included in their regular runs when it can be avoided. * * * Verbal complaints made by engineers against firemen will not be noticed. Engineers will be required to submit their complaints to superintendent of motive power in writing, a copy of which shall be immediately sent to the fireman against whom the complaint is made.

The schedule of pay is very liberal. On eight-wheel passenger engines the pay for engineers is $3.50 per day, of 100 miles or under; the fireman receiving $2 10. Extra running to be paid in proportion. When the engine has more than two pairs of drivers, the engineer gets 25 cents and the fireman 15 cents extra per day. Freight engineers receive from $4.00 to $4.25 per day, and firemen from $2.40 to $2.60, according to the type of engine and kind of service. The men on construction trains and switching service are all paid a little more than the rates prevailing east of the Rocky Mountains.




### In the Hancock Inspirator Works.

The Hancock Inspirator Works, of Boston, have the largest works we have ever seen devoted to the manufacture of injectors. Although comparatively little known on railroads their inspirator has for years enjoyed a large share of the boiler-feeding business, and a very elaborately worked-out plant is in use for the manufacture of the instruments. They have a special tool made by the Pratt & Whitney Company which looks like a drill press with ten heads set in line. The tools for the various operations are set in these heads and the instrument is moved successively from one to the other. This plan is considered quicker than doing the work on a turret lathe.

Mr. W. H. Park, the Superintendent of these works, has been for years working on an inspirator for locomotive work, and the company are now putting it upon the market. A great many railroad companies have got one or more inspirators and are watching their performance carefully.

The leading merits claimed for the inspirator are, reliability in starting, no adjustment of water required on account of change in steam pressure, and a range of 50 per cent. between maximum and minimum delivery.

Besides inspirators, this company makes about 500 globe valves daily

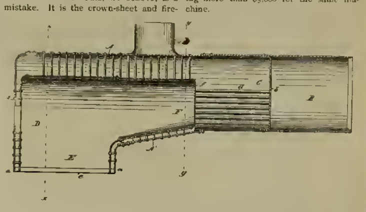
Mr. Park has a most interesting laboratory where he spends a great deal of time experimenting with appliances for raising and forcing water. In connection with it he has a museum of injectors of all kinds. Some of them are fearfully and wonderfully made and more complex than a Jacquard loom.

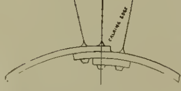
### Connelly's Boiler and Boiler Seam.

J. T. Connelly, of Milton, Pa., has recently obtained a patent on a boiler for locomotives, illustrated herewith. Fig. 1 is a longitudinal section, Fig. 2 a cross section through fire-box, and Fig. 3 a cross section through combustion chamber.

The inventor's idea is to produce a boiler without places for deposits of mud and scale, without flat surfaces, except at water leg, and with short, rigid flues.

We observe by the drawings that the stays for the fire-box are just what they are called, "radial." They all go through the shell straight, and start for the center of the boiler, going through the fire-box wherever found. This, we believe, is a mistake. It is the crown-sheet and fire-






box you are trying to stay, not the shell. The flue area in this boiler is greatly reduced, as will be seen.

Mr. Connelly has also patented a lap joint, with an inside welt strip, put in as shown, his main object being to support the calked seam. The two outside rows of rivets are spaced twice as far apart as the center row.

### A Long English Engine Without Bald Tires.

Anent the discussion in the N. Y. Railroad Club about the use or non-use of bald tires, a case may be cited in the best English practice. Mr. Webb, of the L. & N. W., has recently turned out the first of a heavy class of eight-wheel connected mineral engines, the heaviest in the country; they have no truck and a rigid wheel base of 17' 3", yet all the tires are flanged. This engine has 51-inch boiler with a total heating surface of 1,245.3 square feet. Cylinders 19½ x 24 inches with a 53½-inch wheel. The side-rods are in short sections and are interchangeable, the wheels being the same distance apart; this calls for double bearing on two pins, but gets rid of the objectionable knuckle joint.

In our last issue mention was made in a paragraph that a tire which broke on one of the Johnstone bogie engines was of the Midvale make. This was on another engine and of another make. The Rhode Island Locomotive Works people writing on the subject, pay a high compliment to the reliability of the Midvale tires.

### Fire Door Flanging.

This cut shows the most popular form of fire-door flange in Europe, and one that is used some in this country. It calls for the least bending of the sheet, takes the seam out of the fire, exposes the rivets and is easy to repair. The fire-door joint is often made directly against the edge of the flange.

A well-informed English correspondent tells us that a first-class freight engine of average size costs there £2,600, and a passenger engine £2,800, this is $12,662 and $13,636 respectively. A well-known locomotive superintendent over there showed the writer a severely plain goods engine, without trucks, cab, continuous brakes or other extras, and using cast-iron driving wheel centers, and seemed to feel a great deal of pride because he turned them out for £1,600, or $7,792. We don't believe any builder in the United States would think of asking more than $5,000 for the same machine.

On the North Eastern road, in England, they have a great many locomotives where a reverse lever is used instead of a screw, but the quadrant is a long oval screw about 2 inches in diameter at the ends and 5 or 6 at the center, this has a handle at one end and a man who can't get used to using a lever can screw the old mill over to his heart's content. It's about the clumsiest looking thing that the writer ever saw.

The machinery department of the World's Fair, at Chicago, will be an interesting one to mechanics. The Egan Company, of Cincinnati, the famous builders of wood-working machinery, claim that they will make the finest display ever made in that line. Some novel time and labor saving machines will be shown in actual operation.

The Engineering Literature Company, of East Orange, N. J., report that their business has greatly increased among railroad men during the past year. They have a catalogue of books specially prepared for railroad men who are studying engineering subjects. This is sent free to any one who applies for it.

The expert engineer of the Illinois Railroad Commission recently went over two divisions of the Peoria & St. Louis and condemned the line as unsafe, and proceedings were at once instituted to make the company put it in proper condition.

The train robbers who tackled a C. & O. train on December 14 and got left were all in State's prison for life inside of twenty days. That's business. The ticket collector who stood them off has received $100 from the company—cheap bravery.

Several wholesale slaughters took place last month by sleighing parties being struck by trains. Young men who drive crowds around the country at 2 and 3 o'clock in the morning ought to give bonds to keep off the railroads.

### Jim Wainright's Kid.

By John Alexander.

As I put down my name and the number of the crack engine of America—as well as the imprint of a greasy thumb—on the register at our roundhouse on last Saturday night, the foreman borrowed a chew of my fireman's fine-cut and said to me

"John, that old feller that's putting on the new injectors wants to see you."

"What does he want, Jack," says I, "I don't remember to have seen him, and I'll tell you right now that the old squirts on the '411' are good enough for me—I ain't got time to monkey with new-fangled injectors on *that* run."

"Why, he says he knowed you out West fifteen year ago."

"So! What kind o' looking chap is he?"

"Youngish face, John, but hair and whiskers white as snow, sorry-looking rooster, seems like he'd lost all his friends on earth and wan't jest sure where to find 'em in the next world!"

"I can't 'magine who it would be. Let's see—'Lige Clark, Dick Bellinger, Hank Baldwin, Jim Karr, Dave Keller, Bill Parr—can't be none of them; what's his name?"

"Winthrop—no, Wetherson—no, lemme see, why,—no,—no, Wainright, that's it; Wainright—J. E. Wainright."

"Jim Wainright," says I, "Jim Wainright; I haven't heard a word of him for years—thought he was dead; but he's a young fellow compared to me."

After supper I went up to the hotel and asked for J. E. Wainright.

Mebby you think Jim and I didn't go over the history of the "front." "Out at the front" is the pioneer's ideal of railroad life, the memory of it is to a man who has put in a few years there like the memory of the marches, skirmishes and battles in the mind of the volunteer.

I guess we started at the lowest numbered engine on the road and gossipped about each and every crew.

Ah, how many of those men who blazed the way for the good runs there now have laid down their work and folded their hands across their pulseless breasts!

It makes me shudder when I think of the many noble forms, mangled and bruised, and scalded and crushed! I shudder at the thought of their agonizing, heart-rending deaths, but my heart fills with horror and resentment as I go back over the files of my *Journal* and read the confessions of superstition and the hopeless bowing-down to idols and ideals of the dark ages, and the shifting of responsibility from mankind to a deity, in the stereotyped resolutions of us survivors:

"*Resolved*, That it has pleased Almighty God to remove from our midst our beloved brother," etc., etc.

That sentence is at once the only monument, the only eulogy, and, alas! often the only history of many and many a noble man.

It is no little satisfaction to me that there is no incriminating evidence in the files of the *Journal* that I have ever accused man, God or the devil of "being pleased" to scald my friend to death by slow, awful torture.

Jim and I went through the list of engineers, and had fairly started on the firemen, when a thought struck me, and I said

"Oh, I forgot him, Jim, the 'Kid,' your cheery little cricket of a firesy; thought Jim Wainright was the only man on the road that could run an engine right. I remember he wouldn't take a job running switcher—said a man that didn't know that firing for Jim was a better job than running was crazy. What's become of him? Running, I suppose."

Jim Wainright put his hand up to his eyes for a second and his voice was a little husky as he said.

"No, John, the Kid went away—"

"Went away?"

"Yes, across the great divide—dead."

"That's tough," said I, for I see Jim felt bad. "The Kid and you were like two brothers."

"John, I loved the—"

Then Jim broke down. He got his hat and coat and said

"John, let's get out into the air. I feel all choked up here, and I'll tell you a strange, true story—the Kid's story."

As we got out of the crowd and into Boston Common, Jim told his story, and here it is, just as I remember it—and I'm not bad at remembering.

"I'll commence at the beginning, John, so that you will understand. It's a strange story, but when I get through you will recall enough yourself to prove its truth.

"Before I went beyond the Mississippi and under the shadows of the Rocky Mountains, I fired, and was promoted on a prairie road in the great basin well known to the railroad world.

"I was much like the rest of the boys until I commenced to try and get up a substitute for the link motion.

"I read an article in a scientific paper from the pen of a jackass who showed a Corliss engine card, and then blackguarded the railroad mechanics of America for being satisfied with the link because it was handy.

"I started in to design a motion to make a *card*, but, well, you know how good-for-nothing those things are to pull loads with.

"After my first attempt I put in many nights making a wooden model for the Patent Office. I was subsequently informed that the child of my brain *interfered* with about ten other motions; then I commenced to think—what I ought to have done before. I went to studying *what had been done*, and soon come to the conclusion that I just knew a little,—about enough to get along running. I gave up hope of being an inventor and a benefactor of mankind, but study had awakened in me the desire for improvement, and after considerable thought I came to the conclusion that the best thing I could do was to try and be the best runner on the road, just as a starter. In reality in my inmost soul my highest ideal was the master mechanic's position.

"I was about twenty-five years old, and had been running between two and three years, with pretty good success, when one day the general master mechanic sent for me.

"In the office I was introduced to a gentleman, and the G. M. M. said to him in my presence.

"'This is the engineer I spoke to you of. We have none better. I think he would suit you exactly, and, when you are through with him, send him back, we are only lending him, mind' and he went out into the shop.

"The upshot of the matter was that the stranger represented a firm who had put up the money to build a locomotive with a patent boiler for burning a patent fuel, and she had an improved valve motion, too They had asked our G. M. M. for a good engineer to send East to break in and run the new machine and go with her around the country on ten-day trials on the different roads. He offered good pay, it was work I liked, and I went.

"John, I came right here to Boston and reported to the firm. They were a big concern in another line, and the head of the house was a relative of our general M. M.—that's why he had a chance to send me.

"After the usual introductions the president said to me.

"'Now, Mr. Wainright, this new engine of ours is hardly started yet; the drawings are done and the builders' contract ready to sign, but we want you to look over the drawings to see if there are any practical suggestions you can make. Then stay in the shops and see that the work is done right. The inventor is not a practical man, help him if you can, for experience tells me that ten things fail because of bad *design* where one does because of bad manipulation. Come up into the drawing room and I will introduce you to the inventor.'

"Up under the skylight I met the designer of the new engine, a mild little fellow—but he don't figure in this story.

"In five minutes I was deep in the study of the drawings. Everything seemed to be worked out all right except that they had the fire door opening the wrong way and the brake-valve couldn't be reached—but many a good builder did that twenty years ago.

"I was impressed with the beauty of the drawings—they were like lithographs, and one, a perspective, was shaded and colored handsomely—I complimented him on them.

"'They are beautiful, sir,' said he; 'they were made by a lady. I'll introduce you to her.'

"A bright, plain-faced little woman, with a shingled head, looked up from her drawing-board as we approached, shook hands cordially when introduced, and at once entered into an intelligent discussion of the plans for the new record-beater.

"Well, it was some months before the engine was ready for the road and in that time I got very well acquainted with Miss Reynolds.

"She was mighty plain, but sharp as a buzz-saw. I don't think she was really homely, but she'd never be arrested for her beauty; and, while there was nothing fetching about her appearance, you couldn't help liking her; she was intelligent, and it was such a novelty to find a woman that knew the smokestack from the steam-chest.

"I didn't fall in love with her at all, but I liked to chin her over the work. She told me her story, not all at once, but here and there a piece, until I knew her history pretty well.

"It seems that her father had been chief draughtsman of those works for years, but had lately died. She had a strong taste for mechanics, and her father, who believed in women learning trades, had taught her mechanical drawing, first at home, then in the shop. She had helped in busy times as an extra, but never went to work for regular wages until the death of her father made it necessary.

"She seemed to like to hear stories of the road, and often asked me to tell her some thrilling experience the second time; her eyes sparkled and her face kindled when I touched on snow-bucking experience, and she often said if she was a man she'd go on the railroad; but after such a remark she would usually sigh and smile at the same time and say

"'Think of being anchored for life to a petticoat, and have to always say "Oh, dearie me," when your spirit longs to say "dammit" as hard as ever you can.'

"One day, when the engine was pretty near ready, she said to me

"'Mr. Wainwright, who is going to fire the "Experiment?"'

"'I don't know. I had forgot about that. I'll have to see about it.'

"'It wouldn't be of much use to get an experienced man, would it—the engine will burn a new fuel in a new way?'

"'No,' said I, 'not much.'

"'Now,' said she, coloring a little, 'let me ask you a favor. I have a brother that is just crazy to go out firing I don't want him to go without it's with a man I can trust; he is young and inexperienced, you know; won't you take him? Please do'

"'Why, I'll be glad to,' says I; 'I'll speak to the old man about it.'

"'Don't tell him it's my brother.'

"'Well, all right.'

"The old man told me to hire whoever I liked, and I told Miss Reynolds to bring the boy in in the morning.

"'Won't you wait till Monday? it will be an accommodation to me.'

"Of course I waited.

"The next day Miss Reynolds did not come to the office and I was busy at the shop. Monday came and no Miss Reynolds, but about 9 o'clock the foreman came down to the 'Experiment' with a boy apparently about 18 years old, and said here was a lad with a note for me.

"Before reading the note I shook hands with the boy and told him I knew who he was, for he looked like his sister.

"The boy was small but looked wiry, and had evidently come prepared for business, as he had some overclothes under his arm and a pair of buckskin gloves. He was bashful and quiet, as boys usually are on their first experience away from home.

"The note read

"'Dear Mr. Wainright—This will be handed you by brother George. I hope you will be satisfied with him. I know he will try to please you and do his duty; don't forget how green he is I am obliged to go into the country to settle up some of my father's affairs and may not see you again before you go. I sincerely hope the "Experiment," George and his engineer will be successful. I shall watch you all. Miss G. E. Reynolds.'

"I felt kind of cut up somehow about going away without bidding 'old business,' as the other draughtsmen called Miss Reynolds, good-bye, but I was busy with the engine.

"The foreman came along half an hour after the arrival of young Reynolds, and seeing him at work cleaning the window glass, asked who he was.

"'The fireman,' said I.

"'What! that "*kid!*"'

"And from that day out I don't think I ever called young Reynolds by any other name half a dozen times That was the 'Kid' you knew. When it came quitting time that night I asked the Kid where they lived, and he said Charlestown.

"I remarked that his voice was like his sister's, but he laughed and said I'd see difference enough if they were together, and bidding me good-night caught a passing car.

"We broke the 'Experiment' in for a few days and then tackled half a train for Providence. She would keep her water just about hot enough to wash in with the pump on It was a tough day; I was in the front end half the time at every stop. The Kid did exactly what I told him, and was in good spirits all the time, I was cross. Nothing will make a man crosser than a poor steamer.

"We got to Providence in the evening, tired, but after supper the Kid said he had an aunt and her family living there and if I didn't mind he'd try and find them. I left the door unlocked and slept on one side of the bed, but the Kid didn't come back; he was at the engine when I got there the next morning.

"The Kid was such a nice little fellow I liked to have him with me, and somehow or other (I hardly noticed it at the time) he had a good influence on me.

"In them days I took a drink if I felt like it, but the Kid got me into the habit of taking lemonade, and wouldn't go into drinking places, and I soon quit it. He gave me many an example for controlling my temper, and soon got me into the habit of thinking before I spoke.

"We played horse with that engine for four or five weeks, mostly around town, but I could see it was no go. The patent fuel was no good, and the patent firebox little better, and I advised the firm to put a standard boiler on her and a pair of links and sell her while the paint was fresh.

"They took my advice The Kid and I took the engine to Hinckley's and left it there; we packed up our overclothes, and as we walked away the Kid asked, 'What will you do now, Jim?' 'Oh, I've had a nice play, and I'll go back to the road. I wish you'd go along'

"'I wouldn't like anything better, will you take me?'

"'Yes, but I ain't just sure I can get you a job right away.'

"'Well, I could fire for you, couldn't I?'

"'I'd like to have you, Kid, but you know I have a regular engine and a regular fireman. I'll ask for you, though.'

"'I won't fire for anybody else!'

"'The devil you won't! Why? What would you do if I should die?'

"'Quit.'

"'Get out!'

"'Honest; if I can't fire for you I won't fire at all.'

"I put in a few days around the 'Hub,' and as I had nothing to do my mind somehow kept turning to Miss Reynolds. I met the Kid daily, and on one of our rambles I asked him where his sister was.

"'Out in the country.'

"'Send word to her that I am going away and want to see her, will you, Kid?'

"'Well, yes; but Sis is funny; she's too odd for any use. I don't think she'll come.'

"Well, I'll go and see her.'

"No; Sis would think you were crazy.'

"'Why? Now look here, Kid, I like that sister of yours and want to see her.'

"But the Kid just stopped, leaned against the nearest building and laughed, laughed till the tears ran down his cheeks.

"The next day the Kid brought me word that his sister had gone to Chicago to make some sketches for the firm and hoped to come and see us after she was through.

"I started for Chicago the next day, the Kid with me.

"I had little trouble in getting the Kid on with me as my old fireman had been promoted. I had a nice room with another plug-puller, and in a few days I was in the old jog—except for the Kid. He refused to room with my partner's fireman, and when I talked to him about saving money that way he said he wouldn't room with anyone—not even me. Then he laughed and said he kicked so no one could room with him.

"The Kid was the butt of all the firemen on account of his size, but he kept the cleanest engine, was never left nor late, and seemed more and more attached to me—and I to him.

"Things were going along slick enough when Daddy Daniels had a row with his fireman and our general master mechanic took the matter up. Daniels' fireman claimed the run with me, as he was the oldest man, and, as they had an 'oldest man' agreement the master mechanic ordered Smutty Kelly and the Kid changed.

"I was not in the roundhouse when the Kid was ordered to change, but he went direct to the office and kicked, but to no purpose, then he came to me.

"'Jim,' said he, with tears in his eyes, 'are you satisfied with me on the 12?'

"'Why, yes, Kid. Who says I'm not?'

"'They've ordered me to change to the 17, with that horrible old ruffian Daniels, and Smutty Kelly to go with you.'

"'The h—l they have,' says I; 'that slouch can't go out with me the first time; I'll see the old man.'

"But the old man was mad by the time I got to him.

"'That baby-faced boy says he won't fire for anybody but you; what have you been putting into his head?'

"'Nothing; I've treated him kindly and he likes me and the 12—that's the cleanest engine on the—'

"'Tut, tut, I don't care about that; I've ordered the firemen on the 12 and 17 changed—and they are going to be changed.'

"The Kid had followed me to the office, and at this point said very respectfully:

"'Excuse me, sir; but Mr. Wainright and I get along so nicely together; Daniels is a mean man, so is Kelly; neither will get along with decent men. Why can't you—'

"'There! Stop right there, young man. Now, will you go on the 17 *as ordered?*'

"'Yes; if Jim Wainright runs her.'

"'No *ifs* about it, will you go?'

"'No, sir, I won't!'

"'You are discharged, then.'

"'That fires me too,' said I.

"'Not at all, not at all; this is a fireman row, Jim.'

"I don't know what struck me then, but I said

"'No one but this boy shall put a scoop of coal in the 12 or any other engine for me; I'll take the poorest run you have, but the Kid goes with me.'

"Talk was useless, and in the end the Kid and I quit and got our time.

"That evening the Kid come to my room and begged me to take my job back and he would go home, but I wouldn't, and asked him if he was sick of me.

"'No, Jim,' said he, 'I live in fear something will happen to separate us, but I don't want to be a drag on you—I think more of you than anybody.'

"They were buying engines by the hundred on the Rio Grande, the Santa Fé, and the A. & P. in those days, and the Kid and I struck out for the West, and inside of thirty days were at work again.

"We had been there three months, I guess, when I got orders to take a new engine out to the front and leave her, bringing back an old one. The last station on the road was in a box-car thrown out beside the track on a couple of rails; there was one large, rough-board house, where they served rough-and-ready grub and let rooms, the latter were stalls, the partition only being about seven feet high. It was cold and bleak, and right glad we were to get there, turn the big 'hog' over to the watchman and get a warm supper, everything was rough, but the Kid seemed to enjoy the novelty.

"After supper I asked the landlord if he could fix us for the night.

"'I can jest fix ye, and no more,' said he; 'I have just one room left. Ye's'll have to double up, but this is the kind o' weather for that; it'll be warmer.'

"The Kid objected, but the landlord bluffed him—didn't have any other room—and he added 'If I was your pardner there I'd kick ye's down to the foot, such a cold strip of bacon as ye must be.'

"About nine o'clock the Kid slipped out, and not coming in for an hour I went to look for him. As I went toward the engine I met the watchman:

"'Phy don't that fireman o' yourn sleep in the house or on the caboose floor a night like this? He'll freeze up there in that cab with no blankets at all; but whin I tould him that he politely informed meself that he knowed men to get rich mindin' their own biz. He's a sassy slip of a Yankee.'

"I climbed up on the big consolidation and lighting my torch looked over the boiler-head at the Kid. He was laying on a board on his seat with his overcoat for a covering and an arm rest for a pillow.

"'What's the matter with you, Kid?' I asked. 'What are you doing freezing here when we can both be warm and comfortable in the house? Are you ashamed or afraid to sleep with me? I don't like this for a cent.'

"'Hope you won't be mad with me, Jim, but I won't sleep with anyone, there now.'

"'You're either a fool or crazy,' says I, 'and I want some explanation of such a trick as this. Why, you will half freeze here.'

"The Kid sat up, looked at me soberly for a few seconds, reached up and unhooked his door and said.

"'Come over and sit down, Jim, and I'll tell you something.'

"I blew out the torch and went over, half mad. As I hooked the door to keep out the sharp wind, I thought I heard a sob, and I took the Kid's head in my hands and turned the face up to the moonlight. There were big tears in the corners of each tightly closed eye.

"'Don't feel bad, Kid, I am sure some reason keeps you at such tricks as this; but tell me all about your trouble—it's imaginary, I know.'

"There was a tremor in the Kid's voice as he took my hand and said: 'We are friends, ain't we, Jim?'

"'Why, of course,' said I.

"'I have depended on your friendship and kindness and manhood, Jim. It never failed me yet, and it won't now, I know. I have a secret, Jim, and it gnaws to be out one day and hides itself the next. Many and many a time have I been on the point of confessing to you, but something held me back. I was afraid you would not let me stay with you if you knew—'

"'Why, you ain't killed anyone, Kid?' I said, for I thought he was exaggerating the trouble.

"'No—Yes, I did, too,—I killed my sister.'

"I recoiled, hurt, shocked. 'You—'

"'Yes, Jim, there is no such a person to be found as my sister, Georgiana—*for I am she!*'

"'You! Why, Kid, you're crazy!'

"'No, I'm not; listen, Jim, and I will explain.'

"'My father was always sorry I was not a boy. Taught me boyish tricks and made me learn drawing. I longed for the life on a locomotive—I loved it, read about it, thought of it, and prayed to be transformed into *something* that could go out on the road. My heart went out to you early in our acquaintance, and one day the thought to get started as a fireman with you shot into my brain and was acted upon at once. After the first move there was no going backward, and I have acted my part well; I have even been a good fireman. I am strong, healthy and happy when on the road with you. I love the life, hard as it is, and can't think of giving it up, and—and you, Jim.'

"And then she broke down and cried as only a woman can.

"I took both her hands in mine and kissed her—think of kissing your fireman on the engine—and told her that we could be happy yet. Then I told her how I had tried to get a letter to the lost sister, and how they never came back and were never answered—that I loved the sister and I loved her. She reminded me that she herself got all the letters I had sent and was pretty sure of her ground when she threw herself on my protection.

"It was a strange courting, John, there on that engine at the front, the boundless plains on one side, the mountains on the other, the winds of the desert whirling sand and snow against our little house and the moon looking coldly down at the spectacle of an engineer making love to his fireman.

"That night the Kid slept in the bed in the house and *I* stayed on the engine.

"When we got back to headquarters the Kid laid off to go home and I made a trip or two alone, and then I had to go to Illinois 'to fix up some family business'—Kid and I arranged that.

"We met in St. Louis, the Kid hired a ball dress, and we were married as quietly as possible. I had promised the Kid that, for the present at least, she could stay on the road with me, and you know that the year you were there I done most of the heavy firing while the Kid did the running.

"We remained in the service for something like two years, a strange couple, yet happy in each other's company and our work.

"I often talked to my wife about leaving the road and starting in new where we were not known, as man and wife, she to remain at home, but she wouldn't hear to it, always asking me if I wanted an Irishman for a side partner. This came to be a joke with us—'When I get my Irishman I will do so-and-so.'

"One day, as our hog was drifting down the long hill, the Kid said to me, 'Jim, you can get your Irishman; I'm going to quit this trip.'

"'Kind o' sudden, hey, Kid?'

"'No; been hating to give up, but—' and then the Kid come over and whispered something to me

"John, we both quit and went South. I got a good job in Texas, and the Kid was lost sight of and Mrs. J. E. Wainright appeared on the scene in tea gown, train and flounces.

"We furnished a neat little den, and I was happy. I missed my Kid fireman, and did indeed have an Irishman. Kid had a struggle to wear petticoats again, and did not take kindly to dish-washing, but we were happy just the same.

"Our little fellow arrived one spring day, and then our skies were all sunshiny for three long, happy years, until one day Kid and I followed a little white hearse out beyond the cypress grove and saw the earth covered over our darling, over our hopes, over our sunshine, and over our hearts.

"After that the house was like a tomb, so still, so solemn, and at every turn were reminders of the little one that had faded away like the morning mist, gone from everything but our memories—there her sweet little image was graven by the hand of love and seared by the branding-iron of sorrow.

"Men and women of intelligence do not parade their sorrows in the market-place, they bear them as best they can, and try to appear as others, but once the spectre of the grim destroyer has crossed the threshold his shadow forever remains, a dark reminder, like a prison bar across the daylight of a cell.

This shadow is seen and recognized in the heart of a father, but it is larger and darker and more dreadful to the mother-heart.

"At every turn poor Kid was mutely told of her loss, and her heart was at the breaking-point day by day, and she begged for her old life to seek forgetfulness in toil and to keep away from herself.

"So we went back to the old road, as we went away—Jim Wainright and Kid Reynolds—and glad enough they were to get us again for the winter work.

"Three years of indoor life had softened the wiry muscles of the Kid, and our engine was a hard steamer, so I done most of the work on the road, but the work, excitement and outdoor life brought back the color to pale cheeks and now and then a smile to sad lips—and I was glad.

"One day the Kid was running while I broke up some big lumps of coal, and while busy in the tank I felt the air go on full and the reverse lever come back, while the wheels ground sand. I stepped quickly toward the cab to see what was the matter, when the Kid sprang into the gangway and cried 'Jump!'

"I was in the left gangway in a second, but quick as a flash the Kid had my arm.

"'The other side! Quick! The river!'

"We were almost side and side as she swung me toward the other side of the engine, and I jumped just as we crashed into a landslide. I felt Kid's hand on my shoulder as I left the deck—just in time to save my life, but not the Kid's.

"She was crushed between the tank and the boiler in the very act of keeping me from jumping to certain death on the rocks in the river below.

"When the crew came over they found me with the crushed clay of my poor, loved Kid in my arms, kissing her.

"They never knew who she was. I took her back to our Texas home and laid her beside the little one that had gone before.

"The Firemen's Brotherhood paid Kid's insurance to me and passed resolutions saying that:

"'It has pleased Almighty God to remove from our midst our beloved brother, George Reynolds,' etc., etc.,

"George Reynolds' grave cannot be found; but over a mound of forget-me-nots away in a southern land there stands a stone on which is cut

"'Georgiana, wife of J. E. Wainright, aged thirty-two years.'

"But in my heart there is a golden pyramid of love to the memory of a fireman and a sweetheart known to you and all the world but me as 'Jim Wainright's Kid.'"

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Nearly three pages of the United States *Patent Office Gazette* were lately occupied with the description of an elevated railroad invented by Arthur E. Hotchkiss, Cheshire, Conn., and Arthur himself is shown riding on it on a bicycle. It is a one-rail bicycle railroad and looks like a board fence.

## A Roundhouse Cat with Brains.

BY SOLOMON WHITE.

We have all of us read more or less about cats, and their peculiar traits of body or mind. Who has not seen the high-bred tortoise-shell tabby that was the pride and delight of her mistress, or the cat with the long white hair that comes from some foreign land, and that looks for all the world like a poodle dog; and we all remember reading in our youth of the pretty gray cats that gave a regular circus performance to the gentle word of command from their loving masters, and what numbers of common, every-day cats there are all about us that one never sees except as they skip under the woodpile or up a tree; and never hear but in the night when one wants nothing so much as to sleep—unless it be the chance of annihilating the cat. Some of these every-day cats are not so common after all, for we often read of the lawyer's office cat, who, in spite of his half-starved condition, stoutly maintains his master's superiority against the jibes of the sleek and well-fed banker's cat. And even the editor has his pet feline, that is a sort of walking encyclopædia to furnish him reliable data, and sometimes secrets not otherwise obtainable. To all these we wish to add the story of another of these ordinary cats—ordinary only in pedigree. Did any of you ever hear of a roundhouse cat? Perhaps so, but it was doubtless a poor, dirty, half-starved creature that ran and hid every time one of the workmen came near it and lived only in the fear of a bunch of dirty waste shied at it. But this is a different sort of a story I have to tell.

It was a cold, dark night in early November that our roundhouse cat came to us. The caller had just gone out, leaving the door slightly ajar, and soon there peered in two bright eyes, slowly followed by a long, lean body covered with yellow-gray fur. The boys were quietly at work, and after making a careful survey from where he stood, Mr. Cat slowly walked about the house, peering into corners and keeping pretty well away from everybody till he came to the sand stove. Here he found a place to suit him and lay down as if he was at home. A close look at him revealed the fact that he had had trouble; his ears were torn and bleeding and there was a long scratch across his nose. Undoubtedly he had had a disagreement—was it with a neighbor, or was it with a brother in a too full house? Perhaps the latter, and he had vowed to go out into the cold world and seek himself another home. Anyhow, he seemed pleased with his new surroundings, and after carefully dressing his wounds curled himself up for a nap. The boys went about their work, their torches throwing uncertain light on their greasy suits and grimy faces and on the shining sides of the great engines they were wiping, and none of them saw their new companion comfortably dozing by the warm sand stove. One of the wipers, whose merry whistle was always heard as he polished up the great drivers, passed near by the stove with his arms full of waste, and his whistle roused the cat, who jumped up in alarm, ready to run if danger threatened, but the whistle was already gone, and he lay down again. When midnight came the cat retired under the nearest engine, for the boys gathered around the sand stove to eat their lunch, and as each hunted his particular coffee can out of the hot sand they called to him in their most coaxing terms, and though they threw bits of their lunch toward him he would not come out. After the lunches were finished, there happened what often does happen—the boys all took a nap, "just to settle their lunch!" And while they were stretched out around the stove, oblivious of all surroundings, the cat came out of the pit and ate up all the scraps of lunch thrown on the floor, and seeming to realize that there was nothing to fear, he lay down near them to settle *his* lunch.

From this time on he never showed any disposition to leave us or be afraid of any one about, and it was not long before he was a regular luncher and showed his good living in his fat sides and sleek and shining fur. In the days that followed he began to show interest in the work going on about him, and might be seen sitting on the edge of the pit intently watching the boiler-washer splashing about in his big boots, or on the steam-chest watching the machinist lining up guides; or on the running-board with his bright eyes on the waste in the hands of the fireman, and if a long string dangled out behind you would be sure to see Tom jump at it. There was one set of workmen that he soon lost all interest in, and that was the boiler-makers. In his walks about, he one day came upon one of these men just emerging from a front end, and his sooty face with its stary eyes seemed to fill Tom with disgust, or perhaps fright, for he never afterward stopped to watch them at their work. It was soon apparent that Tom's special delight was the engineers and firemen; and before very long his peculiar bent made itself known and became one of the most interesting topics of conversation in the roundhouse. And this is how it all became clear to us.

Engines 93 and 126 always stood in the same stalls, side by side, and their engineers were two very different sorts of men. Sam McGuire, who ran the 93, was one of those young fellows who knew pretty well how to run an engine—in his own mind—and thought a good many of the instructions about oiling, looking over and the general care of an engine were old-fogy notions not at all necessary to follow. He used to say, "That great iron mill 'aint going to knock to pieces just because she 'aint tended like a baby." And so he used to saunter into the house any time of day, ask his fireman if she was all right, walk along beside her with his hands in his pants' pockets, perhaps stretch his neck enough to get a bird's-eye view of the links and eccentrics, and then spend the rest of his time swapping lies on the machinist's bench.

But the engineer of 126, John Bright, wasn't that kind of a fellow, he was one of your big, quiet chaps who always seemed to be thinking of something pleasant; he'd come down as regular as clock-work, and you could see him climbing under and about his engine, and you'd feel sure he'd never go out with a loose nut or a lost cellar bolt. He was always whistling softly to himself, and he never failed to see everybody that came by, and his cheery nod and smile didn't interfere with his work—or his whistling either. It was to him that Tom soon became strongly attached. He'd follow him everywhere, and when "Old Fogy," as Sam McGuire used to call him, was down in the pit tapping each nut to be sure it was tight, Tom was close by seemingly taking careful instructions. And when he filled his rod and guide cups—and he always examined the feeders carefully, so you knew pretty well that he wouldn't be laid out by a hot pin—Tom would follow, walking along the rods, and he'd peer into each oil cup just as interested as if he was watching a fresh mouse-hole. So their friendship grew, till you'd always be sure to find Tom where John was—that is, till John got ready to pull out of the house; then Tom would retire, for it seemed he never could get used to the steam coming from the open cylinder cocks, and the boys used to laugh to see him skip for the other end of the house at the first blast. But it wasn't very long till John had him so attached to him that he could take him up on the right side with him, and ride him out over the turntable, and sometimes to the coal chute, till finally Tom would contentedly stay till John put him off. One evening, when they were ordered out on a stock extra, John told his fireman he was going to take the cat with him for a trip over the road. So Tom, like all visitors, was put up on the fireman's seat, where he looked as dignified and knowing as a director of the road. They pulled out in due time, and, as they went whizzing over the road Tom seemed as interested as a woman in watching the grass and trees fly by, and occasionally looked over at John as if to be sure he hadn't deserted him. They were to meet No. 1 at Rufton, where they were also to take coal and water; and they drew into the passing track with five minutes to spare, just after dark.

While the fireman was up taking coal and water and the engineer hurriedly dropping on a little oil, the conductor appeared and handed the latter a piece of yellow manifold, saying, "Here is an order. No. 1 is running thirty minutes late, that will give us eighteen minutes to make Komo and clear them five. Can you make it?"

As John held the manifold in the glare of the fire-door he said to himself, "Twelve miles", at the same instant there flashed through his mind the condition of his engine and he saw no reason why he should not make Komo easily, and turning to the conductor said

"Are you ready?"

"Yes; let her go! The coal-man will shut the switch for us"—and before you could tell it they were well into the country. So they sped through the black night, past farm houses whose presence could only be told by the flash of light from their windows, over bridges whose rumble revealed them, and through snow-sheds that made the darkness more close by shutting out the stars, everything in the cab showed the intensity of the strain on brain and nerve. John leaned out of the window with his eyes strained to the farthest point of the lighted track, occasionally glancing at his watch in the glare from the fire-door; while the fireman divided his time between the steam-gauge and the scoop. They were in to clear at Komo and had three of their five minutes.

All during this quick run Tom had calmly laid upon his cushion with his bright eyes intently watching everything going on about him, but certainly not in the least excited or uncertain of the result. But when No. 1 whistled, and he saw the headlight, which seemed to be coming straight at them, he sprang up and looked quickly about as if to leave the cab, but seeing John sitting quietly in his seat, he too settled down; and during the rest of the trip lay curled upon the seat, sometimes sleeping, and sometimes watching the fireman. When they reached the end of their run, the hostler told them they were to go right back, and while he turned the engine John and his fireman went over to a neighboring high-stool-and-ham-sandwich hotel for something to eat. Tom staid on the engine, but sat up very straight and alertly watched the hostler; he was plainly disturbed at John's disappearance, but evidently intended sticking by the engine, and when John returned bringing one of those aforementioned sandwiches for him Tom showed his delight in unmistokable purrs.

The trip home was uneventful, and Tom slept most of the time, and when they ran into their regular stall he jumped down from the engine as if it was a usual thing for him to go over the road. The boys were all amused at the fireman's description of Tom's journey, and Sam McGuire thought it would be a fine thing to some day take him along on the 93, but Tom's brains just showed up right there. Do you think Sam could get him onto the 93? Not a bit of it! No amount of coaxing would induce him to set foot on that engine, and while it tickled the rest of the boys, Sam was mad and felt like killing the cat. And one day Jimmy Black, who has a way of telling the truth no matter how hard it hits, said "Sam, the cat's onto you, he knows you haven't been under that old scrap of yours for a month." And though Sam walked away, muttering something to himself about "d—— chumps," he didn't deny Jimmy's accusation, and the boys always laid Tom's refusal to ride on the 93 to his brains.

## A Heroic Conductor.

BY ANGUS SINCLAIR.

There are deeds of heroism performed every day in a matter-of-course fashion by our railroad men that would entitle them to honorable decorations were their actions done in spheres where gallantry, and daring, and endurance were rewarded. In the battlefield of industry, bravery and conspicuous courage are supposed to earn no special reward. They are the matter-of-course attributes of many occupations. Hundreds of heroes who have displayed these attributes in the saving of human life, or in the performance of daily duties, go in the course of nature to their graves without knowing that they have performed deeds worthy to be commemorated beside the acts of glory which have made other names immortal.

Such thoughts passed through my mind one evening in a quiet house in Kansas as I listened to H. R. Nickerson, general superintendent of the Atchison, Topeka & Santa Fé, tell for the amusement of his guests some reminiscences of railroading on the frontier of civilization. In relating his personal performances Mr. Nickerson was like Bill Smedley's frog after its phenomenal leaps, perfectly modest and unconscious of having done anything out of the common.

We had been talking about the hardships endured by trainmen in fighting snow.

"We have not been much troubled with snow on the Santa Fé of late years," remarked Mr. Nickerson, "but in the early days of the road's history we got enough to last us to the end of the chapter. When we first stretched out toward the mountains, the prairies and plains were perfectly bare and the snow was swept for miles to the nearest lee spot. Away about '76 I was conductor of a passenger train, and we got stuck in the snow about twenty miles west of Dodge City. We toiled and struggled to get out of a cut where we were stalled, but a fierce blizzard was raging and the snow drifting over the plains unchecked by bush or brake, filled up the cut quicker than we could work it out. We had been out for a day and night, and the situation was getting serious. The train was full of passengers, many women and children among them, and there was not a morsel of food to eat. Dodge City, over twenty miles away, was the nearest habitation.

"Being a telegraph operator, I carried an instrument with me. Thinking that a relief party might be sent out, I climbed a telegraph post and made connection with the wire, intending to ask Dodge City to send provisions. I called and called but no Dodge City or other haunt of civilization could be raised. The wires were down, but I did not know that then, and wasted much valuable time trying to establish communication that was hopelessly cut off.

"When at last I realized that the calling for help over that wire was useless, and that there was no hope of the storm soon abating, I made up my mind to walk to Dodge City. The other trainmen and even the passengers declared it was too risky, but I could not sit still for another night and look at those women and children crying with hunger.

"I wrapped myself up well, tied some bagging over my shoes and started out on the twenty-two miles tramp. The cold wind was blowing with cutting force, and the snow kept falling, falling as if the upper air was a reservoir with a never-ending supply. It did not fall fast, but kept up a steady downpour as if it had set out to keep up the operation for a month.

"There is a peculiarity about the kinds of snowfall. If it comes down in great flakes that nearly monopolize space in the air, the snow is likely soon to turn to rain. If a finer snow falls in blinding density it soon exhausts the supply and stops. But

when it keeps falling steadily, gently, as it trying to husband its strength, you may depend on having a liberal supply for days.

"This was the kind of snow which I had to encounter. It kept falling with painful monotony, but it never rested. Before reaching the ground it joined a moving tide of snow that was wafted before the wind in search of a resting place. The vast plains seemed to be a sea of moving snow. Silently and quietly it moved along in its white purity, too light evidently to harm the twittering birds, but woe to man or beast that sought shelter in a spot where protection from the wind permitted the snow to rest.

"With the thought only of my passengers in my mind and Dodge City for a magnet at the end of my vision, I kept trudging onward. The telegraph poles were the finger-posts that pointed to safety. Sometimes I walked on the track and sometimes on the prairie, but I never failed to keep within sight of the telegraph poles. When the snow or drift was so thick that I could not see from one pole to another, I counted the seconds, and if the next pole did not appear at the right time, I turned toward the track and by that regained my bearing. The wind kept steadily on my left, so that it helped as a guide, for the track was straight. The tramp was toilsome. Now I would be walking through soft snow that broke through at every step, then I would suddenly stumble into a covered slough or buffalo wallow and be half smothered before I could again reach firm footing. A great part of the way the track was raised slightly above the plain and the wind kept it fairly clear of snow, so that the walking was good. At other places there were small cuttings which were drifted level, and these parts sent me away from the track.

"The mileage numbers on the telegraph poles told me that Dodge City was yet far away when the shadow of a lurid gleam in the west intimated that the sun was going down. Toward nightfall certain forms had flitted past within my line of vision that gave me some uneasiness. They were prairie wolves, cowardly, harmless animals as a general thing, but I did not know how they might act in the case of a lonely tramp, encountered when they were stimulated to courage and fierceness by hunger.

"I carried my signal lamp, and thinking that it might be some obstacle to any of the wolves that might be inclined to eat my hams for supper, I proceeded to light it. That was no easy job. The oil was frozen, and the lamp would not burn. As dusk was falling, I began to feel certain that the lighted lamp was a beacon that would frighten my enemies, and I determined to make it burn. To accomplish this I groped under the snow for some bunches of dry grass, got down with them in a sheltered spot and started a small fire. On this I held the fountain of the lamp long enough to melt the oil, then lighted it without difficulty.

"When I started up to go after lighting the lamp, several wolves were snarling within sight. As the shades of night waxed deeper the animals became bolder and more numerous. They kept pressing toward me, yelling and snarling at each other and then staring at their intended victim with blazing eyes, but a wave of the lamp would send them scampering away. At first they would run far enough for most of them to be out of sight, but they gradually grew bolder. They kept pressing closer upon me and I continued to swing the lamp at them without making much impression. I was beginning to imagine how the first bite of their teeth would feel and how long it would take them to eat me up. I had no intention of permitting this performance to go on without resistance, and I had my revolver ready for the emergency which seemed impending. I noticed that one gaunt-looking fellow was more enterprising than his companions. He went the shortest distance at the swing of the lantern and returned first to the charge. After making half-hearted attempts he made a spring at my leg, and received a bullet from my revolver.

"There was a great hurrying to the front and rear, and I kept moving ahead while the wolves lingered to pick the bones of their comrade. The feast did not satisfy their longings for the good things of this life, for I had not passed many telegraph poles when the pack was within sight again.

"But they appeared to reason that there was some dangerous relation between the swinging of the lantern and the shot that gave one of their number as supper for his friends. They had no taste for figuring as the principal at that kind of a feast. For a time they kept without reach of an easy shot, but their memory of the disaster that happened to their gaunt member was short lived, or the necessities of their appetite were pressing. By degrees they crowded closer around me. A swing of the lantern would frighten them beyond bounds at first, but gradually its terrors waned.

"I kept plodding forward doing my very best to keep the hungry brutes at bay, but watching an easy opportunity for another victim. I had not to wait very long. The first of the pack to display conspicuous enterprise receive my next shot, and he was near enough to get it straight. The hosts scattered again, and again they united to pay the last tribute of affection for their relatives. Their obsequy ceremonies were not protracted. I had not time to grow lonely in my solitary journey, when they were beside me again singing their eerie requiem which I feared would soon apply to myself. Between rubbing my ears, swinging my lantern and keeping a watchful eye on my escort, I was kept busy. The drama that became a tragedy to two of the wolves was enacted twice again, but no sign of the hospitable dwellings of Dodge City greeted my longing eyes.

"The cold and the fatigue and the hunger (for I had not eaten anything since the previous day) must have begun to affect my senses, for during the last part of the journey it appeared to me that a wave of wolves was moving over the country as the waves of snow had been seen moving in daylight. But I continued to swing my lantern and hold out my revolver. The impression came that the whole thing was immensely funny, and I must have laughed loudly at the absurdity of the scene. This was the feeling pervading me when I stumbled into Tom Dowd's saloon at two o'clock in the morning.

"This was the only house in the town that had a light burning, and there I went, followed to the door by the wolves.

"I remember vaguely a crowd of men getting around me and of their dragging me outside and beginning to rub my face and ears with snow. I was rather badly frozen but soon was myself sufficient to explain what was wanted. A relief party was organized within an hour. A large sleigh was loaded with provisions, and before daylight broke we were far on our way to the spot where many hungry people were waiting to be fed."

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Our various articles on "Railroading During the War Time" has excited in those who took part in the stirring events referred to a desire to come together in a convention and fight the battles over again. An old engineer who has read the articles with much interest and remembers many of the personages mentioned, wishes us to propose that a convention of men who were railroading in the South during the war time be held in Chicago this summer. We gladly put the suggestion before our readers and will be pleased to do all in our power to aid in organizing such a meeting. If any one will take the initiative we feel certain that the project will meet with a cordial response from hundreds of old railroaders who are anxious to meet associates of those trying times.

### The Invention of Cast Steel.

There are few subjects connected with mechanical engineering that have more romantic associations than the development of steel making. The first progress in the art was incited by the desire to make trusty weapons of warfare, but the scientific development of modern times has been accomplished in the interest of peaceful arts.

Steel has supplied a favorite simile to the poets. Milton says

"Arm the obdured breast
With stubborn patience as with triple steel."

Shakespeare speaks of the "flinty and steel couch of war"; "hearts as true as steel"; "hearts with strings of steel." Byron frequently uses this obdurate metal for illustration, and Scott speaks of

"The stern joy which warriors feel
In foemen worthy of their steel."

Since the important inventions and discoveries of Bessemer, Siemens, and others were made, which have so wonderfully reduced the cost of producing steel, it has been common to hear the present time spoken of as the age of steel. With all the good the cheapened metal has done for mankind, we hardly think that the metal is now regarded with the admiration and romance of early times when the article was scarce and when its production was an art of mystery. Stone and bronze were used as weapons of war and implements of peace in times preceding the working of iron, but it seems likely that steel was the first form in which iron came into use. Steel is mentioned by Homer, and the famous Wootz steel of India was described by Aristotle, who lived about 400 B.C.

The ancient metallurgists appear to have attained wonderful skill in steel making. The business was carried on by secret crafts, and there is reason to believe that certain parts of the art were lost in the cataclysms to civilization in the first seven centuries of the Christian era caused by superstition and barbarism. What little knowledge was perpetuated about metals in Europe found root in Germany and the Netherlands. Up to the seventeenth century these countries produced nearly all the steel used in the Western World.

Steel at this time, was not of the admirable brands from which the swords famous in history had been made. It was nearly all made by the blister process. That is, bars of iron were placed in a box among granulated charcoal and kept there at a red heat for many hours, thus causing the carbonization that converts iron into steel. The process of making cast-steel was not discovered until about 1750, and the art of making this kind of steel was not generally known till this century began.

Early in the seventeenth century the art of making cutlery began to extend in Sheffield, England, and the artizans who made the best articles were naturally those who were most skillful in manipulating the steel used. At first all the steel was imported from Germany, but after a time the more enterprising makers of cutlery began making their own steel, or it was made by parties in the district who went into the business. As the fame of Sheffield cutlery spread and business increased, a rivalry arose in the art of steel making. The improvements effected were not remarkably great and were achieved principally by skillful selection of good iron, but a steel was produced which satisfied the requirements of ordinary cutlery.

There was, however, in the district a clock-maker named Benjamin Huntsman who was very much dissatisfied with the clock springs made from the best kind of steel to be procured, and he began to experiment with the view of producing a better article. He was very intelligent, ingenious, something of a chemist and persistent beyond measure. His efforts to improve the quality of steel were carried on for many years before they were rewarded with success. Whether by reasoning or by accident it is not known, but he conceived the idea of cutting up pieces of the very best blistered steel into small pieces and melting them in a crucible. No crucibles had ever then been made that would stand the intense heat necessary to melt steel, but by patient effort Huntsman succeeded in making sufficiently satisfactory crucibles and melting the steel. The success was achieved on the altar of many failures, but the results obtained entitle Huntsman to an elevated niche among the heroes of industry. The invention of cast-steel was second in importance to no previous event in the world's history, unless it may have been the invention of printing.

Huntsman used his marvelous steel for a time exclusively for purposes connected with his own business. After a time he became convinced that cast steel would be valuable for the cutlery trade of Sheffield. He offered it for sale to the manufacturers of cutlery, but they refused to use it because it was more difficult to forge than the softer steel in use. Failing to find a market in his native country, he sent specimens of the cast steel to France. There it was patronized with avidity and used for the manufacture of all kinds of cutting tools. Its merits were so quickly recognized that French hardware makers bought all the cast steel which Huntsman could make, and pushed him to extension of his manufacturing facilities.

The fame of the French cutlery made from Huntsman's steel spread rapidly, and it soon came to pass that the Sheffield cutlers found out that they were being beaten by steel made in their own town. Their action in this emergency was characteristic of the unscrupulous grasping so frequently observed in trade competition. They did not propose buying Huntsman's steel and trying to beat the French in a fair way, but they appealed to the government to prohibit the exportation of Huntsman steel. They failed in this contemptible scheme, and then they proceeded to try and steal the invention.

Huntsman kept his process of steel making a secret. The work in his foundry was done by reliable, trustworthy men, who were true to the interests of their employer. He was a Quaker and kept in his employ only men of that persuasion and they proved incorruptible although large bribes were offered for the secret of making the new steel. A number of unnecessary operations were performed in the mixing of the material for the crucibles and useless fluxes were employed which lent an air of complexity to the work done. This no doubt aided in preventing the process from being divulged.

The process was kept secret for about twenty years and then it was stolen by a rival steel maker who, dressed as a vagrant, obtained the shelter of the foundry on a fierce winter night. But this made little difference to Huntsman. The secret had been kept long enough to enable him to establish a lucrative business, and he could afford to let the world have the full benefit of his invention.

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Our weekly readings in that fascinating publication, the *Patent Office Gazette*, leads us to believe that the inventive genius of the world is wrestling laboriously over the production of an electrical locomotive. There must be a great many machines of this character protected by letters patent but the right one does not seem to be booming very high above the others. We are not much in the electric business but we have a very decided impression that the persons toiling over designs of electric locomotives are on the wrong track. It appears to us that the advantages of electrical traction are that the dead weight of the paying vehicles may be used and that the heavy addition of weight caused by a locomotive may be saved. If operating electric cars calls for the weight of a locomotive there is no advantage over operating the same train by a steam locomotive and many disadvantages.

Ask for our Calendar. Sent free on application.

# Railway Liars' Association.

Dr. MUNCHAUSEN, Sec'y.

References as to experience and ability required of all candidates.

### Corralling a Bucker.

Out at Pittsburgh one of the roads has a Swede named Murphy, who is night hostler. Murphy's assistant is of the same nationality and sails under the name of O'Rafferty.

One night, not long ago, Murphy had to bring in a big consolidation that had a very leaky throttle and no brake. As he brought her back from the table she didn't seem to want to stop, and Murphy promptly reversed her, then she dove for the turn-table pit.

In the excitement Murphy had neglected to shut her throttle entirely.

Murphy got excited and so did O'Rafferty, who was hopping around on the ground. The engine was diving back and forth from the inside to the outside of the house

"Moike!" yelled Murphy.

"Phwat?" answered O'Rafferty.

"Moike, phwen oi git her insoide agin do yes *shut the doure on her*!"

### Forewarned is Forearmed.

Joe Meadows was one of the hardest drinkers on one of our Western lines once, and the management were "onto him."

Joe could run an engine all right, pulled passenger, and all that, but when he got drunk he took an especial delight in "showing off" by wild and reckless running.

Joe got away one day full of rye, and down the road he pulled half the spikes on the line (so the section men said), he ran over it so fast.

He went into one town eighteen minutes ahead of time—that was the dispatcher's signal that Joe was on a tear.

He telegraphed an order for John Slitam to take the engine at the next station. John was there with a freight train.

Joe sailed into town ahead of time, one leg hanging out of the cab window and his hat in his hand. The conductor stopped him with the air.

John presented his order, and as Joe was too full to read, read it to him "John Slitam, Engineer No. 13. You will relieve Engineer Joseph Meadows and take charge of engine 164 at Davis Crossing, and pull train No. 1 to destination.—W T. B."

"Why the old man's at home, scheen him thish mornin', he never wrote that, when'sh it dated?"

"To-day, an hour ago."

"How'd it get here?"

"Telegraf."

"Tela—oh, yes, forgot about the tel'graf, but sahy, John, if I'd a knowed they was'a tryin' to catch me by telegraf, they'd a never done it—I'd a beat the fastest tel'graf they got, I would. See."

### Just to Accommodate the Conductor.

Jerry Simpson went up onto the hilly division for a few trips last month, and the men up there have a great deal of respect for Jerry's nerve

It's always been the by-word of the men on the hilly division that the men from the river division couldn't get along up with them—hadn't the nerve to run for the hills, etc

Up on the "hilly" the top is at Salem siding—it's down hill for ten miles each way from there.

The first day out, as the old ten-wheeler crawled up Salem grade, the conductor sent a brakeman over to tell "that new feller" when they got to Salem—"put him onto Salem," as the conductor expressed it. All the way up the crew had expressed disgust because Jerry had lost time.

The brakeman was one of that breed who were born languid; he slouched over the cars and got up on the fireman's side for a few minutes, looked at his watch as they passed the first switch, and said to Jerry, who was busy

"Salem!"

"All right," said Jerry

The brakeman dropped off to catch the train further back, and Jerry never shut off; he hooked her back a notch and let her go.

Pretty soon the coal commenced to shovel itself off the tank; some empty flats back in the train were dancing a jig and the conductor and crew were hanging on to the running boards.

They were making express-train time when Jerry said to the fireman

"Wonder where that next hill is?"

Just here the conductor crawled over to the engine.

"Say, man, let up; didn't the gufter tell you about this hill?"

Jerry shut off and dropped the lever into the corner, as he remarked.

"He told me to sail'm, and if this isn't sailing 'em fast enough I miss my guess. What do ye expect—want me to fly?"

### A Professional.

The contrary and argumentative spirit of the average Englishman is very well illustrated by Dr. Williams, of the Baldwin Locomotive Works. The doctor was in Australia with a lot of new engines at one time, and had a little difficulty in getting the men, who were used to English machines, reconciled to the new power.

One old fellow who got a new Baldwin, delighted to kick against the innovation. He didn't like a cab over him; couldn't do as much work with outside cylinders as with inside; plate frames were the only safe things when you got off the track; headlights were no good, etc., etc.

One day the doctor rode with this runner, and asked him how he liked the engine; he at once began to tell the virtues of his old engine.

"Now," said Mr. Williams, "this engine is equalized; don't she ride easier?"

"Well, maybe, but that makes no difference."

"Don't you like to sit down?"

"No; I like to see a man stand up to his work."

"Well, David," said the doctor, "I'll go and speak to Mr. Blank and ask him to put you on the old engine; it is wrong to make a man run an engine he dislikes; besides, there are some young men who think they can pull more cars and take more comfort on the Baldwins."

"Oh, I wouldn't do that, I can stand 'em well enough, but give me an old Bobby Stephenson an' I'll——"

"You shall have her back, Davie. I didn't think how a man gets attached to an engine."

"No, don't go on my account; it's too much trouble; maybe I'll get used to this one, but——"

"I'll go; fact of the matter is I don't think, feeling as you do, you can do our engine justice. You can't, or won't, pull as many cars as a young man."

"I'd like to see the young fellow who can best me, now."

"It's no trouble to me at all, Davie."

"Say, Mr. Williams, now you know I'm an old kicker. I don't mean half I say; this engine is better than the old one; more comfortable and all. Don't you ask to have me taken off, and I'll bet you nothing on the line will do more or better work than the Baldwin."

### A Problem in Arithmetic.

"One day last fall," said Traveling Engineer Poole of the Nickel Plate, socking in his breath with that of a perfecto, "our pay car dropped anchor in the yard and an anxious crew boarded her. One of the first men at the window was a green French fireman we had, and as it came his turn he smiled on the paymaster and said.

"Good avenin' till ye, sorr, have ye a bit ave a check for me?"

"Whose roll are you on?"

"Divel a roll is there on me, de'ye moind, 'oim assistont to the engineer."

"What's your name?"

The fireman took a look at the questioner, and then said, without catching his breath

"Pat Maa-haney, 'oim firing for Jimmie Killduff on the forty-foure, made noine days on construction, wan day on pile driver, siventeen hunder miles on way-freight, owe foive dollars and twinty cents for board, and going out on nineteen—ye's can figger it up yoursel'."

### An Independent Boarding House.

When the Prairie Midland was first run out into Dakota, the trainmen found very thin feeding between terminals, and provident providers invested in big lunch buckets. It was lunch on cold victuals for days at a time, and we were all very glad of any chance to get a mess of hot coffee and a warm potato.

A few rods from the water tank, at Muddy Creek, Tim Maloney, the section boss, had put up a very decent shanty where his wife lodged and boarded the section hands. This was provisioning station for many a hungry wayfarer, and it came to be a regular thing for the crews of certain trains to take their meals there. But the accommodation was given under protest. Mrs. Maloney had no taste for keeping a restaurant. She was noted for her freedom of speech, and the men who wanted to get their meals there regularly had to be on their good behavior. Mrs. Maloney gave lessons in self-repression to some of the men who never had learned to restrain their tongues before

People who knew Conductor Phil Nevans were not surprised that he was the first to get fired out of this boarding house run on the independent plan. Phil was a natural grumbler. He was never happy unless he was abusing some one or finding fault with things generally. The boys called Phil the shadow kicker.

The name originated in this way Phil was always in hot water with his brakemen There was a brakeman on the road called Sam Ramson, a good man but a little wild, strong as a Rogers pony and as free in his talk as Mrs. Maloney.

Well, Trainmaster Mission put Ramson on as hind brakeman with Nevans. They made one round trip together without overt acts of disagreement, but the next trip Nevans came out of the caboose at Greenville with a black eye and an unusually fat nose. How the difficulty had arisen and been settled no one was informed, but Phil was ever after particularly choice in the language he used toward his hind brakeman. When Sam was questioned about the marks of conflict on Phil's face, he answered that Phil got mad and tried to kick his shadow, and knocked down a coupling-pin on his nose.

Phil was not improved in his conversation toward others. One day he sat down at Mrs Maloney's table, and on the viands being brought in remarked "Hash! hash! Hash is good for hogs."

Mary Ann, who helped her mother and acted as waitress, said nothing, but departed for the kitchen, and presently Mrs Maloney walked into the dining room. "Phil Nevans," she exclaimed, trembling with suppressed excitement, "ye was sayin' that hash was good enough for hogs. Indade, Phil, in that case, hash will suit you very well. It will be the kind of vittals you will like. Take yer fill, but never come into this house again."

### Examinations.

The practice of examining firemen and brakemen before promoting them is greatly on the increase, remarked a traveling engineer at the last meeting of the Club. There are now few well managed railroads where it is not the rule to find out what men know about the business before putting them into the responsible position of locomotive engineer or of conductor. There was much opposition to examinations for a time. Ridicule and abuse were heaped upon book-learned men, but the men who had obtained book information in their business, in addition to the teaching of experience, were so much superior to the man who had the experience alone that there was no going back to the old plan.

We have examined the men for years with the very best results. Sometimes there are funny answers given to questions. In answer to the question "What is the dome for?" a would-be engineer answered "to keep the smokestack from being knocked off by the bridges." Another was asked, "What is a brace?" and answered "a full drink." One fireman told that the purpose of parallel rods was to keep the driving-wheel from flying apart, and another believed that the stand-pipe was put in to keep the engine from roaring.

Brakemen are not behind firemen in curious answers. One said that the purpose of a triple-valve was to trip the couplings when the train parted, while another demonstrated "train rights" to be the right to stop and eat any time the conductor was hungry. The brakeman probably spoke from experience who answered that the principal duty of the hind brakeman was to waken the conductor. He was not much further out than the candidate for a higher position who was asked the question, "What would you do if your train was running away on a grade?" answered, "signal the engineer to put on the steam-brake."

When people are under examination they are naturally nervous and often answer at random. School examination papers are full of funny blunders like that of the boy who was asked the meaning of a Papal Bull and answered, a sort of big cow, that does not give milk

### Have You Any Interesting Old Tickets or Time Cards?

It will be remembered that the Department of Transportation Exhibits of the World's Columbian Exposition some months ago appointed Mr George De Haven (General Passenger Agent of the C. & W M. and D L. & N roads), to make a representative collection of railway and steamship tickets and passes. It is desired especially to secure, by gift or loan, such tickets, time-tables, maps, etc., as have a special historical value. Large numbers of these are doubtless in existence, in the hands of collectors, or of those men or their descendants who were identified with the railway or steamship business during the first half of the present century It is hoped that this paragraph may reach the attention of many such, and that they will at once communicate with Mr De Haven on the subject. Suitable acknowledgement will be made and the best of care given to such loans.

Information as to the existence of such relics and whom to apply to for them will also be gratefully received Mr De Haven's address is Grand Rapids, Mich.

We are in receipt of a letter from Drifton, Pa., saying that the men behind the many-wheeled locomotive mentioned by Mr. Marks in the last issue, had sold some stock to a grocer there Our correspondent advised the stockholder to buy stock in the wheel foundry that got the contract for making the extra legs.

### Improved Pump Governor.

Two sizes of the improved pump governor are supplied, which differ only in the lower portions to which the steam-pipe connections are made. The 1-inch governor is intended to accompany the 9½-inch pump, which has 1-inch steam pipe, and the ¾-inch governor is intended to be used with the 8-inch pump, which has ¾-inch steam pipe. A description of one, therefore, applies to the other.

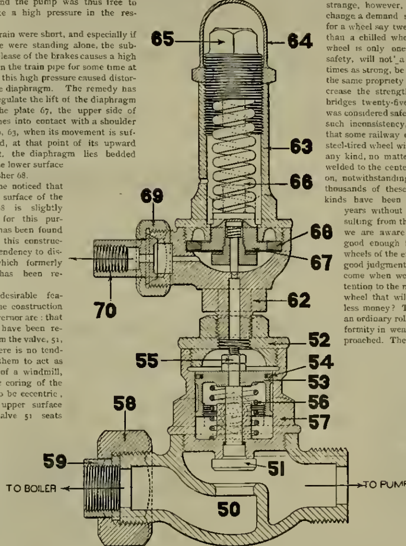
The chief difficulty which has existed hitherto has been the distortion of the diaphragm beneath the plate 67, which occurred when the brakes were a long time applied and the pump was thus free to accumulate a high pressure in the reservoir.

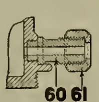
If the train were short, and especially if the engine were standing alone, the subsequent release of the brakes causes a high pressure in the train pipe for some time at least, and this high pressure caused distortion of the diaphragm. The remedy has been to regulate the lift of the diaphragm through the plate 67, the upper side of which comes into contact with a shoulder of the cap, 63, when its movement is sufficient, and, at that point of its upward movement, the diaphragm lies bedded against the lower surface of the washer 68.

It will be noticed that the lower surface of the washer 68 is slightly rounding for this purpose. It has been found that, with this construction, the tendency to distortion, which formerly existed, has been removed.

Other desirable features of the construction of this governor are: that the wings have been removed from the valve, 51, so that there is no tendency for them to act as the arms of a windmill, should the coring of the passage 50 be eccentric, also the upper surface of the valve 51 seats against the case 57 when the valve is in its upward position, so that no steam or oil can be forced up into the chamber and blow out of the exhaust port 60. This permits a reduction in the length of the stem of the valve 51 and the tube through which it extends, as was formerly necessary where the length of such tube and stem was depended upon to prevent the entrance of steam into the chamber above. Also, that the piston 53 is much longer and is kept tight with much more certainty than in the former construction.

Another feature which is perhaps worthy of attention is the fact that this governor has a cap, 64, as a part of the check-nut which screws on to the adjusting screw 65, and so avoids the conspicuous attention which the unprotected adjusting nut of the old governor called to the fact that that was the place to adjust the governor. One principal trouble in the past has been, that engineers have been in the habit of adjusting their governors to suit their own ideas. The air connection to this governor must be made to the train-pipe with the engineer's valve having an excess pressure-valve, and to the main drum with the new valve, shown last month.




### On Car Wheels.

By Steel.

It is somewhat remarkable that the railway systems of the world were developed on such different lines in the matter of wheels, those of this country being of the solid cast-iron type, while those of England and the Continent were composite or tired wheels. It might be said that this was owing to the fine quality and abundance of our charcoal iron, but this does not fully account for it, for there was plenty of just as good charcoal iron made on the Continent of Europe during the past fifty years. Hence, it must be due more to the matter of cheapness and the lack of any governmental supervision, allowing all railroad officials to follow their own bent in matters of construction and equipment. Certain it is, however, that the cheap chilled wheel assisted greatly in the rapid development of our railroads, and it is an important factor to-day in the problem of cheap freight rates. It can also be said with confidence that the chilled wheel, when properly and carefully made, is only one remove from entire safety for passenger and locomotive service, particularly that of a few years ago. Even now at least one of our great railways is still using chilled wheels largely under passenger equipment. Hence, it cannot be said they are unsafe. The record of the chilled wheel, as far as accidents are concerned, considering the enormous number that have been put in use, practically without inspection or test till within a very few years, is, to say the least, extraordinary, and the public certainly have no quarrel with them. And, for freight service wheels, it is doubtful if any other metal will ever supersede chilled iron, as it is difficult to imagine how we could get a cheaper material for the service rendered. Eight years is now considered the average life of a chilled wheel under even heavy freight cars.

The value of a 33-inch wheel being, say, $8, and when worn out, as scrap, $4—we have $32 as the cost of the wheel service for a freight car for eight years, or $4 per year.

But this is the age of steel, and it is natural with the increasing weight of equipment and higher speeds that steel wheels in some form or other are gradually displacing chilled iron wheels for locomotive and passenger service, both on account of safety and economy. It seems strange, however, that in making this change a demand should have been made for a wheel say twenty-five times stronger than a chilled wheel. Now, if a chilled wheel is only one remove from entire safety, will not a steel wheel, say five times as strong, be absolutely safe? With the same propriety we might as well increase the strength of all iron railway bridges twenty-five times beyond what was considered safe. As an illustration of such inconsistency, it may be mentioned that some railway officials will not use a steel-tired wheel with a cast-iron center of any kind, no matter whether the tire is welded to the center or shrunk or bolted on, notwithstanding the fact that many thousands of these wheels of different kinds have been used for years and years without a single accident resulting from the cast-iron center that we are aware of. Yet cast-iron is good enough for the large driving-wheels of the engine. Does this show good judgment, and has not the time come when we should direct our attention to the making of a high-grade wheel that will give more wear for less money? The chief trouble with an ordinary rolled tire is lack of uniformity in wear as the center is approached. The first, say, ¼-inch gives good service, the next ¼ gives less, and the next still less than the second, and so on till the center of, say, a 3-inch tire gives comparatively few miles per unit of reduction as compared with the outside. This is inherent in a rolled tire. Hence, it would seem that we must look to a solid cast steel wheel to get better wearing material, *i. e.*, material in the unforged state, which will not only give better wear than a tire in the beginning, but will continue to give the same service per unit of reduction till the rim is worn out. It might be said that improvement does not lay in the direction of a harder material, as a rolled tire, which is much softer than the chill of a cast-iron wheel, will outwear in the same service and before the first turning from two to three chilled wheels, but it must be remembered that chilled iron will not stand both heat and abrasion, and that the moment chilled iron is heated by the action of the brakes the surface structure is broken up and disintegration follows rapidly. While the comparatively softer material in the rolled tire will give much more service than chilled iron, it is very certain that a harder and more dense steel will give still greater service.

As is well known, great progress has been made in casting steel in the past few years, particularly in Europe, and unforged projectiles have been made to stand the shock of piercing through armor plate that seems almost incredible; a 9.2-inch projectile having penetrated 16½ inches of wrought iron and passed 8½ inches into another plate behind, without breaking, and a 6-inch shell has been fired through 8 inches of wrought iron without breaking—both unforged, or just as they came from the mold, except for annealing and treating. If unforged steel can be made to stand such shocks as these, surely we should be able to cast a solid steel wheel free from strain and blowholes, possessing better wearing qualities than any tires made to-day, and of course cheaper at the same time. Hadfield's manganese steel, for instance, while it has not so far been used for regular railway wheels, has shown extraordinary wear in mine car wheels, where they have been spragged (slid) for miles down heavy grades. It cannot be said that we do not need a harder material for better wear in car wheels, and in all probability this can be obtained better and more cheaply in the unforged state, *i.e.*, in a solid cast wheel, than with a rolled tire and a center.

At least 25% of the railway wheels used on the German railways are solid cast steel, and have been for more than twenty years, and some of the solid wheels that have been made and used in this country strongly indicate what should be done in this direction when undertaken by skilled and experienced steel founders.

That considerable prejudice exists against cast-steel wheels is undoubtedly true, and it has been caused by faulty material due to lack of experience; but this feeling will promptly give way when it can be shown that no ground for it remains, and, judging from what is now being done, this may be at no far-distant day.

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The Sheffield newspapers say that there is little doubt that the Admiralty will use the Harvey armor plate in new war ships. The final decision will be considerably influenced by the latest experiments, but as the Sheffield *Telegraph* frankly admits, it is clear that so far the American invention has achieved the greatest success in armor resistance to projectiles ever known. There is to be another trial in England for the purpose of confirming the first impressions as to the value of the process. The Pennsylvania Railroad Company are investigating the suitability of Harvey treated steel for various railroad machinery articles, including tires.

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We have been surprised to find by conversation with a man generally well informed, that he was under the impression that copies of patent papers were to be obtained only by the patentees. As others interested may be laboring under the same belief, we would inform them that a copy of any American patent may be obtained from the Commissioner of Patents, Washington, D. C.

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The Lake Shore & Michigan Southern Railway people have decided to equip one of their largest roundhouses with the Smith fire kindling apparatus. This device is making its way steadily into favor. We do not remember of any improvement that is more urgently needed. The prevailing method of raising the steam in locomotive boilers by means of wood, is expensive, dirty, slow and dangerous, on account of the piles of firewood that must constantly be stored beside the engine houses. The cost of kindling a good coal fire by the Smith invention is small and the work is done in a sensible fashion.

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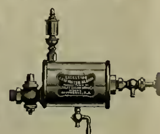

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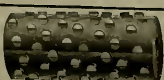

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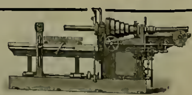

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### Who Knows the Best Way to Lay Out Eccentric Keyways and Properly Locate Them Before Wheels Are Put Under Engine?

*Editors :*

Have you ever come across a shop on this continent where the eccentric sheaves of locomotives are keyed on in their correct positions in the wheel shop prior to their coming in the erecting shop to be placed under the engines? We used to do it on the M S. & L. Railway Works at Gorton, (Lancashire, England). If you have, I should like a description of the method adopted. F. L. WANKLYN,

G. T. Works Manager.

*Montreal, Can.*

### One Run in Ireland, Where They "Biled the Wather" While Running.

*Editors .*

I am much obliged for the copy of your paper containing description of our works and those at Crewe, by Mr. Hill. I served my time at Crewe and was on the L. & N for two or three years after.

The inclosed cutting from a Cork paper will show that we do manage to "bile the wather" a little, while running, sometimes

"An occurrence which caused much excitement took place here to-day. An American gentlemen, who had booked a saloon passage in the White Star liner, Teutonic, for New York, named Mr J. S. Piza, of the firm of Messrs. Piza, Nephews & Co., dry goods merchants, New York, left London last evening by the limited mail, so as to catch the Teutonic here to-day. On arrival in Kingstown this morning, his luggage, through some cause or another, got astray, the result being that he missed the mail train at Dublin. This was a most serious matter for Mr. Piza, inasmuch as he had most important business matters to transact in New York on the 21st inst, on which day the Teutonic will be due there. Without much thought the enterprising Yankee arranged with the Great Southern & Western Railway Company to run a special engine with a carriage attached, to Queenstown for the sum of £50, and at 9.25 A.M. a powerful engine with its one passenger sped away from the Kingsbridge station on its long journey of 180 miles, at the rate of 55 miles an hour, which speed it maintained throughout The traveler left nothing undone to secure his chance of catching the White Star liner. He offered the engine driver an unlimited sum if he reached Queenstown within a certain time, and wired before he left Dublin to have a steamer ready to chase the Teutonic. Never before did a train travel as rapidly in Ireland; it broke the record between Dublin and Queenstown and accomplished the distance in the rapid time of three hours and twenty minutes. At 12.55 Mr. Piza alighted, and his luggage was rushed across to the Deep Water quay to the powerful Clyde steamer, Flying Fox, lying in readiness. All being on board the hawsers were cast off, and five minutes later the Flying Fox was chasing the big ocean liner out the harbor. Amidst much excitement, crowds on shore, as well as on the Teutonic, watched the result of the chase. The go-ahead American desired to catch his ship, for which he made such a bold race. His efforts were rewarded by boarding the Teutonic before she had reached Roche s Point, amidst much jubilation amongst his fellow travelers, and soon afterward was out on the Atlantic on his way to Sandy Hook."

The actual distance is 177¼, and the time was 3 hours 31 minutes, running speed, excluding signal stops and two stops for water, 54 Engine, 6-foot 6-inch, four coupled, 17-inch by 22-inch cylinders, small express type, same engine went through. There is nothing very remarkable about the speed as the load was light, (one carriage and one van, about 25 tons) but we had to find an engine at a moment's notice, and as there were already three engines with express trains on their way to Queenstown, we had to take the first we could get, and this was one due to work a slow train and not used to fast and long runs, so I think engine and men did very well.

Best part of the run was 62¼ miles in 65 minutes, start and stop. The offer of unlimited gold to the driver existed only in the fertile brain of the reporter.

H. A. IVATT.

Locomotive Supt. Gt. Southern & Western Ry. of Ireland.

*Inchacore, Dublin.*

### Faith Cure for Engine that Slips Shut Off.

*Editors :*

I see inquiry made again about engines slipping after being shut off. In my experience of over twenty-one years on an engine, I never had it occur until within the last six months. I had run the engine three months before she made the first attempt to get ahead of herself, and she did it for several trips when I shut off running fast.

I have been asked to account for it, but won't be positive that I have. About that time the engine had settled so that she was not properly equalized; had the engine raised some on engine trucks and also on different driving springs. I did not have this done to stop the slipping, but she has not slipped any since I don't know whether this has solved it or not; am waiting to see. The enigma is U P. build, 18 x 26, 5-foot 10-inch wheel.

*Plattsmouth, Neb.* HANNEI.

### Dangerous Axles—What Causes Their Weakness.

*Editors .*

I have a word to say about your article on "Dangerous Axles," and your comment thus "And is a good illustration of the ultimate result of the race for cheapness, etc." Now, I'll venture the assertion that those axles, every last one of them, were made by piece-work. Yet your "senior philosopher," at least, is an advocate of that system, and every mechanical publication in the land teems with plans, schemes and ideas to produce cheap results. It seems to me that justice to all concerned would call for a little more liberality in this respect, good work cannot be insured where a ridiculously low limit of cost is established, and nothing tends to bring about this result more than the piece-work plan. I furnished your office some time ago, with an instance of cheap, quick work that came under my observation, where a new engine just from the builders, was completely overhauled before she ever made a trip; but to return to the axles; $8,000 (the cost of the accident) would have bought a good many first-class axles.

There is no doubt but that many of our most frightful disasters and sacrifices of life have been caused by defective and cheap workmanship. The laborer is worthy of his hire (if he is not, fire him and get one who is), and the patron of a railroad has a right to expect that the car he rides in has good wheels and axles under it, and that its weight will not crush down some fine-appearing bridge whose timbers or irons were so cheaply procured as to preclude the possibility of their being good. I was glad to see you take the position you did in the above case.

W. H. WESLEY.

*Nashville, Tenn.*

### Railroad Shop Kinks.

*Editors*

One can scarcely enter a railroad repair shop and look about without finding useful, and to him at least, new "kinks" and ways of doing work, and my experience in the E. T., V. & G shops at this place has been no exception to the rule, and I would like to tell the machinists who read LOCOMOTIVE ENGINEERING about one or two "kinks" which to me were new, and which I know will be found very useful by those who put them into practice. Possibly these kinks may be familiar to many, but I hope that they may be new to some, and as they can be made at very small cost, I think it will pay those who have not used them to do so. One of the first things which attracted my attention was a simple contrivance for holding work to a planer bed, and was made as follows The small wrought-iron or steel pieces which are commonly driven into the square holes through the bed, and used as

End View

Fig 1

snubs, are drilled through near the top ends at an angle of about 30 degrees, and tapped ⅝-inch, into these holes steel bolts having large centers in their thread ends are fitted loosely enough to be turned easily with the fingers. The only other things necessary are several pieces of ½-inch round steel of various lengths pointed at each end.

Lay the piece to be planed flat on the bed with one end resting against a snub in the usual way. Then, where the work to be planed is not too long, place two of the iron blocks containing the steel screws into holes in the bed at each side of the piece to be planed with the screws pointing toward the work. (See Fig. 1.) Then opposite each screw make a small center-punch mark in the work near the lower surface and insert one point of the round steel pieces in each, placing the other points in the large centers in the screws. By tightening the screws the work is forced solidly to the planer-bed, and against the snub. The work cannot move when held in this manner, and I have seen a ¼-inch cut taken from a piece of wrought-iron thus held, and the work not budge from

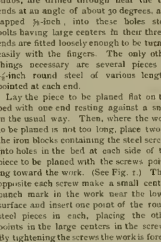



Fig.2

its position on the bed. When it is desirable to finish all sides of a piece of work, the center-punch marks in the sides already planed need not be made deep enough to prevent hammering them over after the planing is done, so that when the work is finished they cannot be seen. This manner of holding work to a planer-bed was introduced here by a former master mechanic, and to my mind is a useful kink

Another neat thing noticed here is an arrangement for pressing in driving brasses, bushings, etc., to make which the best plan is to have a cast-iron base made, about 18x24 inches and 3 inches thick, with two holes, each 2 inches square, bored through it. These holes should be about 18 inches apart Into these holes fit the lower ends of a 2-inch-square bar of steel, bent into the form of *A*, Fig 2, fasten the ends under the casting by putting through ¾-inch steel pins. The height of the top of bar *A* from the base must be determined from the thickness of the driving box, length of driving brass and length of the jack to be used. Place the driving-box with brass entered in it on the base with the brass directly below the center of the loop in bar *A*. Then place the base of a common 20-ton hydraulic jack on the upper end of the brass, with the jack-head in the loop in bar *A*, and you are ready for business. It is a good scheme to connect a hydraulic pressure gauge to the lower chamber of the jack, or, in case you have no gauge, connect to it a common small pop valve set to the pressure at which you wish the brass to go in. This simple, cheap tool can be put to a great variety of uses and very soon pays for itself

L. C HITCHCOCK

*Selma, Ala.*

### A Neat Way to Fit Up a Room for Educational Purposes.

*Editors*

I have been a reader of your valuable paper since May, 1888, and have watched it grow from a small 16-page paper to its present size, and predict for it a future not equaled by any mechanical paper published. The hints dropped by it have been of great value to myself and I presume many other readers.

The Enginemen's Mechanical Association of North Platte, Neb., was suggested to me by reading your paper, and as I have not heard of any other association exactly like it, perhaps you might like to give your readers an idea of what we are.

The Union Pacific, through Master Mechanic J. H. Manning and Division Foreman M. K Barnum, furnished us a coach and fitted it up with tables and shelves In it we have one of your valve models, also models of different injectors, lubricators, metallic packings, Westinghouse and New York brake and triple valves, pump governor, Leach sanding apparatus and other engine appliances We subscribe for several mechanical papers, among them LOCOMOTIVE ENGINEERING. We meet as often as we can and exchange ideas, and I believe it has been of great benefit to most of its members

W J. STUART

*North Platte, Neb.*

### Some Improvised Milling Methods.

*Editors .*

Having a small gear to cut with V-shaped teeth, the teeth being on an angle to act as a worm gear, and having no milling cutter with the angle of 30 deg. on each side of the center of the cutter, had to use one having the right angle but having the front face straight, as shown in the cut, Fig 1.

So, turning the milling table on the proper angle to bring the teeth right for the worm, the table was brought forward until a line drawn through the center of the angle of the cutter was in line with the center of the work, this is shown by the dotted line in the cut.

Now it will be seen that all necessary feeding into the cut can be done by simply raising and lowering the table (with the work on it between centers) and that this will bring the teeth with their angles correct in relation to the center line of the gear wheel.

This method often proves useful where the variety of cutters is limited or where special work requires some maneuvering to accomplish the desired end.

The other cut, Fig 2, shows a method adopted to cut into a piece of finished brass work in order to show the internal arrangement, and the work was first attempted with a cutter of about the required angle but this was slow work and also cut

much more brass into chips than was necessary, so a saw with coarse teeth, for metal work, was put on the milling machine spindle and the work turned to the right position for the first cut. Then, after this was cut through from end to end, the work was turned to the right position for the other cut and the work was done in a very short time, besides saving the brass cut away in a solid piece, or rather pieces. I do not think the metal saw is used enough for

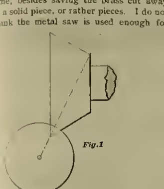


*Fig.1*

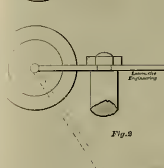
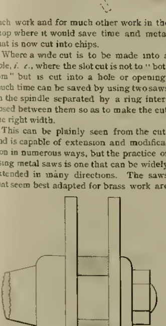


*Fig.2*

such work and for much other work in the shop where it would save time and metal that is now cut into chips.

Where a wide cut is to be made into a hole, *i. e.*, where the slot cut is not to "bottom" but is cut into a hole or opening, much time can be saved by using two saws on the spindle separated by a ring interposed between them so as to make the cut the right width.

This can be plainly seen from the cut, and is capable of extension and modification in numerous ways, but the practice of using metal saws is one that can be widely extended in many directions. The saws that seem best adapted for brass work are



those of coarse or few teeth and whose sides are concave from the very point of the teeth to the center, which prevents any binding on the sides if cared for in a half decent manner. The coarse teeth can be readily sharpened on any ordinary emery wheel or even grindstone if it is respectable shape, and there is more room for chips between the teeth. These are not expensive and will prove more useful than those who have never made use of them will imagine, while their saving in metal and time when they can be successfully used will be appreciated as their usefulness becomes known.

There is room for improvement in the ordinary milling machine vise both as to capacity and adjustment after the work is fixed in the jaws. Of course you can get anything you want in a milling machine vise, but most of the improved ones are special.

I do not want anything fancy in the vise, none of the ball and socket arrangements for milling around corners or anything of that kind, but one capable of being turned in a horizontal plane as well as having considerable adjustment in a vertical direction for use in milling surfaces with angular faces. These can be made without much additional expense and would, I am sure, be appreciated in the job shop where angles of all kinds, to say nothing of corners, slots, etc., have to be done and often with improvised cutters and rigs for holding the work as well. There are many who still persist in using the planer for all kinds of surfacing work but the milling machine is bound to hold its own on certain classes of work and the sooner this is realized the better for those who have work for them.

But above all things, remember the ever prevalent warning of a well known firm and "keep the cutters sharp."

For brass work the saws of about 5-inches diameter will be found about right for most work, although special work requires special tools. FRED H. COLVIN.

*Worcester, Mass.*

## Something for Our Air-brake School.

*Editors:*

Some time ago we had occasion to explain to an air-brake man something of the calculation of leverage, and the first difficulty that was encountered was a complete lack of knowledge of proportion; so we began by inculcating the first principles of this important branch of mathematics, after which we made an adaptation of an old rule for proportion which will apply to almost any problem.

It was as follows:

Let the letter $x$ represent the fourth term, or unknown quantity.

Put down for the third term the quantity that expresses the same thing as the answer required (for example, if $x$ or the result we are seeking is to be in inches, the third term must also be inches, and if $x$ is pounds the third term must then be pounds).

After this arrange the two remaining quantities in the problem as the first and second term respectively, putting the greater one down as the second term if $x$ is to be greater than the third term, and putting the lesser one down as the second term if $x$ is to be smaller than the third term.

If in the problem to be solved all that we have for the third term (that is, if the only given quantity that is of the same kind as the answer required) is the *total* length of the lever, then the pull or strain on the *center* hole must come as the first term. If the strain on the *center* hole of the lever is the third term, then the *total* length must be used as the first term.

To solve the proportion, multiply the second by the third and divide by the first, and the result will be the fourth or $x$, which is the answer required.

It will be immediately seen by those familiar with mathematics that this rule is based on Euclid's test of a proportion, and when understood can be applied to any kind of a lever.

To illustrate, let us take an example.

We have a six-wheel truck car weighing 60,000 pounds, the middle wheel of each truck having no brake attached. Hodge system used; see sketch.

Truck levers are 8 x 24 inches; equalizing levers, 18 x 18 inches.

Total length of the cylinder-lever, 24 inches.

Let us find the proper position of the center hole in the cylinder-lever, or in other words the length of its two arms.

As the middle wheel on each truck does not have any brake at all, we must subtract the weight carried by those wheels, which being one-third of 60,000, leaves only 40,000 pounds weight carried by the wheels against which the brake is to act. Now, to avoid danger of sliding wheels we must subtract 10 per cent. from this, which will leave us 36,000 pounds as the total braking power of the car. To find the pressure on each beam we divide this by 4 as there are four beams, and this gives us 9,000 pounds as the pressure on each beam. Now we come to the application of the rule. Put down $x$ as the fourth term. For the third term we must have some quantity that expresses the same thing as the answer required, and as the answer in this case is to be pounds, or the strain at the top end of the brake-beam lever, 9,000 will be our third term.

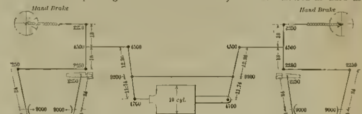
According to our rule, if the strain on the *center* hole of the lever is the third term, then the *total* length must be used as the first term. In this case 9,000, which is our third term, is the strain on the center hole, so we must place the total length of the lever, 32 inches, as the first term. For the second term we must use the shortest end or arm of the lever, as the strain at the top will be smaller than the strain at the lower end, as the upper end is of course the longer.

Our proportion then reads as follows

$32 : 8 :: 9,000 : x.$

Multiplying the 9,000 by 8 and dividing by 32, we have as $x$, or the strain at the top end of the lever, 2,250 lbs.

Since the equalizing lever arms are equal, each being 18-inches, the strain at the center hole of the equalizing lever will be




twice the strain at one of the ends, or 4,500 lbs., and this is transferred to the cylinder lever at the outer end. We have now 4,500, the strain on the outer end of the cylinder lever; 4,700, the strain at the inner end or next to the cylinder (in other words, the total braking force of the cylinder, a ten-inch passenger), and the total length of the cylinder-lever, 24 inches. Now we begin again, according to the rule.

Put $x$ for the fourth term. Since $x$ is to be inches, the third term must also be inches, so 24, which is the only known quantity in inches, we place as the third term. Now, as 24, or the *total* length of the lever, comes as the third term, the strain at the *center* hole, which is the sum of the two strains at the respective ends, must come as the first term. We find this to be 9,200 lbs. For the second term we can use either the pull on the cylinder end or the other end of the lever, but we must remember always, in applying the result, that the *heavier* strain always comes at the end of the *shorter* arm. Our proportion now reads as follows

$9,200 : 4,500 :: 24 : x.$

Multiplying the 4,500 by 24 and dividing the product by 9,200 we get 11.74 inches, which is $x$, or the shorter arm of the lever. The other arm will, of course, be the difference between 24 and 11.74 or 12.26 inches.

And the shorter arm will come next to the cylinder because the strain at the cylinder end is the greater.

Some might say, "What is the need of all this work, when a formula could be used?" That is all very well, but it must not be forgotten that if the slightest departure from the standard arrangement is made in making the design, then the formula is useless, and besides this, unmeaning formulas are hard to remember and if a mistake is made in substitution it is very hard to detect. PAUL SYNNESTVEDT.

*Chicago, Ill.*

## Vibration and Crystallization.

*Editors.*

In your January issue Mr. Lottes puts the question. "Now, when you a get a broken side-rod to weld, do you weld it where it was broken, or do you cut a piece out and put in a new one so as to keep your weld from the terminus of vibration?" Assuredly, by all means put in a new center.

He also wishes to know how I would go to work to crystallize a piece of good nail rod or a piece of Norway iron. Repeated hammering will make iron brittle; as an evidence in hammering a head on a Norway iron rivet, if the hammering is continued after the rivet becomes cold, the head will separate or fall off.

As I have stated, repeated hammering will make iron brittle, and brittleness is indicative of crystallization. This is one process of crystallization. Another is, put a Norway iron bolt to hold the riders in a drop-hammer and note the process of crystallization. I have known 2¼-inch bolts to break under the head and in the thread in this manner. Still another case; harden a piece of Norway iron, subject it to a certain process and it will crystallize to a great extent. All minerals, I believe, and the great majority of substances, are capable of undergoing the process of crystallization.

Now, Mr. Editor, with your permission, I beg to quote authority on the subject of soft iron *versus* hard iron. Samuel M. Vauclain, of the Baldwin Locomotive Works, says. "So it is with stay-bolts. The inclination of a good many people is to get stay-bolts as soft as possible. I do not believe in that at all. What I believe in for stay-bolt iron is an iron as hard as you can get it. You want a good, clean iron of good fiber. But you want it as hard as that iron can be made, to allow you to head them up nicely. Iron of this kind will stand a great deal more vibratory action on the boiler than when it is so very soft that you can hammer it up and squeeze it up like putty." Now I hold the same views and the conditions can be applied to side rods, on account of the vibratory action.

I might quote still further to bear me out, but it is needless.

GEORGE F. HINKENS.

*Gladstone, Minn.*

## Taking Centers—Quick Valve-Setting.

*Editors:*

I saw in your last issue some "Wants to know" why centers are taken from the main or parallel rods. I always do this, and my reason is on account of uneven track, as the wheel and rod rise and fall together; as for the lateral, that cuts no figure, but you can only use those centers once, and every time you set your valves you must take the centers over or prove the old ones correct, as main or parallel rod either shortens or lengthens, which would make some difference.

Well, if you stop to think, you will see the stationary mark for the wheel center is the same if you have a shoe forward and wedge back, every time you set up the wedge you carry the wheel forward. Now I claim this, that before setting the valves on any locomotive you should see that the wedges are set up properly and that parallel or main rods are lined up, then take your center and see that your valve stems are the proper length, then proceed with your valve-setting. Get your rocker arms to vibrate equal from center of arm forward and back, then I will guarantee your valves square in full stroke; now cut her back, say to 4 or 6 inches, try your center again, and you will find perhaps a little variation, make the change needed for an equal travel of rocker arm at this point, and I will guarantee your valves as square as any ear can detect.

I always gauge on a valve with the thickness of tin or iron, just the thickness I want lead, then I set my valves so my tram will drop in all center punch marks on the valve-stem on the four wheel centers. Now, I have explained the proper way of setting a valve, but I use the improper way—as all my acquaintances claim. Well, I am a kind of an improper fellow, but I get there all the same.

I set my valves in this way (but it may be hard for any of you to understand), but as I remarked some time ago in this paper, I do not want a foreman who will keep the laborers more than ten minutes pinching an engine around; I want him to be able to instruct the machinists what to do, and then attend to his duties as foreman. It takes a little practice to do this.

Now, do not all get up on your ears and say I am a "nigger driver," but just try and catch on and you will readily see I have not hurried anybody.

In the first place, the foreman sends a machinist to see that the wedges and rods are properly adjusted; if so, then the foreman takes the center on one side, uses the quarter on the other side. Now, you see, he only gets one turn for his wheels. In working in forward motion he puts the reverse lever in forward notch and pinches her back of dead center until the rocker arm moves, then come ahead, catch the dead center, then mark your valve stem on both sides of your engine, then throw the reverse lever back and pinch her ahead until the rocker arm moves, then pinch her back to catch the dead center, then mark both stems as you did in forward motion, then come ahead half turn and proceed as you did before.

I use a single-tram gauge for my valves, the same tram that I use for my wheel centers, so I only handle one tram and use my laborers just long enough to get one turn out of the driving-wheel.

I then divide the marks on valve-stem, this shows you just how much to lengthen or shorten the blades, then you call the machinist and tell him what to do. After he gets through then you go back and see that he has done it.

If you want to change the lead you just stay at the valve-stem with your tram and see that he does it.

If eccentrics are keyed on and you make any change in the lead, you have to take out the keys and offset them—you had better not stay at the stem then—just tell the machinist which way you want the eccentric, lead on or off.

You should always take off lead before you put it on.

Now, Mr. Editor, here is another nut for the boys to crack, and when cracked they will find lots of meat in it.

When an engine comes out new with eccentrics keyed on and are on properly they can be kept proper for a long time, and I will tell you why.

Most all engines of the present American type have a stationary shoe on front jaws, or "horn block" as you choose to call it, the driving-box fits up close against this with the wedge behind it.

As this shoe wears away and you push up the wedge, that carries the wheel ahead, takes lead off the front end of valve and adds to back end. Now if you will pull down the wedge a little below its original place to take up this wear and then line up the shoe, you will find your lead comes back to its proper place and also the blades if they have not been moved since coming out.

E. A. CAMPBELL.

Supt M. P. & Mach., H., E. & W. Texas.

*Houston, Tex.*

## Who Knows?

*Editors:*

Who knows and can tell the points wherein the standard Westinghouse freight triple valve differs from the standard passenger triple valve?

It has been noticed by many that special caution is given that one should not be used in place of the other under any circumstances.

This is for very good and sufficient reasons. The question is, What are the reasons?

An answer to this is requested from all men interested in air-brakes except those employed by the Westinghouse Company, as it is to be presumed that they could answer too easily, knowing all the fine points in their own construction.

PAUL SYNNESTVEDT.

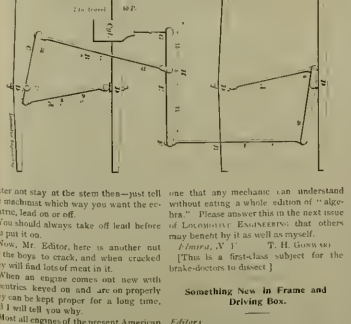
*Chicago, Ill.*

## Strange Brake-Rig for Tank.

*Editors:*

Here is a rough sketch of brake-rigging of locomotive tender that my attention was lately called to by one of the shop men. There are two Cooke engines equipped in this way. I have never seen a brake put up this way before, and do not think it properly designed. Please note the difference of power in the two trucks; you will notice in diagram that rod *B* or pull-rod is coupled at extreme end of lever *E* at *F*, 21 inches from center on front truck, and rod *B* on back truck is coupled to lever *E* at *H*, 6 inches from center, making a difference of 15 inches in the leverage of the two trucks; there is also a difference of 2½ inches in the long and short ends respectively of levers *C*, back and front trucks.

With 50-lbs. pressure and 7-inch piston travel, what will be the difference in brake-power of both trucks? Also give a simple rule for calculating the lengths of rods and levers for a properly designed brake—



one that any mechanic can understand without eating a whole edition of "algebra." Please answer this in the next issue of LOCOMOTIVE ENGINEERING that others may benefit by it as well as myself.

*Elmira, N. Y.* T. H. GONWSKI.

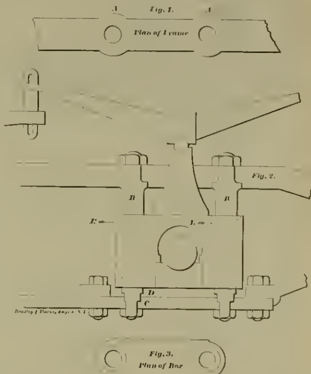
[This is a first-class subject for the brake-doctors to dissect.]

## Something New in Frame and Driving Box.

*Editors:*

The partial abolition of straps and keys being a step in the right direction to simplify locomotive construction, why should the wedges not go also? Some one says, how are we going to adjust the center and get the wheels in tram without the wedge? In reply to that question would say, on the same principle that we put on a solid end-rod. The wear on shoes, and wedges, and driving axle-journals, is no worse than the wear on crank-pins. Now, the question comes up, what shall we substitute in place of wedges?

Inclosed I send sketch of a new style of jaws for the frame. I propose to forge the frame with a swell, *A A*, Fig. 1, also make the frame somewhat heavier in its vertical section; drill accurately, and counter-bore the frame on the under side. Fit in the columns or studs, *B B*, making a good fit both in the hole and counter-bore. The idea of the counter-bore is to




have the shoulder on the stud take part of the thrust of the engine. The binder is drilled and counterbored also. You will notice two shoulders, *C D* on the lower end of the studs, the shoulder *D* is to allow for turning down in making repairs, without changing the fit in the binder. The studs can be 4 inches in diameter, which we will call the maximum. In fitting up new work 3¾ inches would be the best size to start on, as that would give us material in the box for reboring in repairs, when we could put in a set of 4-inch studs. The 4-inch studs can be reduced afterward to 3⅞ inches, and be used for new boxes. Fig. 3 shows top of box. The stud-holes in box should be bored after the brass is in and sides planed. The studs should be case-hardened, put in lathe centers and ground true with an emery wheel. You will notice the thrust is taken up at two points in this style of frame, ditto the wear, as shown by the arrows, *E E*, while in the frame in use at present the thrust is back and forth between the faces of the two jaws. I claim for this frame that it is cheaper to make and keep in repair, than the old style, and when fitted up with good malleable-iron boxes and case-hardened studs, and by a man who knows his business, it will give first-class results. Who speaks first, and what are your objections? Pull it to pieces, and look it over, you progressive men; strap-rod men may say it is no good. The solid end-rod has come to stay, and it wants company and here it is.

This frame is not patented; use it.

W. DE SANNO.

*Indianapolis, Ind.*

## Hardening Tools, Leaving a Soft Center.

The causes that regulate the efficacy of tool steel and the results depending thereon is a subject on which opinions differ.

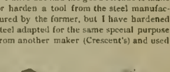
The conditions into which steel can be worked, and the hardness and elasticity it may be made to acquire, are qualities which have been turned to account, and upon these the tool-smith's art and skill depends.

But there is a great difference in steel, and it is only by knowing its nature and construction that any real advance can be attained.

The method pursued in making steel is the same in principle everywhere, yet distinguished variations are produced by different manufactures.

One maker of steel will furnish special grade as to carbon, designed for a distinctive tool, and instruct us to harden at a "high red," whereas the steel of another maker, designed for the same purpose, can be hardened with good results at a "low red."

I have not had the good fortune to make or harden a tool from the steel manufactured by the former, but I have hardened steel adapted for the same special purpose from another maker (Crescent's) and used



a low red heat. I reduced or hammered the steel to a certain degree, and that has a refining effect, at any rate it increased the carbon. Undoubtedly either brand will answer the purpose, but why this discrepancy—possibly a "trade secret."

We also made some bolt-thread cutting-dies out of some of the best English steel—steel adapted for that special [illegible] of work. We handled it in the same manner as we do Crescent's, but learned that we could not apply the same mode of treatment. We were obliged to use a higher heat in hardening and a different color temper.

The one great difficulty to overcome in hardening and tempering tools, particularly long taps, reamers and tools that are long, thin or narrow in proportion to circumference or thickness. Taps, reamers and like tools, above a certain size, can be straightened after they are hardened, providing you retain a soft center, but tools below a certain width or thickness will spring more or less. Heat that is perfectly

even, and water at a perfect temperature, or oil, will not prevent the trouble.

As to the cause I do not wish to presume to know. I only wish to indulge in what might be a probable cause. Is it not possible that the active power produced by sudden cooling affects the molecules or particles, causing them to contract and encroach upon each other? Sometimes it may be a single particle, or it may be a multiple of them, which gives cause to turn or twist the tool out of shape.

Of course, the larger the tool the less the tendency will be to get out of shape, on account of its having more support.

One of the most important and generally used tools is a chipping chisel, and I wish to direct attention to an evil effect (quite common) in dressing them, and that is, hammering them edgewise after the red heat is gone and the chisel has become black, which causes the cutting end of chisel to become foliated or lamellar, causing a shelly fracture which invariably causes the chisel to nip, nick or break off on the corners.

The better way is, before giving chisel the finishing blow and before the red heat leaves, to narrow it, giving proper estimate as to width, and let the final blows be applied to the face of chisel; harden at a low red, and as a result the particles are firmly and closely united with a tenacity that means business.

Not so long ago a special steel with soft centers was especially manufactured for a certain class of tools that required toughness and elasticity on account of the peculiar nature of the work, this is all obviated now, for the reason that steel can be hardened on the outside to almost any desired depth, leaving the center soft and in an annealed state.

The mode of operation is simple. Cool the tool in water, keeping it there long enough to obtain the desired depth of hardness, then quickly withdraw the tool out of the water and plunge in an oil tank for the purpose. It is not possible to say just how long to keep the tool in water before it should be taken out and dipped in oil, as much depends on the size of steel and the temperature of the water. A good way is to take a worn-out tap or reamer and use them as trial pieces, both as to heat and length of time for keeping in water; break a piece off and you will see on examination the consequence or effect; a few trials will put you in line.

GEO. T. HINKENS.

*Gladstone, Minn.*

[The photo illustrations here shown were made direct from broken taps hardened by Mr. Hinkens. As can be seen, the teeth of the tap are so hard that they were easily broken by a blow, while the center is so soft it was drilled. The structure of the metal is plainly shown.—EDS.]

### Brake Experience—A Tender Brake that Went On and Off All by its Own Self.

*Editors:*

While reading the air-brake problems as expounded by some of the readers of LOCOMOTIVE ENGINEERING, I was reminded of a little incident in "air-brake practice" which at the time seemed very mysterious.

Something less than two years ago the writer was firing one of those engines sometimes known as a "Pittsburgh Hog." We had pulled in on a siding, on a warm summer's night, with a train of stock, to await the passage of some "varnished cars," and seated on the ends of ties, alongside of the tank, cooling off, we were surprised to hear the brake rigging moving slowly, and finally the brakes were applied. My first impression was that we had "air-cars" next to engine and that some person was bleeding the train-pipe at some point, but an investigation showed that we had no air except on engine and tank. In a short time the brakes were released, only to set again in a few minutes, and so on, alternately setting and releasing. This set us to hunting with torches for a leak in the train-pipe, but after a careful search we were about to give it up for the time being, when we discovered a bad leak from the joint of the main air-pipe with the main reservoir at the point where it (the main reservoir) receives its supply from the pump. This had been overlooked on account of its being on the side next to boiler, and might easily be confounded with a blow from a mud-plug, stay-bolt, washout-cock or a seam.

Our solution was this. With handle of brake-valve in full release position the main drum forms part of the train pipe, only in greater area, consequently, when the governor shut the pump off, in a short time the pressure was reduced in main reservoir slightly below that in auxiliaries, thus causing the action referred to, and which was soon remedied by a few turns of a wrench.

Another case I think worthy of mention was where two engines were "double-heading," the leading engine handling the brakes, second or helping engine having brake-valve blanked, with service-stop exhaust closed, but no stop-cock in train-pipe below brake-valve. By some means the air-pump on second engine stopped working, pressure became reduced on top of rotary valve, which allowed the air in train-pipe from leading engine to raise the rotary valve sufficient to cause a bad blow at emergency port, thus setting the brakes. After some delay the pump was finally started, and after pumping up more air than was in train-pipe, the rotary valve was of course forced down to its seat. In a case of break-down, however, where the pump could not work, some way would have to be found, probably with a blind washer, to shut off the air from the brake-valve. Would this be considered good practice? If not, would like to know why.

JOHN BRUCE.

*Pittsburgh, Pa.*

### Oiling the Air Cylinder.

*Editors:*

I saw your item in regard to oiling air-pumps. You are quite right in saying that many engineers use too much and the wrong kind of oil in their air-cylinders.

An excellent lubricant for the air-cylinder is a very little lard oil. It don't gum, and keeps the brake-valve working free and easy. Soft soap makes a good lubricant for the air-cylinders, a tablespoonful or so each trip, letting the pump draw it through the bottom suction-valves. I have seen it used in air-pumps under hard service for twenty-four hours at a time, in shop work that would almost burn up otherwise.

Air pumps equipped with metallic packing get very little oil through gland into air-cylinder, but I think very few roads use metallic packing for air-pumps, but it is A No. 1, and saves lots of expense and trouble.

CORY S. CONCANNON.

*Hannibal, Mo.*

### How a Shop Boy Gained the Model.

*Editors:*

The valve motion model was safely delivered here last week and has been set up in my room. Every night since it arrived we have had a picnic in the house made up of shop boys and firemen who come in to see how the thing works, and they are all taken with the plain way it shows the working of the valve motion. We are going to have regular lessons in setting valves and Hiram Williams, who does the valve setting in the back shop, has promised to come and give us pointers.

We all think the model is a dandy and just the thing we want. After we were done working it the night before last, Phil. Moore, who is next in turn to be set up, said that he never understood before how the steam got in and out of the cylinder, but the model shows it clearly.

I have been thinking that it might amuse you to hear about how I contrived to get enough names for LOCOMOTIVE ENGINEERING to entitle me to the valve model. My father was killed when the flyer ran into the washout at Brandons four years ago, and I am only a helper in the shops, so I do not have any money to spare for buying models or anything else. But I have plenty of spare time of evenings and I made use of that to get what I wanted awful bad.

The way I came to know about the model was this. Walt Matthew, who runs the 29 rooms in our house takes LOCOMOTIVE ENGINEERING. He is a good fellow, Walt, everybody knows that, and he said that I might read the paper all I wanted and that I could get one for myself by raising a club. That was how I came to send for club rates. When I got the premium list I was stuck to decide what I should like best to have.

At first I thought of trying for a set of drawing instruments, but I have a set that belonged to my father and did not need them very bad. Then I thought of a clock but I do not expect to be running an engine very soon and there was no hurry for that. I am studying valve motion and the model took me, but I had no idea of getting enough names to get that. I went to work asking everybody to subscribe and showing them the paper. It was uphill work at first, for very few of the men had seen the paper. I began lending the specimen copies you sent to show what a good paper it was and on the first pay-day I got three shop men, seven firemen, two engineers and Mr. Brown, the master mechanic. I did not like at first to ask Mr. Brown. He was very pleasant and said he would like to see all the men taking the paper and would do anything in his power to help me to get subscribers. All through the work of getting the 85 names I have had Mr. Brown's encouragement, but he did nothing except speak a good word for the paper, and that was all I wanted. If he had tried to do any more the boys might not have liked it, and I did not want any form of compulsion to be tried.

All through, my motto has been moral persuasion. The paper itself helped me along, for the men who took it praised it to the others. It is funny to watch the motives that induce some of the men to join the club. Most of them took it because they were convinced that the paper would be worth the money to them, but others took it because they did not want to be considered of the class that take no interest in their business. Some took it because they had seen other men reading the paper and they wished to display equal enterprise. In three months I had got seventy-six names, and then the end seemed to be come. There were nine names more needed to complete the list that would entitle me to the valve model, but everybody had been repeatedly canvassed. Trying for more names seemed like trying to get milk out of a stone. I felt awful bad to be beaten with the prize in sight, but beaten I seemed to be. I made a final turn among the men without getting a single additional name, and then I made up my mind to write to you asking for the money commission on the names sent in. I had written the letter and was going to take it to the letter-box when Walt Matthew came in. I told him how disappointed I was and he offered to make up the shortage. This was very kind, but I would not take any help of that kind, for he had been my best friend in the canvassing.

"Have you tried the train men and the people in the general office?" he asked.

I had not thought of anybody out of the rolling stock department taking the paper and said so.

"Go right to the general manager," said Walt, "and take in the superintendents, train master, conductors and brakemen. You will get subscribers among them all."

I hated to go among these people, but after thinking it over I concluded that they could not eat me. I went to Mr. Brown and he gave me a line to the general manager, so I started out in fear and trembling. In one afternoon I got fourteen new names and since that have obtained eleven more, and there are others who will come in.

That is how I got the model and I am going to get a good gold watch next year and some pocket money besides. Getting subscribers to a club is a picnic when your heart is in the work.

*Chicago, Ill.* ROBBIE WILSON.

### Traveling Engineer's Puzzle(?)

*Editors:*

Traveling Engineer, in his "Lame Exhaust Puzzle," says that he examined valve motion thoroughly, then in his answer states that the lame exhaust was caused by "loose lifting-arm on tumbling-shaft." Is not the lifting-arm a part of valve-motion? This must be the same traveling engineer that gave the "Alex Cunningham Puzzle" some time ago.

*New Castle, Pa.* P. W.

[We have several letters similar to this.]

### Answer to "A Blow; Where Was It?"

*Editors:*

The engine had the long curved eccentric blades, and the right go-ahead one had elongated or stretched ⅜ of an inch. The valve had ¾-inch lap, and the steam-chest was long enough to permit the valve to open the exhaust port in traveling back. In springing there was not a crack nor flaw opened up in the rod.

C. G. BRITTINGHAM.

*Danville, Ill.*

### That Engine that Limped when at Work.

There is a liner riveted on the inside of the smokestack and has become loose at the bottom end. Now, so long as the exhaust does not go under this liner it gets out of the stack to the air, and engine sounds all right. But sometimes the exhaust goes under the liner, and the exhaust is not heard, so the engine sounds lame.

THE ANSWER.

*Editors:*

Engine has loose cylinders. This only affected her when she had a hard pull.

*Vandalia, Ill.* TOM.

### That Puzzle Diagram.

*Editors:*

I should say that puzzle diagram was caused by a case of bad valve-setting.

*St. Louis, Mo.* H. E. MATHEWS.

*Editors:*

I guess that puzzle card was caused by slack in the valve-gear, perhaps the yoke; evidently the valve had no lead.

*Atlanta, Ga.* J. GOKES.

THE ANSWER.

*Editors:*

The defect in card was caused by tapping the holes for indicator pipe into the cylinder in such a way that the piston, when at end of stroke, shut off the communication to the cylinder. F. S.

*South Kaukauna, Wis.*

The National Railway Spring Company has been formed by a consolidation of the National Car Spring Company, of New York, and the Oswego Railway Spring Company. The new company intend to build first-class shops at Depew, near Buffalo, and equip them with the best tools. The officers of the company are all well known to spring buyers. They are: President, Thos. Irwin, Oswego, N. Y.; vice-president, Thos. M. Bell, Philadelphia; secretary and treasurer, Geo. B. Sloan, Jr., Oswego, N. Y.; general superintendent, Edward Cliff, New York.

The Interstate Commerce Commission estimate that in 1891 each locomotive engineer in the United States hauled 369,077 passengers and 2,329,639 tons of freight one mile.

# Car Shops and Car Builders.

## Some "Americanisms" in English Passenger Cars.

The photographic reproduction at the top of this page shows a pair of dining cars recently put on the run between London and Glasgow, and known as West Coast Joint Stock, being owned and operated by the London & Northwestern and the Caledonian Railroads. These cars are called "American," but the true citizen of this country will see at a glance that they are very small compared with our diners.

They are "American" in that they have 12-wheeled trucks, are vestibuled, and can be traversed from end to end.

The car body of the one next the train is only 45 feet long; they are always run in pairs—it is 47 feet 9 inches over the platform, having but one; the other car is 50 feet 6 inches over the platform, they are only 8 feet wide over all. Real "Americans" would be 9 feet 8 inches, or 10 feet even.

One car contains the kitchen for both, and in it there is a dining-room for twelve persons and another for six, and a lavatory. The other car has a lavatory, a luggage compartment, a dining-room for twelve persons and another for four; it also contains a small stove chamber and a 6 ft. 6 in. room between the dining-rooms.

These dining-rooms are designed to accommodate the different classes of travel without mixing.


"AMERICAN" TWIN-DINING CARS IN ENGLAND.

The second picture is a view of the largest dining-room in the car containing the kitchen, showing single seats on one side and double on the other, although it is not intended to put four people at a table; the third picture shows the larger dining-room of the second car.

DINING-ROOM FOR TWELVE PERSONS.

These cars ought to be appreciated by the sandwich-eating British railroad travelers; but the other joint stock is composed of eight-wheeled cars 42 feet long, having room for seven first-class passengers, nine second-class and nineteen third-class, and (height of American perfection) a lavatory for each and every class. These cars are of the abominable compartment breed, and a hungry passenger can just wait till the train stops before he can get into the "eating-car."

These joint stock carriages are 7 feet 5 inches wide on the floor, but the body swells out to 8 feet. The entire train is lighted by Pintsch gas, but are not heated except by the ancient hot-water can. Only the platform between the two dining cars is vestibuled.

## A Magnificent Sleeping Car.

The most handsome sleeping cars that we have ever seen have lately been placed on the New York City & Northern to run over that line and the New York & New England between New York and Boston. If convenience and comfort can make a line of cars popular these are destined to liberal patronage. The express train for Boston leaves 155th street, New York, at 11 30 P. M., and an express train is run over the Manhattan elevated to make connection. As passengers coming over the elevated road have merely to cross a platform to reach the Boston train, the new service will be very convenient.

The sleeping cars were built at Pullman and are considered the finest ever turned out of these shops. They are finished in mahogany most elaborately carved on unique designs. They have arched roofs and are so high that unusually great head room is provided in the berths. The ceiling or head-lining is finished in a green ground that is nearly yellow with traceries of silver decorations. The effect of this combination resembles some of the fine Mosaic decorations that East Indian artists put upon beautiful boxes for holding jewels and other ornaments.

There are special ventilating appliances at the ends of the cars, but air can also be admitted through half-elliptical sashes which are set along the sides of the roof. As a marking between each berth there is a wide band of elaborately carved mahogany that stretches from the seat over the ceiling and down the other side. These bands have a most imposing effect. The doors at each end of the body of the car are loosely screened by curtains made of braided woolen rope. The upper part of the end partitions, beginning at the spring of the roof, are filled with half-circles of colored glass with fantastic brass scroll-work laid on. The seats are of a novel design that has "comfort" written on every thread of the yielding mass. The color looks like old gold and is not exactly that tint. Those who want this question settled to a nicety can apply to General Manager Vreeland, who is an expert on describing cars.

The drawing-room of the car appears to be a most *recherché* affair, in other words, all that taste, skill and labor could do to make it attractive have been liberally spread out. We can speak with more authority of detail regarding the smoking-room where no ladies were about to look upon minute inspection as an impertinence. It is finished in mahogany, like the body of the car, and has seats of embossed leather. The portion of the smoking car touching on the side aisle is formed of turreted panels profusely carved, which give an impression of castellated bordering.

Under the end-hood of each vestibule there is a half-spherical dome containing the Pintsch lighting globe. The cars are carried on six-wheeled trucks, and have all modern appliances for promoting safety and comfort.

## The Rodger Ballast Car.

The Great Northern has lately ordered over 400 new Rodger ballast cars in addition to about 200 that have been in use for some time. This car is rapidly becoming popular, especially in the West, and is a great time and labor saving help in the distribution of ballast. The Illinois Central people have used this car for upward of two years in carrying broken stone from the quarries, and those in charge speak in the highest terms of the advantage gained as compared with flat cars. Each car carries about twenty tons of ballast. It is dropped upon the track through two hoppers, one at each end of the car, and lies in a bed reaching up to the axles. On the last car of the train there is a distributing plow which scoops up the gravel wanted for the outside of the rails and lays the supply in ridges over the ends of the ties. The distributing train can be run as fast as ten miles an hour while dropping the ballast. The supply of ballast is left in such a shape that there is no danger in running trains. The Rodger Car Co., Monadnock Building, Chicago, control this useful car.

### Claiming Patent Rights on Car Side Stakes.

There appears to be considerable feeling among railroad men about what is known as the Congdon patent for side stakes of cars. It is a common practice in car building to extend the side stakes down so that the lower ends rest against the two center tie timbers. This is a method of construction as old as car building, yet in 1885 Isaac H Congdon obtained a combination patent for extending the cross-ties downward so that they should act as braces for the side stakes and for putting supplementary tie planks for bracing the stakes at the points where it is not customary to put tie planks. The parties controlling this patent now hold that the railroad companies extending their middle stakes to lean against the tie timbers or needle beams are infringing the Congdon patent. This is an impudent attempt to make a patent go far beyond its claims. If a railroad company puts in the supplementary cross ties to hold the stakes they will infringe the Congdon patent, but to put their stakes against the middle tie beams is merely following a common practice and is no part of the Congdon invention.

The head of the mechanical department of a prominent road which has been annoyed by the claims under the Congdon patent, writes us: "If we are to steer clear of patents on such simple and common devices as this we will next have to look into the Patent Office to see if we can mortise a car frame together without infringement."

A question that occurs to us in connection with the railroad companies which have been harassed over the claims made under this patent is, What is the use of the Eastern & Western Railroad Associations? These associations swallow a great deal of money from railroad companies ostensibly to defend them against patent litigation. Why don't they show up the real hollowness of the Congdon claims?

### Car Heating of the Season.

The exceptionally cold weather of January has provided a crucial test for the various systems of heating railroad cars by steam. There has been very little cause for complaint in the cars, the principal objection being that most of the trains were kept too hot. The writer was traveling almost constantly during the coldest weather and was struck with the influence of the personal equation in keeping cars comfortable. Some conductors are watching the temperature of the cars all the time and they see that the heat is maintained evenly Others seem to pay no attention to changes of temperature and adjustments are made only when passengers complain that the car is too hot or too cold. Wagner cars are not attended to so intelligently as the Pullman sleepers. This is merely a matter of supervision and means that the former company does not manage details as well as the latter.

The lessons of experience with car heating during this severe winter have been that the inventors of car-heating appliances have provided the means of heating cars safely under the most trying conditions but that the railroad companies and sleeping car companies have not got their men properly trained concerning the care and regulation of the appliances put under their charge. On more than one road the vicious practice has again been repeated of putting complex attachments upon cars and giving no instruction as to how they should be managed. When passengers are half roasted or partly frozen in the cars of any railroad company the experience is an impressive intimation that inferior management is in control.

We still have a few of our special calendars, which we will be glad to send free to anyone asking for them.

### How They Exchange Cars in Russia.

Mr. S. Michin, superintendent of motive power of the Russian Government Railways of Polesie, made this office a call recently.

Mr. Michin is studying American roads and American methods. He finds much to admire here and is going to take home several devices to test, among them the Janney coupler, air-brakes for freight cars, steel-tired wheels, etc.

He is at something of a loss to understand our car-interchange system, and don't see how we keep track of cars or how a road keeps its own proportion.

In his country the conditions are not unlike ours—a rigorous climate, long hauls and interchange of business. But in Russia the roads simply trade cars; if one road has a loaded flat to send over another line that other line has to deliver a car of the same class to the shipping road, and if it has no car of that class at the interchange point, the load waits until it is exchanged—like a prisoner of war—and the road that is "short" pays a per diem charge for the delay. By this plan a manager of a line that owns 1,871 box cars knows that there are 1,871 box cars on his own road, though they may not be all his.

This plan has some advantages, no doubt, but if adopted in this country would strip some roads as naked as a Digger Indian, and, we surmise would make something of a boom in the car building line.

### Substitution of Steel for Iron.

At the January meeting of the New England Railroad Club Mr. George Richards read a paper on the above subject. Iron, he admitted, had done much for the world, but the improved form of iron to be found under the various grades of steel is forcing this metal rapidly into use for nearly all purposes. The belief was expressed that steel castings will soon take the place of cast-iron and expensive forgings.

Mr. J. N. Lauder took a decided stand against steel except for boilers and tires. He held that where a part was subjected to reciprocating strains, steel was more likely to fail than iron His experience with steel in piston-rods and side rods had induced him to return to iron. The Eureka steel made at Chester, Pa., did very well for crossheads but it was cast-iron with the surface converted into steel. Steel is very likely to fail if nicked or if it has an abrupt change of section. He considered iron better for locomotive and car construction.

Mr. J. W. Marden favored the use of steel in car construction because it was stronger than iron and costs less. He had experience with steel that was not satisfactory, but he attributed the trouble to unsuitable quality of the steel. He thinks that steel axles are now likely to be perfectly reliable.

Mr. F. D. Adams favored steel except for axles. His experience convinced him that the journals of steel axles wore more rapidly than iron, and that the material was not reliable.

Mr. J. T. Chamberlain spoke of steel axles the journals of which wore with unparalleled rapidity. He had no use for steel.

Mr Angus Sinclair believed that most of the trouble experienced with steel axles arose from the use of inferior material. When steel axles were specified without particulars being given, Bessemer steel was generally supplied and that steel was not suitable for axles. He had devoted much attention to the subject, and found that steel axles did not wear any faster than iron if the proper quality was used. The impression he received was that the failure of parts made of steel was due to faulty design

### Air-Moving Machinery.

Travelers on the Boston & Providence Railroad in passing Jamaica Plain obtain a glance of a long brick building, close to the track, which is notable as being the largest fan-making factory in the world. The factory is the works of B. F Sturtevant Co., whose fans and blowers are known wherever fires have to be forced or buildings warmed.

During a visit to the works we found that, although fans and blowers were the principal articles of manufacture, the machinery that has to be built in connection with the operation of blowers would make a big business for firms that are large makers of special machinery. For instance, these works turned out over 1,000 steam engines last year, and they built more electric dynamos than important concerns that do nothing else.

This company manufacture an immense number of small portable forges with blast attachments, but their principal business is the making of fans, blowers and exhaust apparatus. A few years ago a demand arose for fans to be driven by electric dynamos acting directly on the fan shaft and this company proceeded to supply the demand. Owing to the inferior construction of the dynamos put on the market five or six years ago, this company proceeded to make their own dynamos, and they have now a good plant devoted to this work. The making of steam engines was an earlier enterprise, and they now make all kinds of engines adapted to the driving of their machinery

The system of heating shops made by this company is familiar to nearly all railroad men. It is undoubtedly the most efficient system in use Of late years they have been doing a good business in the making of apparatus for exhausting the smoke and gases from blacksmith shops and other places where smoke abounds. The arrangement is not costly and it is so effectual in keeping a pure atmosphere in shops that it deserves to be much more used. The company also make exhaust-blowers for planing mills, lumber dryers, and all kinds of appliances for forcing hot and cold air

English Dining Car Interior.

We are in receipt of letters from the Ferrocaril Interoceanico (Interoceanic Railway of Mexico) stating that the engineers and firemen are badly treated down there; they work by the month and get nothing for overtime, and overtime is constantly demanded of them. When hurt they receive no attention, often being left at wrecks all night, and when complaints are made they are told to quit if they don't like it The enginemen are Americans, and reported to be steady men. Our correspondent advises enginemen not to go there

## The B. & O.'s New Line.

### Preparing for the Immense Traffic Incident to the World's Fair.

The management of the Baltimore and Ohio Railroad is preparing for an immense business in 1893 while the World's Fair is open in Chicago. The terminals at Chicago are capable of accommodating a much heavier traffic than is now being done, and important changes are being arranged for the handling of very heavy freight and passenger business to the West from New York, Philadelphia and Baltimore. New equipment for largely increased passenger business and an extensive stock of freight cars have been ordered. The various roads of the system will be improved by straightened lines, reduced grades, extra side tracks, and interlocking switches. The new line between Chicago Junction and Akron has shortened the distance between Chicago and tide water twenty-five miles, and between Pittsburgh and Chicago fifty-eight miles.

The distance between Chicago and Pittsburgh and Chicago and Cleveland by the construction of the Akron line and the acquisition of the Pittsburgh and Western line and the Valley Railroad of Ohio, is about the same as via the Lake Shore from Cleveland to Chicago, and by the Pennsylvania from Pittsburgh to Chicago. The alignment is to be changed and grades reduced to a maximum of twenty-six feet. It is expected that within twelve months the old Baltimore & Ohio through line between Chicago and the Atlantic Ocean will have passed away and the new line via Pittsburgh be established, with no greater grades or curvature than on any of the trunk lines.

Work has already begun east of Pittsburgh to meet improvements making west of Pittsburgh. These improvements will consist of additional second and third tracks, a general correction of the alignment, and completion of the double track on the Metropolitan branch. It is expected that the new through line will be ready simultaneously with the completion of the Belt Line through the City of Baltimore, which is intended to unite the Washington Branch with the Philadelphia Division and do away with the present line via Locust Point. Forty new and powerful locomotive engines were added to the equipment during the last two months, and others are in process of construction. The permanent improvements now under way and in contemplation involve the expenditure of some five millions of dollars.

# ? A. What You Want to Know. ? A.

Don't ask questions that simply require a little figuring to determine; make each question separate. No notice taken of anonymous questions.

(16) J. D. B., Manastee, Mich., asks. What is the most popular packing for locomotives. *A.* We suppose you refer to cylinder packing; there is more plain snap ring packing than any other kind.

(17) J. S., Moncton, N. B., writes:

I would like to ask a question on the air-brake. On a train of twenty-six cars, the first five working air, when making a service application, and when the gauge pressure would be reduced five or six pounds, the train-pipe pressure would jump down ten pounds more, making an emergency application which, as you may judge would take the slack up on train rather sudden. What was wrong? *A.*—Something kept piston 17 from forcing its valve to a seat, probably gum or dirt.

(18) Ignorance, Mechanicsville, N. Y., writes:

One of our firemen, who was examined for promotion, said he failed to pass because he declared he would back an engine if necessary with both side-rods down, and he was told such a proceeding would be entirely wrong. This is something new to me What do you think of it? I have fixed up a mogul with the main driver broke off outside the box and she went in all right, and I thought she was good for 100 miles if run slowly, but according to the above I was wrong. *A.*—There is no reason why an engine should not be run either way with her side-rods down, unless it is an engine with her eccentrics on some other axle than the main one. We think perhaps the fireman didn't state his question just right to you.

(19) E. S. G., Havelock, Neb., writes:

Will you please explain what J A. H. means in his article, "The Best Shop I Saw in England," in No. 1, Vol. VI., where he speaks of their failure to make Richardson strips work. He says "Or the slots may have been milled instead of planed." Does he mean they cannot make a good job of them by milling? If so, why *A.*—We believe that these slots can be milled out properly by taking a fine finishing cut but where milled as they are ordinarily, we don't think they make a job; there are tool marks *across* the slot that form channels for the steam to go *around* the strip Planed slots have the tool marks in such a way as to pack against the steam. The late George Richardson, inventor of the packing, made some experiments with milled slots and pronounced against them. He said that *average* milling would not do.

(20) D. O. B., Mancelona, Mich., writes:

It seems I did not state plainly enough what I wished to know in regard to the vacuum in a cylinder, so was misunderstood. The question was, why will not steam of 150 pounds pressure, destroy a vacuum in a cylinder when it is cut off very early in the stroke, steam of that pressure having a volume 169 times that of the water from which it is derived; in other words, why will the expansion line on an indicator card go below the atmospheric line and thus form a loop? It is, of course, not found in locomotive practice. *A.* The steam having been expanded down, say to six pounds, when the exhaust valve opens the cylinder to the condenser, which contains a partial vacuum, say equal to 10 pounds below the atmosphere, the steam would go on expanding—and destroying vacuum in proportion—below the atmospheric line, it is exhausting into a condenser containing a vacuum instead of into the air which has a pressure of 14.7 pounds per square inch.

(21) Harry, Hartford, Ct., writes

Two locomotive engines, built exactly alike, are of the same dimensions every way, one of them is logy and liable to stall, and the other steams beautifully and pulls easily all the load that is intended for her size. Both engines are apparently handled precisely the same. What, in your opinion, is the reason? It is advocated by some that an explanation of the cause could not be given. Will you please give us your ideas, in words that all can understand. *A.*—It often happens that two engines of the same class *seem* very dissimilar, but we do not believe there is a difference without a cause. If one engine steams and the other does not there is some *reason* why she don't. Don't believe for one minute that there is any superstitious "because it is" excuse for condemning the poorer machine—*hunt for the cause.* Twice two is four the world over. If 140 pounds of steam won't push as hard on one 18-inch piston as another, find out what is the matter with the piston—the steam can't tell whether it's in the cylinder of the 11 or the 12.

(22) H M. T., Wheeling, W. Va., writes

Please answer the following through the columns of your valuable paper 1. What is outside lap? *A.*—Outside lap is the amount that the valve is wider than the distance between the outside edges of the steam ports. When the valve is in the center of the seat both ports are covered and the valve over-*laps*; if the valve is an inch and a half wider than the parts it is said to have three-fourths of an inch lap—$\frac{3}{4}$ on each end. 2. Can outside lap and lead be given to a valve at the same time? *A.*—Certainly; lap is given by making the valve longer, lead is given by so moving the eccentric that the valve opens the port a certain distance when the piston is at the end of the stroke—this distance is the *lead.* Lap or lead can be changed, increased or diminished independent of each other except as a matter of adjustment, for instance, if lap were added to a valve it would be necessary to move the eccentric ahead to recover the lead. 3. Will an engine slip as soon cut back as she will working full stroke? *A.*—It all depends upon circumstances, condition of rail, speed, etc. If an engine is slipping hooked up, she can often be stopped by full-stroking her *with a lighter throttle* This simply applies less power but during a longer part of the stroke.

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During a visit paid last month to Berry & Orton's Works, at Philadelphia, we found them unusually busy. Quite a demand has arisen for their cold cutting-off saw for use in machine shops This is a remarkably useful tool and is certain to be appreciated in shops where there is much cutting of iron in lengths to be done. There was in the shop parts of a very large tool of this class for the Franklin Co. Among recent deliveries were two wood planers and a large band-saw to the East Tennessee, Virginia & Georgia, a large bench saw for the Pennsylvania, several heavy tools for the Elgin, Joliet & Eastern and for the Louisville & Nashville. Pullman's people had ordered a large planer, and a heavy special form of grinding machine is under construction for the Johns town Iron & Steel Co.

A correspondent says "A good gunsmith can make most anything in metal, for the work required of him is in most cases very exact and intricate. A gunsmith has to know how to weld, braze and solder, he has also to temper springs of all kinds, besides being able to do fine fitting to cover repairs of any guns, and above all things, he has to be a good file hand."

## Ten Years' Experience With One Class of Compound Locomotives.

John A. Hill, Editor Locomotive Engineering, New York:—

I send you herewith a statement showing the miles run, quantity of coal consumed and consumption per engine mile run, by each and every compound engine on the London & North-Western Railroad since the date of first turning out up to June 30, 1892. The statement shows the average performance of each class as well. We class by the size of the wheel.

| Size of Wheel | Engine No | Name of Engine. | Date first turned out. | Miles run. | Coal consumed. | Consumption per mile Lbs.* |
|---|---|---|---|---|---|---|
| 6 feet 6 inches | 66 | Experiment .... | April 3, 1882 | 440,933 | 116,668 | 30 8 |
| " | 300 | Compound..... | May 2, 1883 | 342,539 | 94,737 | 32.1 |
| " | 301 | Economist.. .. | May 15, 1883 | 368,843 | 104,458 | 32 9 |
| " | 302 | Velocipede ...... | May 25, 1883 | 322,190 | 89,907 | 32.4 |
| " | 303 | Hydra. ... | June 1, 1883 | 362,049 | 101,596 | 32.7 |
| " | 305 | Trentham... | Aug. 8, 1883 | 328,235 | 89,250 | 31.6 |
| " | 306 | Knowsley .. | Aug. 6, 1883 | 299,647 | 86,455 | 33.5 |
| " | 307 | Victor ........ | Aug. 22, 1883 | 374,286 | 102,798 | 31.9 |
| " | 310 | Sarmatian.. ... | April 28, 1884 | 311,601 | 84,894 | 31.7 |
| " | 311 | R F. Roberts... | March 28, 1884 | 332,444 | 92,501 | 32.4 |
| " | 315 | Alaska.......... | March 31, 1884 | 306,913 | 82,967 | 31.5 |
| " | 321 | Servia ........ | April 1, 1884 | 311,840 | 83,560 | 31 3 |
| " | 323 | Britannic... .... | April 7, 1884 | 296,419 | 83,645 | 32 8 |
| " | 333 | Germanic ........ | April 5, 1884 | 308,892 | 82,339 | 31.1 |
| " | 353 | Oregon...... | April 13, 1884 | 308,867 | 83,710 | 31.6 |
| " | 363 | Aurania ... ..... | April 15, 1884 | 310,062 | 83,714 | 31.4 |
| " | 365 | America.. ....... | April 21, 1884 | 310,382 | 85,319 | 32.0 |
| " | 366 | City of Chicago.. | April 23, 1884 | 306,421 | 85,508 | 32.4 |
| " | 372 | Empress......... | Oct. 8, 1884 | 298,564 | 81,387 | 31.7 |
| " | 374 | Emperor. .. .. | Sept. 10, 1884 | 297,699 | 83,992 | 32.8 |
| " | 519 | Shooting Star. .. | Aug. 29, 1883 | 294,360 | 83,317 | 32.9 |
| " | 520 | Express...... .. | Aug. 29, 1883 | 332,923 | 92,688 | 32 4 |
| " | 1102 | Cyclops. ........ | July 17, 1884 | 292,301 | 80,822 | 32.1 |
| " | 1104 | Sunbeam. . .. | July 23, 1884 | 283,558 | 79,104 | 32.4 |
| " | 1111 | Messenger... .... | Aug 11, 1884 | 259,982 | 70,087 | 34 0 |
| " | 1113 | Hecate....... | Aug. 7, 1884 | 296,756 | 82,619 | 32.4 |
| " | 1115 | Snake .... . | Aug. 14, 1884 | 290,576 | 83,811 | 33.5 |
| " | 1116 | Friar ........ | Aug. 14, 1884 | 277,875 | 78,983 | 33.0 |
| " | 1117 | Penguin .. ....... | Aug. 21, 1884 | 270,025 | 74,946 | 32.3 |
| " | 1120 | Apollo....... | July 10, 1884 | 262,665 | 73,909 | 32.7 |
| | | Total and average for Class.... | | 9,399,847 | 2,605,691 | 32.2 |
| 6 feet 0 inches | 2 | City of Carlisle.. | June 29, 1886 | 234,425 | 77,209 | 38.1 |
| " | 173 | " Manchester | July 1, 1886 | 276,795 | 86,593 | 36 2 |
| " | 410 | " Liverpool.. | Dec. 2, 1886 | 202,450 | 72,391 | 41.2 |
| " | 437 | " Chester ... | June 30, 1886 | 231,741 | 73,691 | 36.8 |
| " | 503 | Dreadnaught .... | Sept. 29, 1884 | 298,799 | 93,931 | 36 4 |
| " | 504 | Thunderer...... | March 20, 1885 | 259,741 | 92,241 | 41.0 |
| " | 507 | M'chness of Staff'd | Dec. 26, 1885 | 274,540 | 90,643 | 38 2 |
| " | 508 | Titan ......... | Nov 7, 1884 | 301,956 | 103,188 | 39 4 |
| " | 509 | Ajax ........... | April 29, 1885 | 273,667 | 92,769 | 39.2 |
| " | 510 | Leviathan ...... | June 5, 1885 | 272,794 | 92,243 | 39.0 |
| " | 511 | Achilles .. .. | June 13, 1885 | 257,980 | 88,883 | 39.7 |
| " | 513 | Mammoth.... | June 19, 1885 | 278,668 | 93,919 | 38.9 |
| " | 515 | Niagara. .... | June 23, 1885 | 268,650 | 87,001 | 37.5 |
| " | 545 | Tamerlane. | July 26, 1886 | 237,600 | 81,126 | 39 4 |
| " | 637 | City of New York | March 13, 1888 | 184,964 | 62,467 | 39 0 |
| " | 638 | " Paris. .. | May 21, 1888 | 203,468 | 60,734 | 34 6 |
| " | 639 | " London... | June 2, 1888 | 184,194 | 56,982 | 35 9 |
| " | 640 | " Dublin .. | June 4, 1888 | 201,964 | 67,734 | 38 8 |
| " | 641 | " Lichfield.. | June 13, 1888 | 173,812 | 59,956 | 39.8 |
| " | 643 | Raven. ...... | June 18, 1888 | 174,671 | 58,580 | 38 8 |
| " | 644 | Vesuvius..... | June 30, 1888 | 194,338 | 60,597 | 36.1 |
| " | 645 | Alchymist ... | June 30, 1888 | 165,950 | 59,221 | 41.2 |
| " | 647 | Ambassador.. | July 3, 1888 | 191,121 | 61,562 | 37 3 |
| " | 648 | Swiftsure. ... | July 4, 1888 | 189,164 | 65,667 | 40.1 |
| " | 659 | Rowland Hill... | July 24, 1886 | 275,968 | 94,577 | 39.6 |
| " | 685 | Himalaya | June 27, 1885 | 298,269 | 102,446 | 39.7 |
| " | 1353 | City of Edinburgh | June 30, 1886 | 244,717 | 79,837 | 37.7 |
| " | 1370 | " Glasgow. | July 2, 1886 | 241,056 | 80,786 | 38 7 |
| " | 1379 | Stork. ........ | July 15, 1886 | 216,349 | 75,766 | 40.4 |
| " | 1395 | Archimedes. .... | July 12, 1886 | 247,642 | 81,515 | 38 1 |
| " | 2055 | Dunrobin. ....... | Dec 29, 1885 | 282,911 | 91,660 | 37.5 |
| " | 2056 | Argus . ...... | Dec. 24, 1885 | 273,427 | 81,385 | 34 5 |
| " | 2057 | Euphrates.... .. | Jan. 20, 1886 | 238,832 | 83,475 | 40 4 |
| " | 2058 | Medusa. ........ | Feb. 9, 1886 | 242,711 | 72,086 | 34 5 |
| " | 2059 | Greyhound..... | Feb. 9, 1886 | 261,057 | 81,537 | 36.1 |
| " | 2060 | Vandal .... | Feb. 13, 1886 | 257,746 | 84,353 | 37 7 |
| " | 2061 | Harpy. . .... | Feb. 20, 1886 | 237,194 | 75,672 | 36.9 |
| " | 2062 | Herald. ...... | March 12, 1886 | 242,599 | 78,212 | 37.3 |
| " | 2063 | Huskisson ... .. | March 18, 1886 | 244,040 | 77,723 | 36 9 |
| " | 2064 | Autocrat ..... | March 25, 1886 | 253,742 | 80,091 | 36 2 |
| | | Total and average for Class .... | | 9,591,712 | 3,160,449 | 38.1 |
| 7 feet 0 inches | 1301 | Teutonic..... | April 16, 1889 | 240,413 | 78,751 | 37.9 |
| " | 1302 | Oceanic .. . | June 27, 1889 | 221,416 | 72,584 | 37 9 |
| " | 1303 | Pacific. ... . | July 5, 1889 | 171,383 | 51,249 | 34 7 |
| " | 1304 | Jeanie Deans . . | Dec 23, 1890 | 104,101 | 28,518 | 31.9 |
| " | 1305 | Doric...... .. | July 4, 1890 | 128,182 | 40,322 | 36.4 |
| " | 1306 | Ionic ....... | July 4, 1890 | 131,902 | 40,717 | 35.8 |
| " | 1307 | Coptic. .... . | July 16, 1890 | 141,834 | 37,962 | 31.2 |
| " | 1309 | Adriatic .. ... | July 19, 1890 | 140,360 | 37,711 | 31 3 |
| " | 1311 | Celtic ..... ... | July 31, 1890 | 146,785 | 46,423 | 36 6 |
| " | 1312 | Gaelic ... ... | Aug. 4, 1890 | 137,717 | 43,590 | 36.7 |
| " | 2053 | Greater Britain... | Oct 30, 1891 | 30,390 | 9,144 | 33 7 |
| | | Total and average for Class..... | | 1,594,483 | 486,971 | 35 4 |
| 5 feet 6 inches | 600 | | July 8, 1887 | 101,062 | 31,128 | 35.7 |
| 4 feet 6 inches | 687 | | Oct. 19, 1885 | 129,952 | 29,900 | 27 0 |
| 5 feet 0 inches | 777 | | Dec. 14, 1887 | 111,886 | 37,833 | 39 1 |
| Metropolitan | 3026 | | March 31, 1884 | 252,308 | 53,608 | 25.0 |
| | | Grand Total and average . .... | | 21,181,250 | 6,405,640 | 35.1 |

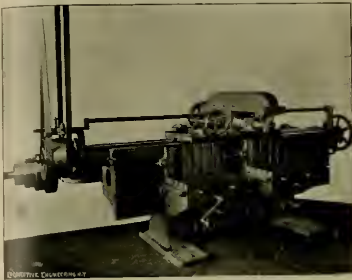
* Includes 1 2 lbs. for raising steam.

F. W. Webb,
Locomotive Superintendent L. & N. W. Ry.

*Crewe, England.*

## Heavy Open-side Miller, Slabbing and Sawing Machine.

This machine was made and designed for Messrs. R. D. Nuttall & Co., Allegheny, Pa., for facing large steel gears that are made in halves to bolt on the axles of electric cars; the wheels are of cast steel 27 inches in diameter, 7-inch face, one-half being milled with a groove, with a corresponding projection on the other half making a surface 27 inches long by 7 inches wide, and to be finished with one cut. The operation of the machine is designed to be cutting almost continuously, or start in any part of the travel, also at either end of the machine, the belts are shifted automatically, not allowing any chance for jambing or doing damage. The cutter-arbor has a shank 12 inches long, 3 inches at the large end and 2½ inches at small end, with a square lock-clutch to insure its being revolved by spindle, it is supported by a heavy, over-hanging arm bolted on top of the spindle carriage, carrying a bearing that is bushed with bronze 4 inches long, with a 1¼-inch hole arranged to take up wear or substituting any size that the operator desires. The saddle that slides on top of the



New Slab Milling Machine.

by using both tables for the work; while one half is being milled off the operator is adjusting another piece on the other table. The feeds of the machine are so arranged that should the tables be placed quite a distance apart a quick feed of twenty per minute is taken over the open space, the feeds are operated by two hand wheels, one on each side of the tool head; the one to the right controls the quick-feed while the left one throws in or out the milling-feed, and they are so arranged that they cannot interfere with each other; it is readily seen that with this arrangement of tables and feeds the machine is capable of doing the work of nearly twice one machine, and the operator is kept busy in placing work on and off the machine without retarding any of the work that is being done. The cut shows it to be built upon the bed of the well-known open-side planer, the driving-gear saddle feed-screw being modified to suit the new conditions. The arbor is geared with wide-face course-pitch gears of large diameter, and driven by a 4-inch belt that is back-geared 17 to 1; this gives the machine ample power to drive the milling cutter. The arbor is of forged crucible steel, has a diameter at the cutter end of 5 inches by 9¼ inches in length, 4½ inches in diameter at back end, and 8¾ inches in length. The feed-screw is of 3-inch diameter, single thread of 2 per inch engages bronze nuts, that are so arranged as to take up wear and prevent lost motion.

For feeding the cutter into the work, it is driven direct from gears from main driving-shaft on the back of the machine, it being necessary to compound these gears from a fast-running shaft, and the screw gives an endless change of feed, from the finest to the heaviest wanted, and insuring that when the cutter is running the feed is absolutely positive. For quick handling the open and cross belts on the left of the machine are used, there being three pulleys, one tight and two loose pulleys, with shippers that have a self-locking arrangement that insures them staying in their proper positions while the feed is running fast in either direction, and are controlled by the operator. To stop bed is held down on large and properly scraped bearing with bronze gibs and a square lock front; these gibs are of the wedge type and adjusted by studs and nuts, it being simply impossible for the cutter to be raised out of its cut. The length of bearing this slide has on the bed is 44 inches, and width of end on top is 24¾ inches, giving ample support in all directions with sufficient wearing surface. By taking off the outer arbor support, large saws or butt mills with inserted teeth up to 20 inches in diameter can be used.

This machine was set up in the works to run and to test its qualities, much to the satisfaction of the builders and those who saw it running. One of the tests was a 5½-in. cutter running 17 ft. per minute, peripheral speed, cutting 2¼ in wide by ⅜ deep, 2½-in. per minute, it not being belted up for more, as it was erected on the second floor of shop, where all light tools are run, and could not without loss of time spare more belt power. In another test with the same cutter, same material, 2¼ in. wide by ⅜-in. deep, 2½ per minute was made, when any more depth of cutter was taken the line shaft belt slipped, and no sign of tremor or stress was shown by the machine. All this cutting was with the work feeding against the cutter, this being a test to see the operation of the tool and not its capacity. The construction of this tool admits of the cutter being run in either direction, and feeding into or against the work, and of using any of the latest construction of mills with staggered teeth, etc. The mill used was an ordinary spiral mill, not of the latest or best design for heavy cutting.

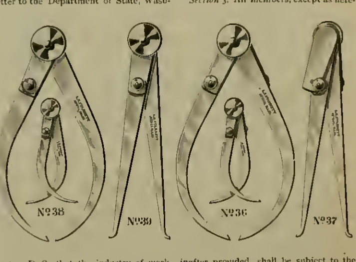
This firm are now designing a rod and slab miller, to mill 10-ft in length, 12 in. or 14 in. in width, with a platen suitable for the work to be raised and lowered by power, and have a very powerful hand-raising attachment for sinking the cutter into the work, embodying all the features of this machine. They claim with the tool traveling instead of the work, space in the shop can be saved and the machine more readily manipulated, and have the cutting tool always bearing the same relation to the bed, and consequently more rigid than the type that the head raises—the larger the work the weaker the machine—while with this system the bed of the machine forms the support for the work as well as the cutter, tying them together as one mass. This machine weighs 12,650 lbs., mill travels 5 ft. 10 in., tables lower 22 in. below cutter, and was built for a special purpose, and will admit of many changes for different heavy work. It was built by Pedrick & Ayer, of Philadelphia.

## Some Improved Calipers.

The well-known builder, L. S. Starrett, of Athol, Mass., has recently put on the market two kinds of calipers that have marked improvements over the ordinary tools and are almost as cheap.

The styles marked No. 38 and 39 have a firm lock-joint, and are still capable of fine adjustment. The improvement consists, first in a socket joint, made tapering, and locked or released by a partial turn of the knurled disc, drawing it together. A spring washer under the disc maintains an easy friction in the joint when unlocked. In the under side of short arm is a slot containing a stiff spring. Riveted into the middle leg and projecting through an opening in the arm, is a threaded stud on which is a knurled nut having a beveled hub—this bears against a cone in the arm —the action of the spring holding them together turning the nut, presses them apart and adjusts the leg while the joint is locked. The spring taking up all backlash the legs are firm. Hermaphrodite calipers and dividers are made in the same style.

The calipers shown in cuts 36 and 37 have all the features of the first tools described, but in addition to common use may be used inside of chambered cavities, over flanges, etc., removed and replaced without losing the size calipered. This is done by loosening the nut, binding one arm to the auxiliary leaf and swinging it out or in (while the joint is locked) to clear the obstruction, then moving it back against a stop, where it will show the exact size measured.




The Hon. T. H. Anderson, United States Minister to Bolivia, says in a recent letter to the Department of State, Washington, D. C., that the industry of working wood by machinery is a growing one in South America, and the trade for all classes of wood-working machinery is given to the United States. And he further says that the Egan Company, of Cincinnati, Ohio, controls over 50 per cent. of this trade in this class of goods, simply as the result of their enterprise in successfully placing their superior goods before the South American buyers.—*N. Y. Evening Post.*

The Chicago, Rock Island & Pacific people have lately erected a new roundhouse at Valley Junction, near DesMoines. It is a substantial brick building of about thirty stalls.

## Constitution and By-Laws of the Traveling Engineers' Association.

### CONSTITUTION.

Article 1.—The name of this association shall be "The Traveling Engineers' Association."

Article 2.—The objects of this association shall be to "Improve the Locomotive Engine Service of American Railroads," through the advancement of knowledge concerning the duty of traveling engineers or road foremen, by discussions in common, the exchange of information on subjects interesting to its members, thereby making the work in all branches more systematic and efficient for members and profitable for railroads and to provide an organization through which, by joint action, the best methods may be adopted.

Article 3.—*Section 1.* The following persons may become active members of the association on being recommended by three members of good standing and signing an application for membership and agreement to conform to the requirements of the Constitution and By-Laws or signing the Constitution and By-Laws.

*Section 2.* (*a*) Traveling engineers in active service, whether assigned to duty on the entire system of railroad or on a single division of any road, their assistants, when said assistants have charge of a division and are responsible for the condition of the engines and discipline of engineers and firemen to the same extent the traveling engineer is, provided that said assistants are not engaged in one line of duties only, such as instructions in firing coal properly, or inspector of engines when in roundhouses.

(*b*) Those who have been traveling engineers and are now employed in other positions of railroad service.

(*c*) Experts in air-brake practice employed by the railroads or air-brake companies.

(*d*) Those whose knowledge of locomotive running and management will be of service to the association can be admitted as associate members at any meeting by a majority vote.

The title Road Foreman of Engines is taken to mean the same as Traveling Engineer.

*Section 3.* All members, except as hereinafter provided, shall be subject to the payment of such annual dues as it may be necessary to assess for the purpose of defraying the expenses of the association, provided that no assessment shall exceed $5 a year. Such dues shall be payable when the amount thereof shall be announced by the president at each annual meeting. Any member who shall be one year in arrears for dues, and neglecting to pay the same within three months after notification by the secretary, will have his name taken from the roll. Members whose names have been dropped for non-payment of dues may be restored to membership by the unanimous consent of the executive committee on the payment of all back dues.

*Section 4.* Any member who, during

the meetings of the association shall conduct himself in an unbecoming manner, may be expelled by a two-thirds vote of the members present at any regular meeting within one year from the date of the offense.

ARTICLE 4.—The officers of the association shall be a president, a first vice-president, a second vice-president, a treasurer, a secretary and three members of the association, who shall be elected by ballot at the regular annual meeting, who shall, with the officers, constitute the executive committee.

ARTICLE 5.—The president, first vice-president, second vice-president, treasurer and secretary shall hold office for one year or until successors are chosen, the three members to serve on the executive committee will be first elected to serve for one, two and three years respectively, their utive committee shall constitute a quorum for the transaction of business.

ARTICLE 8.—*Section* 1. At the first session of each annual meeting an Auditing Committee consisting of three members, not officers of the association, shall be elected by ballot. It shall be their duty to examine at once the accounts and vouchers of the treasurer and the books of the secretary and certify whether they are correct or not. After the performance of this duty they shall be discharged by the acceptance of their report by the association.

*Section* 2. At each annual meeting the president shall appoint a committee of five whose duty it shall be to report at the next annual meeting subjects for investigation and discussion, and if the subjects are approved by the association, the president shall appoint special committees to report on them. It shall be the duty of the com-

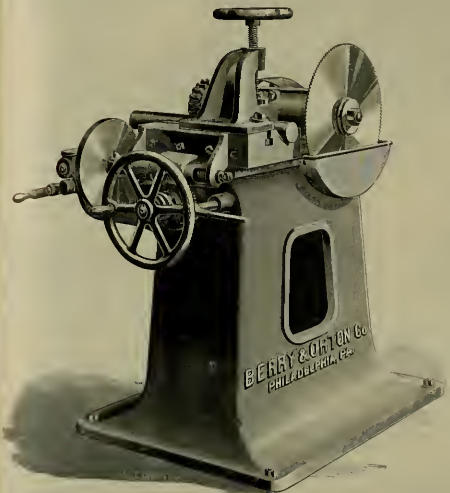
SECTION 5.—Order of Business: 1. Address by the President; 2. Calling the Roll; 3. Acting on the Minutes of the Last Meeting; 4. Reports of Secretary and Treasurer; 5. Election of Auditing Committee, 6. Unfinished Business; 7. New Business; 8. Reports of Committees; 9. Reading of Papers and Discussion of Questions Propounded by Members; 10. Election of Officers; 11. Adjournment.

SECTION 6.—Unless otherwise ordered, the discussion of questions proposed by members shall be the special order from 12 o'clock noon to 1 o'clock P. M. of each day of the annual meeting.

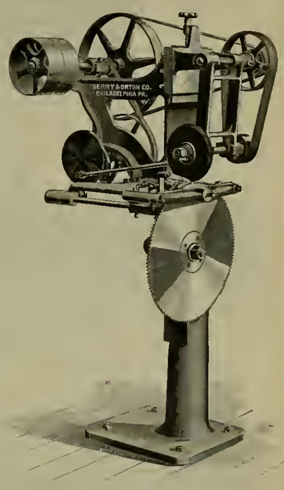
SECTION 7.—No patentees or their agents shall be admitted in the meeting of the association for the purpose of advocating the claims of any patent or patentee unless by unanimous consent.

### Artificial Limbs.

During a recent visit to the workshop of Mr. Edwin Osborne, in Philadelphia, we were much interested in the elaborate work performed in the making of artificial limbs. As the accidents common to railroad life require not a few of our readers to use artificial limbs, it is proper that the unfortunates should be informed of where perfect articles are made. Mr. Osborne has been in the business for forty years, and has worked with rare skill and intelligence to make the artificial article perform as near as possible the functions of nature's limbs. The casing of the legs is made of a light, strong wood, beautifully fitted, finished, the joints being wonderful specimens of special mechanism. Steel bushed pins hold the joints in place, and strong rubber springs give the re-




NO. 2 COLD CUTTING OFF SAW.




AUTOMATIC SAW SHARPENING MACHINE

successors shall be elected to serve for three years.

ARTICLE 6.—The duties of the president, vice-president, treasurer and secretary shall be such as usually pertain to their offices, or may be delegated to them by a unanimous vote of the executive committee.

ARTICLE 7.—The executive committee shall exercise a general supervision over the interests and affairs of the association, recommend the amount of the annual assessment, to call, to prepare for and to conduct the general conventions and to make all necessary purchases, expenditures and contracts required to conduct the current business of the association, but shall have no power to make the association liable for any debt to an amount beyond that which at the time of c ntracting the same shall be in the treasurer's hands in cash and not subject to prior liabilities. All expenditures for special purposes shall only be made by appropriations acted upon by the association at some regular meeting. Five members of the exec- mittee to receive from members questions for discussion, which, if the committee determine are suitable, shall be reported to the association at same meeting.

ARTICLE 9. This Constitution can be amended at any regular meeting by a two-thirds vote of the members present.

BY-LAWS.

SECTION 1.—The regular meetings of the association shall be held annually on the second Tuesday in September.

SECTION 2.—The regular hours of session shall be from nine (9) o'clock A. M. to two (2) o'clock P. M.

SECTION 3.—Places for holding the next annual convention may be proposed at any regular meeting of the association. Before the final adjournment the places proposed shall be voted for by the members, the place having the highest number of votes shall be declared the place for holding the next regular convention.

SECTION 4.—At any regular meeting fifteen or more members shall constitute a quorum.

### Cold Cutting-off Saw and Cold Saw-Sharpening Machine.

The accompanying engravings hardly need description. The makers of these tools have a reputation on this kind of work.

The saws are made in three sizes for cutting merchant bar, etc. One size cuts up to 3 inches of round bar, another cuts up to 5 inches, and a third up to 7 inches. The engraving is of the second size.

This machine has a hammered steel arbor 3 inches in diameter, driven by a bronze worm wheel and a hardened worm. The feed is automatic and can be instantly changed.

The success of cold sawing largely depends on the sharpening of the saws. The machine shown here will take in saws up to 36 inches in diameter and sharpen each tooth uniform at the rate of 56 teeth per minute, and leave the saw perfectly round. They are made by Berry & Orton, of Philadelphia, Pa.

quired elasticity and resistance to motion. There are tendons performing functions similar to the tendons of a natural leg, and other ingenious fastenings that tend to give the wearer ease and natural movement. The legs are so well made that the wearers walk as naturally as if they had never lost a limb.

A patent for a four-cylinder locomotive has been granted to Jackson Richards, who is a master mechanic on the Philadelphia & Reading. The patents are granted on the valve-gear being all actuated by two sets of links and eccentrics. We hardly believe that the invention was worth patenting as it calls for two inside cranks which no superintendent of motive power is likely to adopt to any alarming extent.

An improvement in car couplers has been patented by Joseph E. Forsyth and Erskine R. Merrill, of Chicago. It consists substantially of a chain attachment to prevent the coupler from falling on the track in case of breakage, a safety appliance which is badly needed.

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| 4 " | 0.45 | 10 " | 0.85 |
| 5 " | 0.55 | 12 " | 1.00 |
| 6 " | 0.65 | | |

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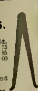

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LOCOMOTIVE ENGINEERING
A PRACTICAL JOURNAL of RAILWAY MOTIVE POWER AND ROLLING STOCK.



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### Home-made Small Tools.

The prevalence in railroad shops of the select machinists being found engaged in making taps and dies is a convincing proof of how slowly sound doctrines of production extend to the men in charge. Tool-making is naturally regarded as work requiring advanced skill, and we frequently find that the best workmen in a shop are engaged on taps, dies and other small tools that could be purchased cheaper and better from those making a specialty of the business. It is edifying to watch the deliberate movements of the man who works on tool-making in railroad shops. He comes to work in the morning prepared to add a new set of ¾-inch taps to the tools of the place. Pieces of steel are selected and subjected to ostentatious inspection. These blanks are then turned upon the lathe to the desired taper. Then they are threaded with no particular degree of accuracy. This makes them ready for the milling machine where the slots are cut and the head milled. The taps are then "relieved" and they are ready for hardening. The machinist has worked steadily and deliberately at this job for nearly three days, and he will show the set of taps and declare they are as good as anything ever made by a manufacturer. The fact that the taps have cost more than they could be bought for is not investigated, and everybody is gratified that the shop can turn out such creditable work. Little regret is expressed that the repairs on locomotives in the shop are dragging behind for want of good men to do the work.

If the history of the home-made taps is followed closely the cause for satisfaction with the work done is frequently modified. The blacksmith did not have his fire just right for tempering, and it is found that one of the taps is slightly burned. This spoils its appearance somewhat, but that is counted as nothing. When rough Rob. Johnson uses this tap some weeks later and gives the lever an unmerciful twist, as is his way, the tap breaks off and its usefulness is ended.

No machinist can relieve two taps exactly alike with the file, and one of our taps has too much taken off to relieve it and the other has not enough. The first one begins its own self-destruction at once. In backing out the tap the cuttings get between the thread and the metal around the hole and gradually grind up the threads. The tap that has not got enough relief works hard, and in the hands of the brute-strength and stupidity of workmen soon snaps off and no one can understand why it has broken.

The manufacturers of taps and dies have special machinery which enables them to reproduce articles of exactly the same size and formed precisely in the desired shape. They have the most approved furnaces for heating and tempering the steel, and the work is done by experts on whom practice makes perfect. These people make tools that are durable, and owing to the wholesale system of production they can be sold at a profit cheaper than inferior articles can be made in a common shop. The master mechanic or car builder who takes pride in making his own small tools is away at the tail of the procession, and is an expensive man for any railroad company to employ.

### Platform Gates.

We understand that among the measures about to be introduced to the New York Legislature at Albany is one compelling railroad companies handling suburban business to put gates upon the platforms of cars. This practice is generally followed by railroad companies handling suburban business about Boston and several other large cities. How it comes that scarcely any of the railroads about New York, except the elevated roads, provide this cheap, simple and efficient means of safety to their patrons, is difficult to understand. People have repeatedly fallen from trains in the neighborhood of New York, owing to want of protection on platforms. The danger of open platforms is well understood, and it is not surprising that the people to blame for neglecting this safeguard are about to receive the pressure of compulsion.

FROM THE SEABOARD TO THE LAKES. SCENE ON THE NEW YORK CENTRAL & HUDSON RIVER RAILROAD, AT LITTLE FALLS, ON THE MOHAWK RIVER.

## Cutting Eccentric Keyways Before Wheels are Placed Under Engine.

BY [illegible]

I see there is considerable inquiry about proper methods and "sure" ways to lay out eccentric keyways when the axle and wheels are in the shop, and considerable experience in this line encourages me to write.

First of all, let me say that I am very much in doubt if there is any rule that can be called "sure"—bound to come out right every time. If all engines were alike there would be little or no trouble, and I venture to say that with new work and direct motion engines there would be little or no difficulty, but *lost motion* is the trouble, and every joint between the eccentric and the valve adds to the danger of a miscalculation.

For repair work—and all my experience has been in the "back shop" of a railroad—there are scarcely ever two engines worn alike, and extra care must be exercised if the pit foreman wants to save time and trouble, and at the same time keep up his reputation among the men for "knowing his business," by cutting the eccentric keyways on a new axle before they are run under the engine. Perhaps the best known plan is the "stick" rule, and in the hands of a careful man it works pretty well. This plan was described in this paper some five years ago by Hiram R. Jones, and with the pleasantest memories of this excellent mechanic (for I put in my first apprentice days under his general foremanship) I will let him describe the "stick" rule himself, for surely none understood it better than he.

The stick is constructed as follows: Take a piece of clear pine three or four feet long and 1½ in. square, Fig. 2. Lay off a line in the center at *A*, lay off another line at *B* as far from *A* as the sum of lap and lead multiplied by length of bottom rocker arm, and divided by length of bottom rocker arm. Set your dividers at ½ diameter of shaft, and with *A* as a center lay off lines *C* and *D*. Set dividers to ½ diameter of eccentric, and, with *B* as a center, lay off lines *E* and *F*. To use this rig set crank-pin on center as before. Place the stick—resting on a support of some kind—under the eccentric, with the face of stick projecting a little beyond side of eccentric, as shown in Fig. 3, which is a plan view. In this way it will allow the plumb lines shown in Fig. 4 (one of which is thrown over the axle and the other over the eccentric) to fall each side of the stick, and close to it at the points indicated by the dots in Fig. 3. Adjust the stick so that the lines *C* and *D*, Fig. 2, will coincide with the plumb lines *C* and *D* hanging over the axle. Then turn eccentric so that the plumb line hanging over it will correspond with the lines on stick at *E* and *F*.

There are one or two important points that should be noted. The crank-pin is not necessarily on its center line when its center is level with center of axle. The crosshead pin is usually an inch or two above center line of axles, which would bring the crank-pin above said line on forward center, and below it on back center. This may be more fully understood by reference to Fig. 5, in which *A B* represents a center line through centers of axles. *C*, the center of crosshead pin at mid stroke. *D*, the center of main driving axle. *E*, the forward center of crank-pin, and *F*, back center of crank-pin. The height of *E* above center line may be obtained by multiplying height of crosshead pin above center line by ½ the length of stroke of crosshead, and dividing by length of main rod, or, simpler still, draw the lines in Fig. 5 on a board and measure the distance at *E* or *F* with a rule. Set crank this distance above center line of axles.

Another thing: If the pin in bottom rocker arm is above center line of engine it will necessitate a new position for crank-pin in using this arrangement.

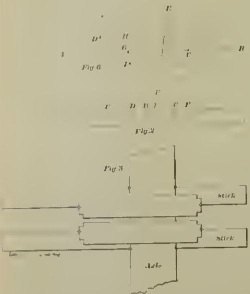


Fig. 6

Fig. 2

Fig. 3

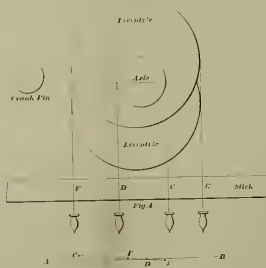


Fig. 4

Fig. 5

Referring to Fig. 6, let *A B* represent a line through center points of crank-pin (not center line of axles). *C*, center of main axle. *D*, bottom pins of rocker arm, and *G*, forward center of crank-pin.

Now for the sake of illustration, the elevation of the pin *D* above line *A B* is somewhat exaggerated. It will be seen that, in order to bring the eccentrics in their right positions, a line *E F* drawn across the front edge of eccentrics will be perpendicular to *C D*, and not *A B*. Now, as the line *E F* represents the direction taken by the plumb lines in Fig. 4, and the eccentrics must be set in that position, and the crank-pin *G* must be kept in the same relative position, we lower the point *G* to *I*, a point as much below *A B* as *H* on *C D* is above it. This distance may be obtained by drawing a diagram on a board, as before, and measuring with a rule.

It may seem as though this procedure was complicated and intricate, but when locomotives are all of one class, a stick once made and properly marked will do away with any further calculation. The proper elevation of the crank-pin should be noted in writing on the stick, and then the stick varnished, to keep dirty fingers from soiling it. It is then ready for use at any time, for any engine of the same class.

When eccentrics are only fastened with set-screws, there will be no particular advantage in adopting this plan; but if they are to be keyed on, especially for a narrow-gauge locomotive, where there is little room, it is a decided convenience.

To me the stick was not very satisfactory, and for a long time I have used a shorter plan, the measurements being found graphically and in such a way as to leave little room for mistakes.

I don't claim that this rule accomplishes results every time, but I have never yet got so far off with it as to call for offset keys all around, and I have had it come out exactly right. A better plan, where sectional eccentrics are used, is to put them up and mark them before cutting keyway.

When I put in a new axle I carefully caliper the journal bearing, and on a—shall I confess it?—piece of tin I draw a circle just the size of the axle. I assume that the pin has been plumbed exactly above the center of the axle, and I draw a perpendicular line, *A B* (Fig. 8), supposed to cut the centers of the pin and axle; at right angles to this and at the center of the axle I draw a horizontal center line. Then, inside the circle representing the axle, and from the same center, of course, I draw a circle the diameter of which is equal to the travel of the valve.

Now I take the sum of the lap and lead of the valve, say the lap is 1 inch and the lead $\frac{1}{16}$-in.; ¾" and $\frac{1}{16}$", or $\frac{13}{16}$", above the horizontal center line I draw another line, *E F*, parallel to it; this, for want of a better name, I call the lap-and-lead line.

Now, from the center of the axle I draw lines *GG* and *HH*, these lines intersect the lap-and-lead line where it crosses the travel circle, and extend out across the circle representing the axle. Where these lines cross the axle circle should be the center of the eccentric keyways—provided your keyways in eccentrics are where they should be—exactly opposite the largest part of eccentric under the stiffening rib.

I have seen men plumb their pin above the axle and go monkeying around trying to draw these circles and lay down these lines on the end of the axle itself. This is all foolishness, as the sole object of laying down these lines is to get a measurement, namely that from the center under the pin to the keyway.

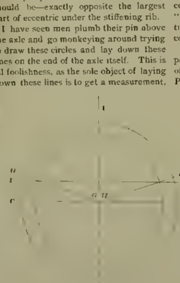


Fig. 8

After getting this measurement (on tin) I plumb my pin above the axle, put the centering piece on my "Starrett universal," and the level piece above it, level to the center and prick-punch. It's a good idea to turn your square around, and if there is a difference it is due to an error in the level; divide this error. From this center-punch mark I lay off, both ways, the measurements I have found, and cut my keyways with perfect confidence that they will come pretty close to right; so close that to slightly offset a key or two is far easier than to drill and chip keyways after the axle is under the engine. Right here let me call attention to the necessity of keeping your wits about you and lay off your keyways in the proper place, the go-ahead next the axle, etc. It will be seen that this plan throws out all figuring on the difference on the length of rockers; it simply deals with the size of axle and travel of valve.

The difference in length of rockers often troubles men who have to overhaul valve motion, and I have often seen them worrying at a row of figures to find the travel of a valve where the top rocker was, say, 7¾-inch long, the lower one 6¾-inch and the throw of eccentric 5-inch.

For such a case I use a graphic method that may be new to some and one that is plain, sure, simple and easily remembered.

From a given point *A*, Fig. 7, I erect a perpendicular, and with my dividers take the length of the lower rocker arm, say 6¾-inch, and scribe an arc of a circle across the top of my perpendicular; then I find the throw of my eccentric and divide it each side of the center line; say it is 5 inches, total movement of the eccentric blade, I lay off 2½ inches each side of the center on my line *B C*, as at *D E*—this is the travel of my lower arm—the one the eccentric actually moves.

Now, with my dividers, set the length of the upper arm, and from the point *A*, which represents the center of rocker shaft, I scribe circle *F G*. Then from the center *A* I draw lines 1 and 2 that intersect the lines *D* and *E* on arc *B C*, continuing the lines 1 and 2 across the arc *F G*. Between the points where 1 and 2 cut this arc will be the throw of the long arm (and the travel of the valve) actuated by the shorter arm and shorter throw. These are actual measurements that can be taken with rule and dividers and found without any figuring at all.

## The "Gowan & Marx."

In August, 1891, we published a description of the engine "Mercury," built in 1842, for the B. & O., by the firm of Eastwick & Harrison, of Philadelphia, and in that description told something of the success made by this firm with the engine "Gowan & Marx"; we did not know at time that there was a picture of her in the country.

Recently one of the philosophers of the paper stumbled across a drawing of her in the office of the Wellman Steel Company, in Philadelphia. The original drawing was

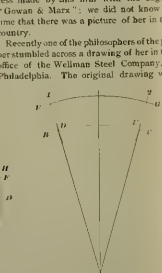


Fig. 7

made for Eastwick & Harrison by a young mechanic, Enoch Lewis, now purchasing agent of the Pennsylvania Railroad.

Some years ago Mr. Wootten, general manager of the Reading road (for whom the engine was built), found the drawing among some other old papers and sent it to Mr. Lewis. From this a photograph was made and framed by Mr. Lewis' son, who is in charge of the office of the Wellman Steel Company, and from it our engraving was made.

This engine was the first to have an axle under the fire-box, the first to have equalizers, and the first to use a blower.

We can't describe her better than to repeat what was said in this paper on the date given.

"Late in 1836, the firm of Garrett & Eastwick, of Philadelphia, built an eight-wheeler, called the "Hercules," for the Beaver Meadow road (now the Lehigh Valley), in which an attempt was made to make the engine more flexible. Mr. Eastwick devised a separate frame with pedestals, in which the two pairs of wheels were placed. This frame vibrated upon a center bearing, and could move as a truck does, except that it could not turn. This allowed it to adjust itself to uneven tracks, provided the unevenness was alike on both sides, otherwise it racked the framing; this frame was underneath and separated from the main frame by side bearing springs.

* * * * * * * *

"This engine was so flexible that she could accomplish more work than the others in use, and more like her were ordered. But in the meantime the firm took in as a partner a young mechanic, Joseph Harrison, Jr., who set about simplifying the flexible engine, and the result was the invention of the modern equalizer, now universally used in this country and most foreign countries.

"Harrison's first equalizers were made of cast-iron, very heavy and clumsy, and were hung above the frame just as they are now in 8-wheelers, the ends bearing on round pins that went down and rested on top of the box; this can be seen very plainly in our illustration. Mr. Harrison's patent covered all the combinations of equalizers now known, and also provided one for the truck. This device made it possible to use any number of driving-wheels on the roughest track, and was, up to that time, the most useful improvement made in the engines of Stephenson.

* * * * *

"In 1839, Eastwick & Harrison got an order from the Reading road for a then 'big engine'; she was to weigh all of *eleven* tons, not less than *nine* tons to be on four drivers, and must burn anthracite coal in a horizontal boiler. This engine, when built and in service, made the fortunes of her builders.

"In order to properly distribute the weight, the rear axle was placed *under* the firebox, just as they are now in mogul and consolidation engines; the boiler was a 'dome' or 'Bury' boiler with a 5-foot firebox.

* * * * * * *

"Two-inch tubes were used, placed close together, and nearly filling the cylindrical part of the boiler.

"The cylinders were 12½ x 18. There was no cut-off used. The wheels were 42 inches in diameter. The exhaust was a box filled with numerous small jets, known as the Gurney exhaust, and the common blower was here used for the first time. When finished, this engine was named the 'Gowan & Marx,' after a London firm of bankers.

"This engine interested the whole railroad world by her great tractive power. On her trial, February 20, 1840, she drew from Reading to Philadelphia one hundred and four 4-wheeled cars of coal at the rate of 9.82 miles per hour—the road had a falling gradient of nearly 4 feet per mile, 27 miles of dead level, 9 miles of it in one place, and only one ascending grade of 26.4 feet per mile for 2,100 feet. This train weighed 423 tons, and, including weight of the tender, equaled *forty times* the weight of the engine. That was the best ever done then, and is pretty hard to beat now.

"This remarkable work attracted no little attention at home and abroad, and among others who came to see and be convinced, were two colonels sent out by the Emperor of Russia to report on the best machinery and appliances for a road then projected between St. Petersburg and Moscow—the first in the empire. These officers reported in favor of engines built upon the general plan of the 'Gowan & Marx,' and in due course of time the Emperor Nicholas asked Eastwick & Harrison to visit St. Petersburg, with a view to contracting extensively for his government.

"In 1843 Mr. Harrison went to Russia, and formed the firm of Harrison, Winans & Eastwick, taking into the firm Mr. Thomas Winans, of Baltimore, and entered into a contract for building 162 locomotives and iron trucks for 2,500 freight cars.

"In 1844 they closed their place in Philadelphia, taking their tools and instruments to Russia, and established the Alexandroffsky Head Mechanical Works, where they completed their fat contracts.

"When the first engine was being built, Mr. Harrison designed and built a machine for accurately boring the holes for crank-pins exactly at right angles to each other—this is believed to have been the first quartering machine—a rude application of the principle had been used by him in Philadelphia in 1838. This contract was finished in 1851, but a new contract was entered into for repairing the rolling stock that kept the firm busy up to 1862, when they came home to America full of honors—and shekels."

The Famous Old-Timer "Gowan & Marx," the First to Haul Forty Times Her Own Weight

## Combustion Chambers for Shallow Fire-Boxes.

During the last ten years the practice has spread very rapidly of designing locomotives with long, shallow fire-boxes set on top of the frames. Increasing weight of trains and acceleration of speed are putting such demands upon the capacity of the boiler that every resort which ingenuity can suggest is employed to augment the steam-generating power of locomotive boilers. The boilers are raised more and more towards the sky to make room for a large shell and the necessity for increased grate area leads to the raising of the mud ring above the frames. By doing this valuable increase of grate area is obtained, but the change has developed a resulting drawback which seriously detracts from the efficiency of locomotives built in this way. A firebox placed entirely above the frames must necessarily be very shallow with limited space between the grates and the lower row of tubes. This puts the tubes almost close to the fire and from some cause or other the tubes are very much given to leaking. We cannot understand why the close proximity of the fire to the tubes should couse leakage, but it is certainly the case, for we do not know of a single road using shallow fireboxes where complaints are not made of trouble with the tubes.

In fireboxes of this form the flame has such a short distance to travel before entering the tubes that theory would say there must be loss of heat due to imperfect combustion, and the coal records appear to show this to be true.

The remedy for leakage of tubes due to the close proximity of the incandescent fuel and for the loss of fuel due to the short journey of the flame appears to be the use of a combustion chamber. When deep fireboxes where used combustion chambers appear to have been of no service, but with a shallow firebox the case is different and we expect to see this aid to combustion largely adopted. A chamber twelve or fifteen inches long ought to be sufficient. Boilers are made so long now that the tubes could easily bear being shortened the distance mentioned. Those who are using combustion chambers with shallow fireboxes speak highly of the influence they exert in preventing leakage and also credit the arrangement as being good for preventing the stopping up of the tubes with cinders. The success of the Wootten firebox appears to give testimony in favor of the combustion chamber.

A novelty in locomotive fire-boxes has been patented by Charles W. Hullings, Philadelphia. This inventor proposes putting in a baffle above the fire door, constructed in the form of a water leg. Pipes to create circulation in the baffle are led across the firebox to the front sheet. A baffle plate for projecting the air that enters the door down upon the surface of the fire is an excellent aid in the prevention of smoke, but we are afraid that using a water leg for this purpose is going beyond paying limits.

## Some Wrecks in India.

One of our readers, Mr. Philip A Hyde, at Saidpur, India, sends us some wreck photos, taken away in the land of the Bengal tiger, the Coolie, the crocodile and Rudyard Kipling's stories

One picture shows an English engine with a crimp in her Yankee pilot and a hole in her abdomen—don't know what else to call it The cork helmet on the "runner" and airy costume of the native galvanizer" give a faint idea of the difference in temperature between that country and our own Dakota "banana belt," the latest reports from there only claiming 57 below zero.

That iron "goods wagon" will need the services of a blacksmith and boiler-maker before she will ever be able to haul rice in bulk

If that Hindoo had only stayed behind the bush for a second more we might have shown up the wash-out picture as a bird's-eye view of gentle spring on some road out of New Orleans It looks very natural

If you look closely at the six-wheeled freight engine you can see the waves of heat rising off the boiler, the engine may be dead for all we know, but they have a sun in India that gets up before daylight and tends to business as long as he can see to work

Maybe you will think it is egotism, but we think it a good time right here to repeat what a railroad man recently wrote

"The showing up of engines and railroad scenery in LOCOMOTIVE ENGINEERING is doing a great fraternal work in making locomotive engine and shop men, the world over, better acquainted with one another" Here's a chance to fraternize with the Hindoo

The superintendent of motive power of one of our leading railroads lately talked in a very edifying manner about his experience with brake beams. He was a firm believer in the merits of the wooden brake beam and clung to its use for long years But the quick-action brake convinced him that an improvement had to be made He tried various ways of trussing the wooden beam, but it did not materially decrease the trouble from broken beams. Finally he tried a few iron beams, and they did so well that he made no more of wood. To his surprise he now finds that the metallic beam is much less costly than the wooden beam which he patronized so long on account of its being cheap

## Heat and Combustion.

BY ANGUS SINCLAIR.

### ELEMENTS.

The nature of fuel, the composition of the air that fans the fire, the character of the gases formed by the burning of fuel, and the proper proportion of air to fuel for producing the greatest amount of heat are the principal things to be learned in the study of the laws relating to combustion. If these things were properly and popularly understood many egregious blunders in the designing of furnaces and fireboxes would have been avoided, and millions of tons of fuel that have been wasted by bad firing would have been saved.

By the process of analysis the science of chemistry has discovered that all matter in the universe has been formed from about seventy simple substances or elements. There are celebrated scientists who believe that the time will come when it will be shown that all matter has originated from one fundamental element, but this is to a great extent speculation, for the most powerful analytical forces have yet been unable to separate elements into more than one substance. Elementary substances combine or mix together and form compound substances. The great bulk of the earth, including air and water, are composed of compounds formed from about twenty elements.

### THE ATOMIC THEORY OF MATTER

In experimenting on the divisibility of matter a celebrated chemist found that a coloring substance could be so subdivided that one billionth of a grain was visible to

AN INDIAN WASH-OUT

the naked eye. This is such an infinitely small particle that the mind cannot comprehend it. In figures it is a grain divided into 1,000,000,000,000 parts. Science has demonstrated that even these small entities are capable of still much greater division. The dividing may go on, however, until a limit is reached, when no further subdivision is possible. When this limit is attained the ultimate separation ends in excessively minute particles of matter which scientists have called atoms. Moved by the internal forces of nature, known as chemical affinity, the atoms group themselves or join with atoms of other substances and form larger particles, which are called molecules. A molecule is distinguished from an atom by being divisible, as it is composed of two or more parts.

GOT THE WORST OF IT

### COMBINING PROPORTIONS.

According to this atomic theory, all the atoms of each element are alike in size and weight, and they combine with atoms of other substances in fixed proportions by weight to form compounds. If one atom weighs 1 and the atom of another substance is double that weight, the two will always combine in the proportion $1 + 2 = 3$. They cannot combine $1 + 1 = 2$, because that would require the dividing into two of the heaviest atom, and division has already gone to the extreme to reach the atom.

The fixed proportions by weight in which elements unite are called the combining weights. The elements that have principally to be dealt with in the study of combustion are

| Element. | Symbol. | Combining Weight. |
|---|---|---|
| Oxygen | O | 16 |
| Hydrogen | H | 1 |
| Nitrogen | N | 14 |
| Carbon | C | 12 |
| Sulphur | S | 32 |
| Iron | Fe | 56 |

The symbol given after the name of the element is the chemist's short way of writing the name. These in connection with figures make up a sort of short-hand, which indicates the composition of a compound For instance, water is composed of two parts by weight of hydrogen, or two atoms as the combining weight of that element is 1, and 16 by weight of oxygen, or one atom. The compound water is therefore written by chemists, $H_2O$.

Some of the elements combine in different proportions and produce an altogether different compound This is illustrated very strikingly in the combinations which nitrogen make with oxygen. They are

| | | | | | |
|---|---|---|---|---|---|
| 1. Nitrogen monoxide, | containing 28 parts by weight of N, | to 16 of O, | written | $N_2O$ |
| 2. Nitrogen dioxide, | " 28 " | " " 32 " | " | $N_2O_2$ |
| 3. Nitrogen trioxide, | " 28 " | " " 48 " | " | $N_2O_3$ |
| 4. Nitrogen tetroxide, | " 28 " | " " 64 " | " | $N_2O_4$ |
| 5. Nitrogen pentoxide, | " 28 " | " " 80 " | " | $N_2O_5$ |

The first of these is laughing gas. It supports combustion. The others are nearly all poisonous and none of them support combustion.

We meet with a similar curiosity of combination in the combustion of fuel when in some instances carbon monoxide is formed with much loss of heat in comparison with what is obtained when the combination of oxygen and carbon produces carbon dioxide. Carbon monoxide is an active poison, and many persons have suffered from it when working about the rafters of blacksmith shops, and similar places where the gas accumulates; carbon dioxide does not support respiration, but is not poisonous.

### THINGS THAT BURN.

The only practicable way of obtaining heat for conversion into mechanical work, is by the combustion of cheap fuel. Combustion, as commonly understood, is the combining of oxygen with carbon. All elements except fluroine unite with oxygen and heat always results, but in many instances its generation is so slow that the heat evolved is imperceptible. The rotting of wood and the rusting of iron are instances of slow combustion, while the explosion of gunpowder, guncotton and fire damp are examples of violently rapid combustion.

There are other fuels beside carbon that evolve intense heat and light when uniting with oxygen. Sulphur and phosphorus will take oxygen from the air and burn hotly, while fine iron wire will act as fuel and burn violently in pure oxygen. If a piece of the pure metal potassium be thrown into a basin of water, its affinity for oxygen is so intense that it will separate the elements in the water and burn vividly, fed by the oxygen taken from the water. The metal sodium, when put into a jar containing chlorine gas, bursts into flame and burns rapidly. All these give good illustrations of curious acts of combustion, but the materials used are too expensive to be utilized in the generation of heat for commercial purposes.

### PRACTICAL FUELS.

The practical fuels that can be employed in steam-making are coal, wood and mineral oil, or gas, their principal constituents being carbon and hydrogen. The immense accumulation of coal found imbedded over a great area of this continent will be the main fuel supply for ages to come, but in special localities and for particular purposes wood, oil or gas may be used.

### FUEL IS STORED ENERGY.

The prodigious storage of potential energy reposing in our coal measures was laid latent by natural agencies during the formation of the earth. The theory is held, that when the globe first solidified the atmosphere was charged with a much greater quantity of carbonic acid gas than the air now contains. This supplied favorable conditions for the building up of trees, and the sun's rays decomposed the carbonic acid gas (or carbon dioxide, as chemists now call this gas), and water to assimilate the elementary carbon and hydrogen necessary for purposes of vegetable growth.

AFTER THE SCRAP.

By this process the sun was imparting to woody fibre the means of performing the work of driving steam engines, just in the way that the same rays by evaporating water and raising it into the clouds provide the power in streams to drive water wheels. It is estimated that the sun imparts 11,000,000 foot-pounds or units of energy for every pound of carbon formed in a tree. When the resulting wood or coal is burned the sun's energy, which has been lying latent, is brought back into activity.

### HOW COAL WAS FORMED.

The geology of the coal measures shows that there must have been an abnormal growth of vegetation when the coal was under formation, something different from what has been found in subsequent periods. There are still phenomena at work that are analogous to the original formation of the coal beds, such as the rank vegetable deposits settling from tropical forests and in the peat formations seen in various parts of the earth. But these deposits are small compared to those which formed the coal beds. As it required about ten feet of vegetable matter to form one foot of coal, the depth of the deposit that built up the thick seams of coal found in Pennsylvania, the Rocky Mountains and in Nova Scotia must have been enormous.

Those who are best entitled to speak with authority of how the earth rose out of chaos, say that uneasy times preceded and uneasy times followed the epoch when coal was formed. There was down-sinking and uprising of the earth's surface over great areas, and the deposits of vegetable matter were covered over with accumulations that afterward became layers of sandstone and beds of limestone. Under this covering the coal ripened or cooked into the forms now familiar to all civilized people.

The process by which the vegetable accumulations have been converted into coal is supposed to be thus When wood, peat and other vegetable matter was buried in the earth exposed to moisture and partially or entirely excluded from the air, they decomposed, slowly evolving carbon dioxide, thereby parting with a portion of their original oxygen. By this means the mass became gradually converted into lignite which contains more hydrogen than wood or peat. Continued decomposition changed the lignite into bituminous coal chiefly by the discharge of carburetted hydrogen.

There are two theories held respecting the changes which converted bituminous into anthracite coal. One set of geologists believe that its composition was changed gradually by the natural process that converted the vegetable matter to lignite, and the lignite to bituminous coal. Others believe that the change was metamorphic or caused by intense heat which vaporized the volatile matters and deposited them in fissures of the rock as bitumen, petroleum and natural gas.

### MOST COMMON KINDS OF COAL.

The forms of coal most popularly known are lignite, bituminous and anthracite. The principal element constituting all kinds of coal is carbon, which, with hydrogen, is the basis of all the inflammable gases evolved from coal. There are a variety of combustible liquids derivable from coal, such as tar, naphtha and coal oil, which are peculiar compounds of carbon and hydrogen Most of these volatile substances are derived from bituminous coal, while anthracite contains little besides fixed carbon.

The American continent has been supplied with Nature's largess in the form of coal in peculiar abundance. The most reliable geological surveys indicate that there are coal measures extending over 192,000 square miles in the United States. There is also said to be 50,000 square miles additional, where lignite and similar fuels not belonging to the carboniferous strata proper are to be found.

In Great Britain, which is recognized as the coal cellar of Europe, the coal measures extend over 12,000 square miles.

### LIGNITE.

Lignite is found over a wide area in the United States and in some of the Western States it is used almost exclusively as fuel. It is the youngest form of coal and belongs to the cretaceous period of geology, which is far above the carboniferous period in which true coal was formed, as any one may see by examining the chart of geological strata in Webster's Unabridged Dictionary or in any book on geology. Lignite varies very much in quality and appearance. Some specimens look like fossil wood and others closely resemble bituminous coal, but in all cases it is deficient in the amount of carbon necessary to make first-class fuel On most of the transcontinental railroads lignite is burned by the locomotives on certain divisions. There are serious objections to its use. It crumbles badly on exposure to the weather and absorbs a large percentage of moisture,

STANDARD FREIGHT ENGINE, INDIA.

seriously detracting from the steaming qualities of the fuel which gives nothing to spare at the best. Another serious objection to its use is spark-throwing, due to the light, friable nature of the material. Rocky Mountain lignite on analysis ranges about 40 per cent. of fixed carbon, 40 per cent. volatile combustible matter, 10 per cent. water and 10 per cent. ash. Lignite found in Montana and Washington ranges from 50 to 60 per cent. of fixed carbon and is fair fuel when newly mined.

BITUMINOUS COAL.

The true coals are classed as bituminous or anthracite. Coal that contains 18 or 20 per cent. of volatile matter is called bituminous, but there is no fixed line of division between lignite and bituminous coal, or between the latter and the more volatile forms of anthracite.

The ordinary run of bituminous coal contains from 50 to 80 per cent. of fixed carbon, which is the coke of the coal. There are exceptionally inferior coals found in some of the prairie States with fixed carbon below 40 per cent. As the fixed carbon is considered the principal element utilized in steam making, it ought to be better understood that some kinds of bituminous coal possess twice the heating properties of others. Yet to most buyers anything is coal that is black, and inferior coal is purchased almost as readily as that of the best quality.

Besides fixed carbon, bituminous coal contains from 12 to 48 per cent. of volatile combustible substances, which burn with a lurid flame and emit the ingredients of coal gas. These inflammable compounds are known as hydro-carbons, since they consist of different combinations of hydrogen and carbon. Great heat energy may be obtained from the combustion of the hydro-carbons if the furnace is properly constructed and the fireman is skillful, but in practice it is found that the volatile gases add little to the heat value of the coal.

Mixed with all kinds of coal there are earthy and mineral impurities consisting of silica, alumina, iron, sulphur and saline matter, most of which does not burn, but settles on the grates as ashes.

Experiments have shown that bituminous coal loses from 10 to 40 per cent. of its evaporating qualities by being exposed to the weather. This makes the building of storage houses a paying investment.

ANTHRACITE COAL.

Anthracite coal contains from 70 to 95 per cent. of fixed carbon, that with the smaller percentage being classed as semi-anthracite. The most conspicuous quality about this coal is that it burns without smoke. The true anthracite is principally found in Pennsylvania. It is slow to ignite and conducts heat slowly. When once properly ignited it burns with a very high temperature, radiates great heat and is difficult to quench. Anthracite burns with very little flame and deposits no solid carbon from its products of combustion.

If fires could be burned indefinitely without cleaning, anthracite would evaporate as much water, pound for pound, as good bituminous coal, but there is much more loss of fuel in cleaning anthracite-burning furnaces than there is in cleaning a soft coal fire. A report of the United States Navy department on this subject gives facts in relation to the burning of anthracite in marine boilers, which applies with equal truth to locomotive fire-boxes and stationary boilers. The report says:

"Anthracite fires need to be cleaned out thoroughly every twelve hours. This causes loss of evaporative power in the following ways, to which the free burning coals are subject in much less degree:

"1. By the direct abstraction of heat from the combustible portion of the fuel to bring the earthy matter and ash to the high furnace temperature. 2. By the direct loss of heat when the clinkers and ashes are withdrawn at that high temperature. 3. By the unavoidable loss of some unconsumed coal during the abstraction of the clinkers. 4. By the influx of cold air through the open furnace door during the operation of cleaning fires. 5. By the loss of heat in raising the temperature of air over and above the quantity needed for combustion. 6. By the loss of effect during the time the newly cleaned fire is recovering full action."

COKE.

There are certain qualities of bituminous coal that tend to adhere into a compact mass or "cake" when heated. When masses of this kind of coal are heated in closed ovens the volatile ingredients are driven off and a coherent mass of fixed carbon is left, which is called coke. Coke is greatly used for fuel in metallurgical operations and it was once the only fuel used in the locomotives running in European countries. The strict ordinances passed in many of our cities against the smoke nuisance is bringing coke into limited use for locomotives and stationary boilers. The steady rise in the price of anthracite may bring coke still more into use for steam making. Its steam-making qualities are about equal to good anthracite.

When considering the purchase of fuel of any character it is wise to ascertain how much heat-generating elements it contains. This can best be done by a skillful analytical chemist. It is important that it should be done systematically. Apart from the large percentage of volatile matter in some kinds of coal, and which gives little return for the weight represented, there is a certain amount of incombustible matter from which no heat whatever can be obtained.

The relative proportion of that may vary to any extent. There is coal with only 1 or 2 per cent. of ash, but there are other varieties which look as good and have from 15 to 20 per cent. of impurities that turn into ash or clinkers. The impure coal nearly always sells as high as that of the very finest quality.

## Exact Sizes.

Some time ago the secretary of the Master Mechanics' Association sent out a circular urging railroad officers to keep strictly to United States standard sizes of screws, threads and nuts, and also advocating the more general use of the standards adopted by the mechanical association. Referring to this circular, Butterfield & Co. write:

"While we are heartily in accord with everything there laid down, there is yet another phase of the question not touched upon by the circular which is causing us more trouble than the frequent calls made upon us to make United States standard taps $\frac{1}{32}$ or $\frac{1}{64}$ over-size. It has always been our practice to make United States standard taps exact size, and we use the word exact in its strictest sense possible to ordinary manufacture, but in our trade with bolt manufacturers and railway and car companies, we have, within the past year, had taps returned with the complaint that they were too small, when, by a rigid measurement with the best michrometer, they were, as a matter of fact .001 or .002 large (this difference occurring in the process of hardening). Now, if exact size, or to use the phraseology of the circular, standard size, means strictly exact size, why are bolt manufacturers and railway and car companies dissatisfied with taps so made, and why do they ask to have them made larger? Or, if by exact size is meant a certain number of 1,000ths large, what is the scale or rule?

"Our trouble has been so great in this regard, that we have been forced to adopt the following as a temporary makeshift pending the determination of this question, viz.

"Size, $\frac{5}{8}$, $\frac{3}{4}$, $\frac{7}{8}$, .004 large; $1\frac{1}{8}$, $1\frac{1}{4}$, $1\frac{3}{8}$, .005 large; $1\frac{1}{2}$, $1\frac{3}{4}$, .006 large.

"We have done this with some hesitation, and we would be glad of your views prior to confirming our temporary scale.

"We deprecate the proposition to put any definition whatever to the word exact, believing that to a manufacturer of tools certainly the word should define itself, yet we must recognize the fact that from the beginning, in the use of a tap and die, the tap grows smaller and the die larger, and the difference in size *may* become appreciable before they wear out, if they are of the best material and construction, and the question to be determined is whether they shall be a few thousandths large, or of the exact size and the oftener replaced with new ones."

## Boasting Without Knowledge.

"There has been a very great improvement of late in the way engineers handle the air-brake," remarked one of the traveling engineers, "but there are still some men too well posted about things about the brake that are not true. Pure ignorance is not so hard to fight as the jumping at conclusions that are wrong. Since it is considered the correct thing to appear well posted about air-brake matters, some engineers continue to make-believe that there is nothing about air-brakes they are not familiar with when as a matter of fact the extent of their knowledge is understanding how to handle the brake without cause for complaint.

Jim Blimson, one of our engineers, is a man who thinks he knows everything by inspiration. Jim is rats on books and has nothing but contempt for those who resort to books for information about their business. "Observation is how I find out about things," Jim used to remark, and he would puff himself out like the frog of the fable and talk vaguely about valve-gear and injectors and lubricators till the boys would gape with admiration.

And still they gazed, and still the wonder grew
That one small head could carry all he knew.

With many of the boys Jim Blimson was a living contradiction of the belief that men need to study books to learn about train mechanism.

The Handsomest Engine in the "Land o' Cakes." Eight-foot Wheel, Single, Caledonian Railway.

One day the 390 that Jim was running broke a side-rod, and he attempted to take the engine in with one rod. The thing was a failure, and to his mortification Jim was laid off for two weeks to impress upon his mind that it is not safe to attempt to run with one side-rod. It also disturbed the confidence of several of the boys in Jim's knowledge for they were ready to quote different books that described just what would happen if a man tried running with one side-rod, and with Jim the case came out just as the books said it would.

The suspicion aroused about this hero of the roundhouse stove was beginning to settle down, for Jim had many plausible explanations to offer, when another blunder due to sheer ignorance hurled him forever from his high pedestal. Something went wrong with the air-gauge of Jim's engine just as he started out with the fast local, and he made the trainmen use the hand-brakes over the remainder of the division. For this he got ten days.

But the suspension was not the worst of the case. When the trainmen who did the braking learned that there was nothing to prevent the engine doing the work except Blimson's ignorance, they were furious.

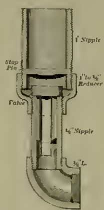
You may give offense to a master mechanic, or general manager, or president and he will get over it and cause you no harm But never give a brakeman a grievance against you, or lead him to believe that you do not understand your business. If you do you might as well quit. That was how Blimson fared. Within a week every man on the road heard the ridiculous story of Blimson stopping his air-pump because the gauge was out of order. All sorts of additions were made to the story, and many other instances were given of stupid things which Jim did when they were really done by others.

At the end of his suspension Jim took his engine again, but he soon found life a burden Instead of admiration for his voluble talk he now found ridicule. Even switchmen, when they passed his engine, would jeer as everybody knows in their way, and ask Jim if he knew the difference between a smokestack and a hay rake? He tried to live the thing down but it would not do. The brakemen would not forget if they did forgive. One day he took his time and went West. He is now running a saw mill engine in Oregon.

Some of the leading locomotive works are now employing men who have had long experience in handling different types of engines, whose duties are to assist in the location of boiler attachments and cab, when these matters are left to the discretion of the builders, so as to make cab as comfortable as possible and all the attachments as near get-at-able as possible for the convenience of the men who use them.

### A Cheap and Good Cylinder Cock.

The engraving shows a cheap cylinder cock used by Master Mechanic Wm. M Morse, of the Toledo and Ohio Central Extension Railroad, at Marietta, O. The cock has a loose, lift-up valve of the regulation pattern, but the rest of the device is made entirely of gas-pipe nipples, a reducer and an elbow, with one rivet ¼ inch by




2 inches long. No casting is required and the cock can be made without a machine shop. It looks to us as if it was just as good as the best and cost about half as much.

### Southern Pacific Metal Cab.

Our engraving gives two elevations and sections of several parts of a metal cab for locomotives, designed by Mr. H J. Small, superintendent of motive power of the Southern Pacific, and used on that system. The climate of the country through which a great part of the Southern Pacific lines pass, is so intensely dry that wooden cabs shrink quickly and then shake apart. This has made the use of a metal cab necessary. Complaints are frequently heard that iron cabs are uncomfortably hot and they must necessarily be worse in this respect than a wooden cab, but every effort has been made in the designing of the cab shown to make it as cool as possible. The roof, as will be seen, is double, with a hollow air space which is lined with asbestos cloth. The cabs are unusually high and wide, with ample windows for admitting air and light. The details of construction are so clearly shown in the engraving that no description is necessary.

### A Rail Joint That Saves Flagging.

When two railroads run side by side there is always some rivalry among the employés of the two companies. Engineers will race when they can do so without violating rules, and sometimes they will show the speed of their engines, rules to the contrary defying.

The Denver & Rio Grande and the Fort Worth roads run side by side, and there is *esprit de corps* feeling between the road departments of the two companies. Two road masters from the rival corporations lately met and were heard bragging about the possessions of the roads. They held their own fairly well till the Rio Grande man said: "There is one thing where your road is ahead of ours Yes has the Norris-Fisher joint on yer rails and it saves yer men from flaggin'. The joints make so much noise that yes can hear a train ten miles away!"

### Stopped Up.

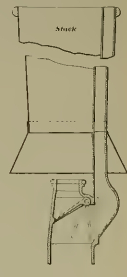
"During the 'Q' strike," said the master mechanic from out West, "I found myself in Denver and went to the Union depot one morning to go South over the Santa Fé. I found a crowd of men around one of the B. & M. engines and a green hand was trying to start her.

"He hossed her back and forth but the train didn't move—I guess some of the strikers had been monkeying with the brakes—the fellow would pull her over and take the slack, then throw her ahead, give her steam and look back out of the window to see what was holding him.

"After he had done this four or five times some one in the crowd yelled

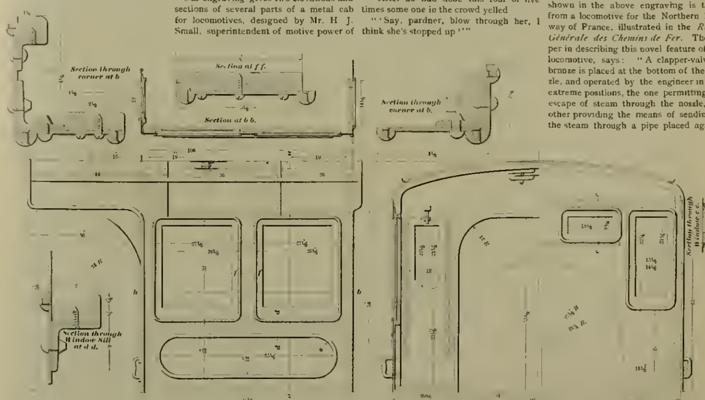
"'Say, pardner, blow through her, I think she's stopped up!'"

arrangement will look up "Clark's Railway Machinery" or Colburn's "Locomotive Engines," engravings will be found that are almost identical with the latest smoke-consuming inventions. The only novelty about the later forms of smoke preventers is in the providing of mechanism the purpose of which is to make the admission of air automatic and to dispense with the attention of the fireman.




### A French Idea.

The exhaust-pipe and arrangement shown in the above engraving is taken from a locomotive for the Northern Railway of France, illustrated in the *Revue Générale des Chemins de Fer*. The paper in describing this novel feature of the locomotive, says: "A clapper-valve of bronze is placed at the bottom of the nozzle, and operated by the engineer in two extreme positions, the one permitting the escape of steam through the nozzle, the other providing the means of sending all the steam through a pipe placed against




Southern Pacific Metal Cab.

This is something which will be appreciated by engineers and firemen; in fact, 'tis a long felt want supplied.

The Mack water-circulating device has been applied to several locomotives belonging to the Boston & Albany and the men in charge are so well pleased with the improved steaming qualities of the boilers that they intend putting the circulator upon other engines. This invention makes independent connection between the water leg and the front end of the boiler, and induces constant movement of the water from the cool to the hot parts. The saving of fuel attributed to the circulator is sufficient to direct attention to the invention as a means of materially reducing the fuel bills.

The agitation that has been carried on so vigorously in Western cities against the smoke nuisance is bringing out a bountiful crop of patented smoke-consuming fire-boxes for locomotives. Those who are familiar with what has been done in this line are frequently puzzled to find the parts of the devices that are patentable. Most of the inventors use some form of the Clark steam jet for injecting air upon the surface of the fire. Others use the baffle plate above the door, in combination with the brick arch, and have some means of conveying air inside. The invention of smoke-preventing firebox attachments was so exhaustively followed in Europe forty years ago that it is very difficult to produce anything new and practicable. If any railroad company anxious to find a good smoke-preventing

the interior of the smokestack to escape directly into the atmosphere.

"This arrangement has been adopted owing to a prolonged trial of a similar arrangement on a suburban locomotive which proved highly satisfactory."

We think we would prefer the Lutgens damper as a means of reducing the draft.

The Eastern Railroad Association gave an opinion some time ago that the Leach Sanding Device might be construed as an infringement of the Collins patent, 271,039, which was designed to use air for cleaning out the sand-pipes when they get stopped up. We now learn from the Leach Sanding Device owners that they have purchased all rights and interests in the Collins patent

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All subscribers will hereafter be notified that their subscription has expired by a patent return blank in the paper. This is ready to fill out, is itself an envelope and is at once the cheapest and best way for us to give the notice.

Should the subscriber neglect to fill out the blank before the next issue of the paper, we send it and notify him the second time by postal card of the expiration of his subscription.

This gives two chances to renew before a name is cut off, gives ample time to communicate with this office if the subscription has been sent and not acknowledged, or to see a club-raiser who has taken a name and neglected to send it in promptly.

With our immense list it is impossible to avoid sending notices to *some* who have renewed subscriptions received near the end of the month and between the time the wrappers are printed and papers mailed.

We assume that every reader wants to keep taking the paper, and we know that many of them are away from home a great deal, and that it is four weeks between pay days. This is why we send two notices and are as easy as possible.

With so large a list as ours no record can be kept other than the list itself, so we do not respond when a man writes "Put me on and I'll send you the money." We enter only paid subscribers, and the date on their wrapper shows how long their subscription is paid.

A receipt is sent for every single subscription and to club-raisers for all amounts received from them. If you have paid a club-raiser and then get a notice, nine to one it is all right and due to his delay in sending the list.

We have set our mark at 30,000 paid subscribers, and to this end propose to deal fairly, give full value and deserve renewal, keep all our old friends and capture many new ones. If there is any doubt the subscriber shall have the benefit.

SINCLAIR & HILL.

### Notice to Club Raisers.

There are more than 400 club raisers hustling for LOCOMOTIVE ENGINEERING and we have a favor to ask of each one of them. We find that many hold a list for a month or more trying to get it up to full size before they spring it on us. This is all right where all the names are of new subscribers, but where there are renewals it is not. We send notices to each subscriber, and a man who has paid a club raiser for his paper a month before dislikes to be notified that his subscription is out. Then he writes us a letter. This is the favor: *Please send in what names you have every month.* It will save lots of trouble in the mailing department. 4,522 names, counting renewals, were put on the list in January, and there were more in February. Every complaint calls for hunting for the name on the last list, and often the month previous.

It won't make a bit of difference to you to send in what you have—you can add to it during the whole year—and it will save us lots of annoyance. SINCLAIR & HILL.

### Profit and Loss of Chain-Ganging.

In the days when very few railroad companies had departed from the practice of regulating the work of a locomotive to the physical endurance of one crew, the president of one of our largest railroads went to Europe, and he traveled with his observing faculties active. He had watched with interest the ceaseless jar of the engines and found food for reflection in the fact that they never stopped from the time the pilot was put off until the boat was slowed to take on another pilot near Queenstown. When this railroad magnate returned he intimated that he did not see why a locomotive could not be run day and night without rest just as successfully as a marine engine. The difficulties in the way of making a locomotive run constantly were explained, but the president looked upon the objections as the excuses of conservative officials, and he insisted that the practice now known as chain-ganging should be adopted. His practice is now followed by many of our railroad companies.

The fact that the practice of keeping locomotives running constantly has extended so much within a few years that nearly all railroad companies follow it more or less is generally regarded as proof that chain-ganging is a decided success. From information that has come to us this winter about numerous delays that have happened on a trunk line from the failures of chain-ganged locomotives, and from our observation of similar causes of train irregularity on another line, leads us to doubt the saving of the long mileage plan. The practice of keeping locomotives running as much as possible enables a railroad company to perform the business with a comparatively small first-cost for motive-power, but curtailment of first-cost is very often extremely expensive in the end. There is some reason for believing that an increase of capital account necessary for the purchase of enough freight locomotives to permit them to be run by regular crews would be a highly judicious investment. In figuring up the expense of operating a railroad there is too much attention bestowed upon the means of making direct saving and too little thought devoted to estimating the causes of indirect expense. When two locomotives, each costing $10,000, are made to do the work of three engines by excessive running, the assumption is immediately made that the interest on $10,000 is yearly saved. This is about $500 annually, and it is easily wasted on increased consumption of fuel and additional expense for repairs. But the great source of waste with the overworked engine is in failures through breakages, which would not have happened had the engines been in charge of a man who followed the practice of thorough inspection, and through want of steam, which would have been kept up by a fireman familiar with the engine, or by an engineer who knew how to adjust the draft appliances. Delayed trains are a fruitful cause of collisions. When accidents happen or when derangement of traffic results from shortcomings which are directly attributable to the chain-ganging system, the loss or expense incurred ought to be charged to the method of engine operating. Were this done regularly, we are persuaded that the chain-ganging plan would be less popular than it is with those who figure up operating expenses.

There is, of course, great difference in the way that chain-ganging is carried out on different roads. On some lines the engines are run almost as economically and successfully as they are under the regular crew system. The secret of this success appears to be in the way inspection is carried out. Competent men are employed who thoroughly inspect every engine on its arrival at a terminus, and the necessary work is done. On other roads the inspection is a perfunctory affair, and failures are constantly happening on the road from defects that proper inspection would have remedied. But the most perfected system of caring for the engines does not overcome certain drawbacks inherent to the chain-ganging plan. It does not supply the live personal interest which working the same engine day after day supplies. The money value of this interest lies in the fact that deterioration of any part is noted and provided against. If a bearing inclines to run hot it receives timely nursing; if a valve has begun to cut, it receives extra lubrication. This kind of acquaintance prevents delays on the road. The engineer comes to know with certainty how the engine can be worked with the smallest drain on steam, and the fireman has learned how she can be fired with the least consumption of fuel. This line of information saves fuel. Theorists say that all locomotives of the same class can be worked in the same way and equal results obtained. It does not come out that way in practice. A very little difference in the alignment of the nozzles will make a decided difference in the steaming qualities of the engine, and variations in the position or condition of the other draft appliances will be strongly felt. Similar influences require peculiar treatment in the handling of an engine to secure the best results. Thus it comes that those who are thoroughly acquainted with one locomotive can work the engine more economically than strangers. When all the drawbacks to the practice which divorces the personal interest of enginemen in the locomotives are summed up, it will be found that the balance caused by chain-ganging is on the wrong side.

### Diverse Sizes of Taps and Dies.

In another part of this paper will be found the expression of views of Butterfield & Co., Derby Line, Vt., on the subject of sizes to be followed in the manufacture of taps and dies for United States standard screw threads. This firm are large makers of taps and dies, and like nearly all others in this line of business, experience annoyance through the diversity of practice that exists among railroad men in the ordering taps and dies. The railroad men who are satisfied with these things when they are made to exact sizes appear to be in the minority. A peculiar feature of the case is that there is very little disposition among all the other vast mechanical interests of this country to call for taps and dies that vary from the standard size. Why is it that those who are in charge of railroad rolling stock are the only class that object to following the standards that were established to secure uniformity and interchangeability? It was rightly expected, when the reform was accomplished establishing standard sizes of screw threads, that railroad companies would be the greatest gainers by the change, and this turned out to be the case. Before the reform was effected railroad companies experienced no end of trouble, expense and delay in repairing foreign cars owing to the diversity of screw threads in use. Now a bolt made and applied in Boston will take a nut threaded in San Francisco as readily as if it was fitted for that particular bolt.

In view of the great advantages that have accrued to railroad companies from the introduction of standard screw threads, we think it is very short-sighted policy on the part of their mechanical representatives to adopt practices that cause diversity of sizes. There is no doubt that a practice has grown up of ordering taps a little larger and dies a little smaller than the standard sizes, the purpose being to make the tool last beyond its natural wear. This is an objectionable practice at the best, even viewed from an economical standpoint. If a large tap is threading nuts larger than the standard, and dies are cutting the bolt smaller than the full diameter, a very poor fit is the result, and the loss of nuts falling off and breakage occurring in consequence is likely to cast up a bill of expense that will not be offset by the small gain secured by making taps and dies last a little longer. The practice, however, has become so prevalent that it ought to receive consideration from the mechanical associations. If it is advisable to depart from the standards it ought to be done systematically. The subject should be put into the hands of a committee that would inquire into the prevailing practice and make recommendations for the guidance of railroad companies and manufacturers. The committee having this subject under investigation last year reported very strongly in favor of maintaining exact standard sizes, but the question would not suffer any from renewed agitation.

### To Indicate Leakage of H. P. Piston.

A master mechanic who was at one time a marine engineer, and is now in charge where there are a number of compound locomotives in use, has urged us to advocate that gauges be placed on receivers so that the engineer may have the means of learning when anything happens to the high-pressure piston to cause excessive leakage of steam. This was, we consider, a good suggestion, and is well worthy of general adoption. Cases were mentioned where the piston rings of the high-pressure piston had broken all to pieces, yet there was no means of telling that anything was wrong, although the leakage of steam must have been very great. To be sure it passed into the low-pressure cylinder and was used there, but leakage of this kind must detract very much from the economical performance of a compound locomotive. An engineer who took an intelligent interest in the working of a compound locomotive would be likely to detect bad piston leakage by the cylinder cocks; but there are not many engineers who are studying the working of this class of engine very deeply, and the average runner does not understand how to detect leakage. A gauge on the receiver would make his diagnosis comparatively easy.

### We Are Pained to Observe, Etc.

The *Railway Age and Northwestern Railroader* comes out with a statement about circulation that shows how reckless some people can get with the truth. It says that it is "read by more railroad men than any other paper in America," and adds "all statements to the contrary are false." The biggest liar on the *Age* has never claimed above 5,000 circulation until the past year, and only a few days ago one of the officers of the company called upon us and stated that they printed 7,000 papers a week—this is doubtless somewhere near correct; say it is, they are *not in it*. LOCOMOTIVE ENGINEERING never prints less than 20,000, and has not printed less for nearly a year, and has printed as many as 30,000 in one month—and has no back numbers. The *Age* must have less than 7,000 readers—the same men don't count each time they look at a paper. We have almost three times as many. There is no doubt that the *Age* has more than any other weekly, but when it comes to saying *our railroad paper* they are off. We are willing to bet that the news-stand sales of LOCOMOTIVE ENGINEERING are more than the paid circulation of any other railroad paper, except the *Age*. Always glad to show our list to anybody—especially circulation liars—the *Age's* young man will please call and see it.

Later. Since the above was put in type the *R. R. & N. W. R.* has changed the wording of its challenge so that it knocks the chip off the shoulder of *weeklies* only. It may come back to us and all will be forgiven.

### Consolidation in New England.

If consolidation of railroads goes on as it has been progressing for the last few years there soon will be only a dozen separate companies in the country. New England appears to be rapidly drifting into two systems. The New York, New Haven & Hartford started a consolidation movement a year or two ago, and in that time it absorbed the New York, Providence & Boston and several smaller lines. Last month this small road, with the strong power of assimilation, opened its mouth very wide, and no less a morsel than the great Old Colony Railroad dropped in. The Old Colony did not have a long trackage as compared with some roads, but it did an enormous business on the 600 miles it reaches over. Its passenger business is exceptionally heavy and remunerative. The road was formed from the consolidation of a great many small roads, one of them having been a granite tramway near Quincy, which was said to have been the first railroad built in this country. The rolling stock owned by the Old Colony is exceptionally good.

Since the Philadelphia & Reading interests got control of the Boston & Maine the latter line has had its ideas of conquest sharpened, and they have been by no means dull for several years. The new deal was hardly accomplished when the Boston & Maine proceeded to swallow the Connecticut River road, and now it is said to be reaching out for other roads which have been considered within sacred keeping. There is likely to be more consolidation soon, but a conflict of giants would not be a surprising accompaniment of the next movement.

Since the above was written the battle predicted has been lost and won, and the Reading has been forced into the hands of a receiver. The intrusion of that corporation upon the preserves of New England roused the wrath of powerful keepers who proceeded to hammer the life out of all Reading securities.

### Send Information About Compound Locomotives.

A circular has been issued by Chairman George Gibbs, of the Master Mechanics Association Committee on Compound Locomotives, asking for information about this type of engine from all those who have notes of experience to offer. The questions asked are particularly comprehensive, and if answered will present valuable facts about compounds which railroad managers are anxious to obtain. The popular interest in compound locomotives has not subsided any within the last year. Nearly all intelligent men connected with the motive power department have been studying the subject, and the large number of compound locomotives in use are giving object lessons of much value. During the last few months we have heard several men who have the best of opportunities for observing the working of compound locomotives make the statement that this kind of engine is not well adapted for high speed. They think that the compound is destined to come largely into use, but that very large driving-wheels must be employed to make the engine do well on passenger service. Others say that the engine is not adapted for anything except freight service, and that of a fairly uniform character. When all the opinions and notes of experience are in, the able chairman of this committee will no doubt sift all the points worth being known and present them to the railroad fraternity in the most intelligible and attractive form.

We would suggest to all concerned that it is their duty toward railroad interests generally to send to Mr. Gibbs all the information in their possession concerning compound locomotives.

### Curious Advertising Methods.

There are some so-called railroad papers which exist merely for the purpose of getting advertisements and are seen by very few people except those who do the advertising that keeps them alive. They take advertisements for what they can get and can afford to do so because very little expense in brains, engravings, typographical matter and paper is expended on the publication. Only enough papers are published to go round the advertisers and a small free list. Yet papers of this character receive patronage from parties who manage the other lines of their business well enough to achieve success. There is a wild scramble for advertising among what might be termed bona fide railroad papers, but we can hardly believe that any of them are referred to in the annexed letter. One of our advertising agents had called upon the American Steam Gauge Company of Boston, and a few days afterwards we received from the company the following letter:

"We have been looking into the matter of advertising in different locomotive and railway papers and have inquired of some parties whom we thought much better posted than we are. We find that while your paper stands very well there are other papers which are considered ahead of it. We will make you the same proposition we have made some other parties with whom we are now advertising, they having accepted our proposition. If you will give us six months' advertising for nothing we will agree to continue for twelve months more and pay you for the twelve months. At the end of this time we can decide whether we are benefited by the advertisement or not, and if so we shall be pleased to continue with you, you to give us space at the top of the page next to reading matter and any little articles on our specialties which you would like to put in the reading matter from time to time."

Among recent railroad news of interest is the announcement that Henry S. Ives has obtained control of the Cleveland, Akron & Columbus road. This is the gentleman who came within an ace of obtaining control of the Baltimore & Ohio as a tail to the Cincinnati, Hamilton & Dayton. Had it not been that the president of the Pennsylvania Railroad and other moneyed magnates stepped in and blocked the movement, Ives would have carried out his plans, and instead of going to prison he would have been hailed as the greatest financier of the day. The railroad world has by no means seen the close of Ives's career. He is the irrepressible sort of a man who does not know when he is beaten and converts defeat into the beginning of victory. Shortly after the collapse of his C., H. & D. scheme, which was just as legitimate as many other railroad deals that met with general approval, Mr. Ives opened an office in Wall street and began making money. He quietly secured control of the Ohio Southern and is building up the property. Some day it will be an active competitor of his old line, the C., H. & D. We shall be greatly mistaken if Mr. Ives does not cut a wide swath in railroad circles before many years.

An order of court has been given to sell all the assets belonging to the Cyclone Snow Plow Co. The history of this company is a good illustration of the fact that it is never safe to count very much on the value of a mechanical appliance until it has been tried. It also shows that ordinary business men are not good designers of machinery.

### PERSONAL.

Mr. Alonzo Dolbeer has been appointed master mechanic of the Lehigh Valley, at Buffalo.

Mr. J. H. Graham has been appointed master mechanic of the Iowa Central at Marshalltown, Ia.

Mr. R. K. Mulcahy has been appointed superintendent of the Oregon Pacific, with headquarters at Corrallis, Ore.

Mr. D. H. Blair, an engineer on the Southern Pacific, has been promoted to acting road foreman of engines.

Mr. George F. Evans has been appointed superintendent of the Connecticut River Railroad. He was formerly on the Boston & Maine.

Mr. C. M. Lawler, assistant general manager of the Philadelphia & Reading, has been made general superintendent of the main line.

Mr. George P. Hodgman, one of the Railway Master Mechanics' Association scholars at Stevens' Institute of Technology, is president of the class of 1894.

Mr. J. A. Wagner has been appointed superintendent of the Des Moines Union Railway, vice Horace Seeley, who goes to the Des Moines Northern & Western.

Mr. Thomas Roope, for some time acting master mechanic of the Sioux City & Northern, at Sioux City, Ia., has been appointed to the position he held on trial.

Mr. Weston Lewis has been chosen president of the Sandy River Railroad, and Mr. Josiah Maxcy vice-president and general manager, with offices at Gardiner, Me.

It is reported that the Rogers Locomotive & Machine Co. has been reorganized, Mr. J. S. Rogers retiring from the firm. The style hereafter to be Rogers Locomotive Co.

Mr. E. Dickinson, for several years assistant general manager of the Union Pacific, has been promoted to the position of general manager, succeeding Mr. S. H. H. Clark.

Mr. I. H. Lyman has been promoted from roundhouse foreman on the New York, New Haven & Hartford at Bridgeport, Conn., to be general foreman at Falls Village, Conn.

Mr. H. W. Hammond has been appointed superintendent of the Western division of the New York & New England. He was formerly on the Rome, Watertown & Ogdensburg.

Mr. W. J. Murphy has been appointed superintendent of the Cincinnati division of the Cincinnati, New Orleans & Texas Pacific. He was formerly on the East Tennessee, Virginia & Georgia.

Mr. O. R. Whitney, for some time master mechanic of the Alabama Midland, has been appointed general superintendent of the New York & Yonkers Steamboat Co., with headquarters in New York.

Mr. W. H. Russell, road foreman of engines of the Southern Pacific, has been promoted to the position of acting master mechanic of the San Joaquin division, with headquarters at Bakersfield, Cal.

Mr. F. A. Harrington, superintendent of the Mohawk division of the New York Central, has been chosen managing director of the Troy Union Railroad, to succeed Mr. Theodore Voorhees, resigned.

The following promotions have been made on the Jacksonville & South Eastern line: J. P. Warner, from roundhouse foreman to be traveling engineer, W. W. Morrow, from engineer to be roundhouse foreman.

Mr. W. H. Voorhies has been promoted to be assistant superintendent of the Iowa Central. He began work on the road 20 years ago as brakeman, and has risen through the grades of conductor and trainmaster.

From an article in a Pacific coast paper regarding the women in California who have graduated as lawyers, we learn that one of our correspondents, Mrs. J. C. Baker, of Oakland, Cal., is one of seven female lawyers in that State.

Mr. G. R. Hardy has been appointed superintendent of the New York, New Haven & Hartford, with charge of engineering work on the New York division. Mr. Hardy has been for some time with the Westinghouse Electric Company.

Mr. E. C. Hieser has been appointed master mechanic of the Adirondack & St. Lawrence division of the New York Central at Herkimer, N. Y. Mr. Hieser has been an engineer on the western end of the New York Central, and was foreman at Lockport when promoted.

Mr. William Renshaw has been promoted to be superintendent of machinery of the Illinois Central, succeeding Mr. Henry Schlacks. Mr. Renshaw has risen on the Illinois Central from a machinist. He was successively foreman, master mechanic and assistant superintendent of machinery.

Mr. T. Hackworth Young, roundhouse foreman of the Chicago, Milwaukee & St. Paul, at Chicago, has been appointed superintendent of the Railway Division of the World's Fair. Mr. Young is a grandson of Timothy Hackworth, one of the pioneers in the development of the locomotive in England. His selection for the position is a graceful tribute to a great inventor.

Mr. E. G. Russell has been appointed superintendent of the Rome, Watertown & Ogdensburg with headquarters at Watertown, N. Y. Mr. Russell was for several years superintendent of the Illinois Central, and attracted considerable attention by the fight he carried on with the striking switchmen of that road at Chicago. He is a man of strong personality and does not tolerate any interference with his authority.

We have to acknowledge several pleasant visits from Mr. E. Tatlin, superintendent of the Moscow-Brest Railroad general works, at Moscow, Russia. Mr. Tatlin has been making a visit to our railroad system for the purpose of obtaining information of a useful character. He was very much pleased with what he saw and with the courtesies shown him. Mr. Tatlin has arranged to translate "Sinclair's Locomotive Engine Running and Management" into the Russian language.

We have received an announcement that the co-partnership between J. G. Hendrickson and F. J. Clamer has been dissolved and all interests acquired by the Ajax Metal Co., Incorporated. In the circular making this announcement there is a very interesting history of Ajax metal, which is an addition of lead to copper and tin in such a way that the lead is not only perfectly diffused through the mass but is fixed and stable in its distribution, so that the alloy can be repeatedly melted without any separation or deterioration of the lead from the other metals.

Mr. Henry Schlacks, who has been superintendent of machinery of the Illinois Central for ten years, has resigned. Mr.

Schlacks had been with the Illinois Central, with a few short breaks, for thirty-three years. He was for a short time foreman of the Rock Island shops at Chicago at the time Mr. Allan Manvel was shop clerk there. A friendship sprung up between the two men then that has been unbroken since, although they have followed different roads. Mr. Schlacks rose on the Illinois Central from machinist to the head of the mechanical department.

After being away from the road about two years, Mr. Allan Cooke has returned to the Chicago & Eastern Illinois as superintendent of machinery. We took occasion to tell some wholesome truths to the management that crowded Mr. Cooke out of the position he had held with so much credit to himself and profit to the road, and we are very glad to learn that he is back in his old place. Without being brilliant Mr. Cooke is essentially a safe man to be in charge of railroad rolling stock. No one understands the practical part of the business better. He will spend the money available to the very best advantage and keep officers and men in good humor. There is no fear of any trouble in the motive power department of the Chicago & Eastern Illinois while Allan Cooke remains at the helm.

Of the many well-known men who were directors of the New York Central from the time it was organized in 1853 until it came under the Vanderbilt control in 1867, only four are alive. The best known of these is Russell Sage, who was State Senator from Troy when he was elected director. Mr. Sage rose into prominence and riches through the political highway. He was originally a saloon keeper in Troy and attended his own bar. His place was noted for its good whisky, and Russell by this means and other methods obtained so much influence with the boys that he became their political representative. He has always been known as a hard man, who will never yield a cent that is not forced from his grasp. He is the kind of railroad owner who has made combination of railroad employes imperative as a means of self-protection.

Professor Arthur T. Woods died at Chicago of typhoid fever, last month. He was a graduate of Annapolis Engineering School, and afterwards spent several years in the navy. Seven or eight years ago he was appointed professor of mechanical engineering at the Illinois State University, where he became a highly popular teacher. While here he devoted a great deal of attention to railroad machinery questions, particularly to compound locomotives. At the writer's suggestion he wrote a series of articles on compound locomotives, which were put in book form, and is the only reliable work on the subject. About two years ago he was appointed professor of dynamic engineering at Washington University, St. Louis. This work he left to accept an editorial position with the *Railroad Gazette* at Chicago. Professor Woods was a pleasant, genial gentleman, and had many friends among the master mechanics, having been an associate member of the association.

The Central Railroad of New Jersey have ordered from Baldwin's fifteen consolidation engines for freight service and twenty eight-wheelers for fast passenger trains. The latter engines, designed by Superintendent of Motive Power Thompson, are well deserving of special mention. They have cylinders 20x24 inches and driving wheels 6½ feet in diameter. The main bearings are 8x12 inches and all the other bearings are unusually large. The boiler is 58 inches diameter at the front ring, made of ⅝-inch steel and arranged for 250 2-inch flues, with ¾-inch space between each. The firebox is 11 feet 1½ inches long, the large grate area being needed for burning hard coal. The boiler provides about 1,700 square feet of heating surface.

## Poughkeepsie Bridge.

The handsome supplement which accompanies this issue of LOCOMOTIVE ENGINEERING gives a striking view of the Poughkeepsie bridge over the Hudson River. Those familiar with the physical topography of the Eastern States understand that the elevated ridge extending southeast from the Catskill Mountains, with the Hudson River at its side, makes a natural barrier between Pennsylvania and the New England States. The spanning of this obstruction was long projected, but it was not till 1871 that the scheme of bridging the great river at Poughkeepsie took practical shape. A company was formed in that year to do the work, and a charter was obtained in 1873. Work was commenced two years later, but the financial panic took life out of the enterprise, and work was entirely suspended three years later. For eleven years nothing was done, but in 1886 a new company was organized which purchased all interests belonging to the old company, and a contract was made with the Union Bridge Co. to push the work to completion. The work was pushed rapidly, and the bridge was opened for traffic two years ago.

This bridge and the connecting lines are now in control of the Philadelphia & Reading, and are used as a direct route for conveying the coal products of Pennsylvania to the New England States. This connection originated the ambition of the Reading management to control important railroads in New England.

The bridge, which is seventy-five miles from New York, spans a gorge about 200 feet deep and nearly 7,000 feet wide. The bridge proper consists of five spans, two cantilevers 548 feet each, one cantilever 546 feet, two connecting cantilevers 525 feet each, and two anchor spans 201 feet each. The western approach is by a viaduct 1,034 feet long, and the eastern approach viaduct is 2,640 feet long, the whole making a structure 6,768 feet in length. The water in the river at that point is sixty feet deep, and there is a depth of seventy feet of mud through which the foundations had to be sunk. The bridge rests on iron towers that stand on stone piers forty feet high. The rails on the bridge are 212 feet above high water mark.

The scene which our engraving presents is the view of the bridge as it appears from the tracks of the New York Central Railroad.

It is estimated that the engines in two new vessels lately launched for the Cunard Line will develop 30,000 indicated horse power.

Under a pressure of 5,000 pounds the deflection of a good oak brake beam is about ¾-inch. A good steel beam will endure the same pressure with a deflection of $\frac{1}{16}$-inch.

It must sometimes be a little exciting living in houses close to the elevated railroad structures. A news item in a Brooklyn paper recently mentioned that a woman was badly hurt by being struck by a cylinder-head while sitting at her window.

The bill before Congress requiring railroad companies to use automatic car-couplers and continuous brakes also makes it unlawful for any railroad company to use cars that are not provided with hand-holds for the convenience and safety of men in coupling. This is one of the Master Car Builders standards and is an inexpensive attachment that has saved many lives. The railroad companies that require legislation to compel them to adopt hand-holds are a disgrace to a civilized community.

The Bridgeport Machine Tool Works have opened a new office in room 86, Taylor building, 39 and 41 Cortlandt street, this city. Mr. N. B. Lyons is in charge.

## EQUIPMENT NOTES.

The "Soo" has placed an order with Schenectady for ten locomotives.

The Pennsylvania has contracted for the construction of 1,000 new freight cars.

The L. I. R. R. is also reported to be about placing orders for some freights.

Buffalo, Roch. & Pitts. are contemplating ordering additional freight equipment.

The twenty coaches for the Long Island have been let to Jackson & Sharpe, of Wilmington.

The Allison Mfg. Co. of Philadelphia are reported to be very busy with freight car building.

It is reported that the K. C., Ft. S. & M. are in the market for ten locomotives and 500 box cars.

The Schenectady Locomotive Works have taken an order from the Mich. Cen. for ten engines.

The Rogers Locomotive Works have taken an order from the Ill. Cent. for seven switchers.

The contracts for the 1,300 freights for the extension of the N. Y., Sus. & W. Line have not yet been let.

It is reported that the Illinois Central have ordered 30 passenger cars from Billmeyer & Small, York, Pa.

The Rhode Island Works have received an order for seven locomotives for the Toledo, St. Louis & Kansas City.

The Chesapeake & Ohio have contracted with the Basic City, Va., Car Works for the building of some freight cars.

The D., L. & W. have placed an order with the Jackson & Woodin Company, of Berwick, Pa., for 500 coal gondolas.

The Lehigh & Hudson have ordered 100 box cars of 60,000 pounds capacity, to be used in the Central Dispatch Freight Line.

The order from the Pitts., Shen. & Lake Erie Road for freight equipment was placed as follows: 500 to the Ohio Falls and 500 to the Pullman Company.

The Pittsburgh Locomotive Works are building three compounds of their two-cylinder type for the Union Elevated Line of Brooklyn.

The N. J. Central orders for twenty-five engines have been placed with Baldwin. They are said to be in the market for 500 freights.

The Boston & Maine have ordered thirty new engines. They consist of twelve eight-wheelers, twelve moguls and six four-wheel switchers.

The Schenectady Locomotive Works have received an order from the Union Stock Yards of Chicago, for thirty switching engines.

Brooks people have received orders from the Duluth, Missabe & Northern for two heavy locomotives. They are working on 45 engines for the Great Northern.

Vice-President Thomas, of the Erie, is said to be contemplating ordering some ten-wheel locomotives suitable for pulling heavy passenger or fast freight trains.

The triple drum sander, for polishing and sandpapering wood-work, made by The Egan Co., Cincinnati, has been awarded the medal of "Superiority" at the fair of the American Institute, New York City.

The St. Charles Car Works are delivering passenger cars to the Missouri Pacific, and they are said to be particularly well designed and equipped with all the most modern luxuries, including Pintsch gas.

The Great Northern, which hitherto has been noted for opposition to the use of safety appliances, has adopted the M. C. B. standard coupler. The vertical plane type will in future be applied to all new cars.

The boys have loaded us up with criticisms of Campbell's valve-setting article; we have not room for all of them, but they are much on the same line; they don't believe much in his plan of throwing wheels by a liner to get his valves square.

Cooke's people are building a large ten-wheel compound locomotive, which they expect will make a record that will attract attention. The first compound they built was used as an object of study, all the weak points being fortified in the new engine.

The Illinois Central have ordered from the Rogers Locomotive Works eight new suburban double-enders of the Hudson type. These will be a little heavier than the engines in use, the cylinders being 17 x 24 inches. The fireboxes will be made large enough to burn anthracite coal.

The Lake Street Elevated Railway of Chicago are about to order 125 passenger cars and a full equipment of locomotives. The engines will be similar to those used on the elevated roads of New York, but a little heavier. The cars will be the same as those used in New York, and will be heated with the Morton system.

In a great measure the prejudice against bushed rods is from a theoretical and not a practical point of view. In support of this we refer to the results of the West Shore Road. Quoting at random from their records we note two bushes, ordinary brass, making a mileage of 101,614 miles to ⅜ inches of wear, and another showing 174,322 miles to ⅓ inches of wear. Comment is unnecessary.

The Wellman Steel Co., Thurlow, Pa., have made a contract to supply all the steel plates for one of the new Inman liners about to be built in Philadelphia. The quantity of steel required will be about 10,000 tons. This increase of business will make the works busy, but no extra plant will be required, as the capacity of the works is now about 2[illegible] tons a day, and about a year is given for supplying the plates.

The piston-rods, crank-pins, side-rods and power transmitting levers of the great double-ended locomotives for the Mexican Central were made of Tennessee iron by the Ewald Iron Co. of St. Louis. The company reports a growing demand for their fine quality of iron for the parts of railroad rolling stock given to breakage. If more of this product were used there would be fewer failures from broken rods, axles and piston-rods.

There is a good deal of killing the goose that lays the golden egg in some of our cities. The latest case of this kind reported is that the Peninsular Car Works are about to leave Detroit on account of the heavy taxation. We wonder if ever our sovereign voters will ever come to realize that other forms of property escape without a fair share of taxation, while every industrial establishment has to bear the burden. If there was more taxation of vacant lots, there would be less of that form of property waiting for a rise.

The introduction of compound locomotives appears to be making rapid headway in France, most of the railroads having this type of engine at work. French lo-

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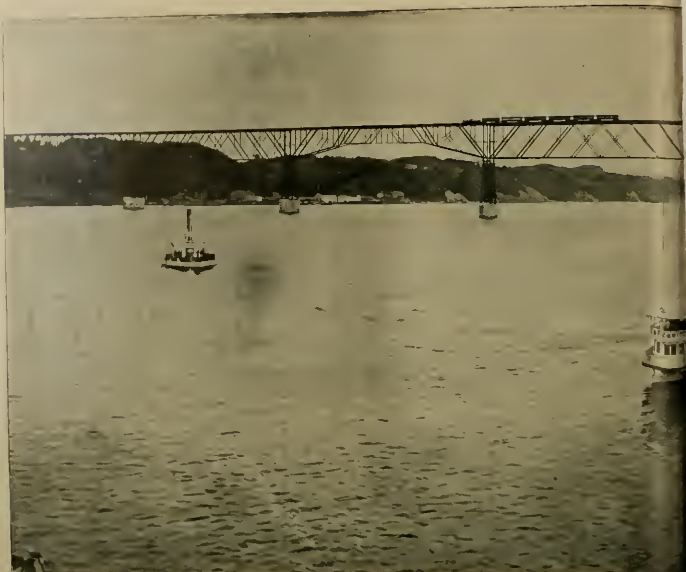

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[illegible] Above High Water
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[illegible] Train over [illegible] Completed [illegible]
[illegible] Engineer J. [illegible] O'Rourke

THE CANTILEVER BRIDGE

THE READING'S GATEW


AT POUGHKEEPSIE, N. Y.

Y TO NEW ENGLAND.

TOTAL LENGTH 6768 FEET
RAILS 212 FEET ABOVE HIGH WATER
FIVE SPANS OF OVER 500 FEET EACH
60 FOOT OF WATER AND 70 FOOT OF
MUD BELOW THE BRIDGE

motive designers appear to be celebrated for the complexity of their machinery. London *Engineering* lately had illustrations of a four-cylinder compound locomotive built for the Northern Railway of France, which is one of the most complex engines ever built. She is an eight-wheel engine, with two inside cylinders set under the smoke-box, and transmitting power to a cranked axle on the front pair of drivers, and an outside cylinder set on each side outside the frames, close to the front drivers. The latter cylinders have mechanism connecting with the back pair of drivers. The design calls for two sets of valve motion and a most objectionable arrangement of steam pipes.

The tendency on the part of railroad managers to curtail their equipment orders, that is, keep them behind the absolute wants of their road, is growing to quite an alarming extent. These constant car famines are working great injury to the business interests of the country generally. Nowhere perhaps is this tendency more noticeable than throughout New England. In a conversation with the general manager of a New England road, of a wide and long experience, he stated, that with an experience covering some twenty years, that scarcely a road in the New England States had owned sufficient equipment to do the business offered and that in his judgment it was very short-sighted policy on the part of the managements to do business in this way. They should provide enough cars for their own traffic at all times of the year, that the business was not of a fluctuating character and that the failure to provide these cars suppressed a great deal of traffic, and deprived the railroad company of a handsome revenue, that a careful study of the question had satisfied him that the cars more than paid for themselves in mileage earned on their own road or if engaged in service on other lines, that in his judgment the roads of New England owned less equipment per mile than any other roads throughout the country. Just what percentage less had not been carefully figured out, but that it was surprising to him and doubtless would be to others who would investigate the subject. It is a surprise to us that this matter is not receiving the attention it deserves. The niggardly policy on the part of these managements certainly ought to be stopped. Shippers complain very bitterly throughout the country and they certainly have reason to do so. Many of the sections of country are not provided with competitive lines and they are completely at the mercy of one corporation.

A party has brought suit against the Lake Shore Railway for $5,000 damages on account of his children having been put out of the waiting-room at Adrian on a cold night, where they went to await the arrival of their father on a late train.

There is a boiler-maker working under Mr. Fred Griffith, master mechanic of the Delaware Lackawanna at Buffalo, who has been a cause of much anxiety to Fred. The man's full name is Perterje Zmnchzizkomskekowlowski. Railroad men in Buffalo—Macbeth and others—say that Mr. Griffith's time-keeper has been claiming over-time for writing this boiler-maker's name. An official correspondence arose in consequence, and an extra typewriter had to be employed to help spell the man's name.

The Q & C Company have always been very liberal in the use of printer's ink, which has no doubt contributed largely to their great success. Not content with ordinary advertising, they have now established *Railway Specialties*, an illustrated journal with humorous tendencies. We welcome our new rival with a warm grasp of good fellowship. If it develops according to the implied promise of No. 1, Vol. 1, the *Railway Specialties* will soon be a formidable rival to *Puck*.

### A Traveling Blacksmith.

Superintendent of Motive Power John Hickey, of the Northern Pacific, has created a new office in appointing James J. Thornton traveling blacksmith of the system.

The idea of having a general foreman of a whole system, whose duty it is go from shop to shop and see that the practice is the best and nearest to standard, is a new one, and it looks like a good one.

So many new schemes are tried in all shops, so many little kinks, all their own, gotten up that others do not hear of, and, on the other hand, so many neglectful and wasteful practices become second nature that an "evener" in the shape of the traveling foreman has a chance to show pretty good results. He can introduce kinks from one shop to the other, stop wasteful practices, and his word will go a long way toward securing needed tools and stock, where a requisition or complaint from the local foreman would be overlooked, turned down or refused.

We understand tha Mr. Thornton has shown after a year of service a saving in the blacksmithing department and that the use of such an officer is shown to be a paying investment; we have been informed that the Santa Fé and the Southern Pacific have both put on traveling smiths.

Blacksmithing is one of the most important of the shop departments but less care is taken in it and less attention paid to it than almost any other.

The blacksmiths are waking up, they are beginning to study their business and will soon bring the importance of their work into notice by the improvement made in it. A great deal of interest has been taken in the railroad blacksmithing articles published in this paper.

The periodically expected visit of the traveling smith will help to keep many a shop cleaner, the stock in better order, the steam-hammer packed, and scrap in its place.

All hail, traveling smith, you are welcome.

We learn that the last year has been by far the most successful period in the business done by the Otley Manufacturing Company, Chicago. The principal products handled by this company are Otley's steam packing cement, asbestos pipe and boiler coverings, sectional hair felt, mineral wool, canvas and paper covering. The cement is the most popular of their goods. Nothing equal to it has ever been tried for making joints, stopping leaks, and for making all sorts of seams tight. It is particularly good for extension smoke-boxes, front ends, stack-saddles, exhaust-pipe joints and such work. The cement is used by a great many railroads and those who try it once always continue its use. A sample for trial will be sent on application.

An improvement in ash pans has been patented by Artemus Welsh, of Lawrence, Kan. Mr. Welsh proposes making an ash pan with oblong openings in the bottom, which are covered with stationary slats. When the pan has to be emptied the bottom is moved away from the slats, mechanism being provided for shaking the bottom to and fro.

### Using the Wells Light for Heating Tires.

The annexed engraving is the reproduction of a photograph taken at the Kingsland shops of the Delaware, Lackawanna & Western, when they were using the Wells light to take off tires. The light seems to be very well adapted for doing this work, as it heats the tire so quickly that the wheel center is not warmed. They took the tires off two sets of 58-inch driving wheels, and in each instance the heating was done in about 15 minutes. With an improved casing to go around the tires, the heating could be done in about 12 minutes. An ordinary sheet-iron casing was used, and a space was left open at each side where the burner was applied. One burner blew the flame round the upper half of the wheel while the other sent it round the under part.

Two tires were afterwards heated by the light and put on to wheels. In this case

WELLS LIGHT.

the tires were hung beside the wheel on brackets, heated in the same way as those that were taken off and then slipped on to the wheel centers.

For other heating purposes the Wells light meets requirements almost, if not quite as important, as tire expanding. Bent locomotive frames can, in a few minutes, be heated by the direct application of the flame sufficiently hot to straighten without burning the paint off, or heating adjacent parts, and the time required for such heating is less than the time required to build up an arch on a forge, as is done in most shops at the present time.

For boiler shop work in laying up laps and corners around water legs and openings, in boiler repairs for heating dropped crown sheets or shaping patches on fire-boxes, the Wells light supplies a long-felt want, as it is practically a large blow-pipe and will heat a considerable section of the plate red-hot in from ten to fifteen minutes.

As a combination shop tool for lighting shops, turntables, yards, tire expanding, heating bent frames and boiler making and repairing, it becomes invaluable and no shop can afford to be without it. It is sold by Wm. Halpin, of 46 Washington street, this city.

### Test of Simple and Compound Locomotives on the Cincinnati Southern.

Through the courtesy of Mr. James Meehan, superintendent of motive power of the Cincinnati Southern lines, we have received a copy of a report made to the general manager of a series of tests carried out to find out the relative efficiency of simple engine and a Vauclain compound. The tests were conducted in a very thorough and careful manner, no labor, expense or care having been spared to obtain accurate results.

The simple engine was a 10-wheeler, with cylinders 19 x 24 inches, driving-wheels 62 inches diameter, and a total weight of 111,000 pounds, 80,000 of which was on the drivers. The diameter of the boiler is 56 inches at the smallest ring, and had 1,566 square feet of heating surface and 18.81 square feet of grate area.

The compound has four cylinders 13 and 22 inches diameter by 24 inches, driving-wheels 68 inches diameter, and a total weight of 120,000 pounds, 84,800 being on the drivers. The diameter of the boiler is 58 inches, and has a total heating surface of 1,822 square feet and 18.4 square feet of grate area.

The report is based on 10 runs made with passenger trains, care having been exercised to make the weight of trains and speed uniform for the two engines under test.

Respecting the dimensions of the two engines the report says: "The saving of fuel approximates 35.5 per cent. in favor of the compound. . . You will observe that the compound has 16.3 per cent. more heating surface with the same grate area, or in detail, the compound has 99 of square feet of heating surface per square foot of grate area as against 83.26 square feet for the simple engine. This gives the compound engine's boiler more efficiency, primarily, on account of the above mentioned additional surface for expenditure of heat units, and shows that the total saving of 35.5 per cent. is not to be attributed wholly to the compounding principle. Just what per centage is assignable to this feature is a difficult matter to determine, and I regret our inability on account of the lack of necessary engines to furnish a comparison of engines that are identical in every respect except the cylinders."

The report concludes:

"In order to see if the actual record as kept by the comptroller, from which he compiles the performance sheet, corresponds with the record of the test, I obtained from him the result of the working of the three simple ten-wheel engines, Nos 530, 531 and 532, and compound engine 604, for the months of September and October. You will notice that the percentage in this case is calculated on the performance of the engines in respect to the miles run per ton of coal, consequently, the comparison in amount of per cent. would exceed that as shown on the blue prints if we take into consideration merely the pounds of coal consumed per mile. The result, however, is the same, and I find by working the matter out that the monthly showing, as obtained from the comptroller, is a little less in merit than that shown by the test, which is no doubt due to the changing of the coal used at Oakdale in banking the fire, etc. I think it would be well to make an estimate of the saving that would accrue were all our engines on the road compounds instead of simple engines. I therefore find that the total cost of the fuel for the year 1891 amounts to $219,552.26, and from this sum I wish to take the amount consumed by the regular switching engines, as I do not believe that it would be practicable to use compound engines for this service. The total amount of fuel of switching engines in 1891 was $17,622.94, leaving a balance for road engines of $201,929.32.

"Now, while our records of tests show a saving of 35½ per cent. in pounds of coal used per car mile, I consider that a portion of this is due, as mentioned above, to the larger heating surface, and would therefore consider that if we take 25 per cent. as the saving, it would be sure to be on the safe side, and figuring the amount in money that would have been saved in 1891, you will notice that it equals $50,000 in round numbers.

"In conclusion, I wish to say that, all things considered, I believe the period of experiment has passed and that the compound engine has come to stay, as the record of test made proves it to be far more efficient in the performance of its work, as compared with simple engines of the same class, and the same result is true in respect to the economy in operation."

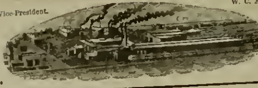
We are requested to intimate for the benefit of clubrooms having models for educational purposes, that the Leach Sanding Device Co., 55 Oliver Street, Boston will supply working models of their device to any parties interested.



Our Line Engravings are made by the wax process, a plan securing accuracy and distinct lines on original copper plates. They are made by BRADLEY & POATES, 251 William Street, New York City.

## OUR ENGRAVINGS.

Of late we have had a great many inquiries as to who made the fine half-tone plates shown each month in LOCOMOTIVE ENGINEERING. Credit is due the expert anywhere and we are glad to recommend the engravers of our plates to those wanting good work at reasonable prices. All the half-tones and reproductions we use are made by the STAR ENGRAVING & PRINTING Co., 607 & 609 Sansom St., Philadelphia, Pa. SINCLAIR & HILL.






OLD & NEW
A.S.MALES & CO.
RAILWAY EQUIPMENT.
CINCINNATI, OHIO

# Car Shops and Car Builders.

## Strong Brake Beams Needed.

The indications are that within a few years railroad companies will begin equipping their best passenger trains with re-enforced brakes for the purpose of stopping trains more quickly than they can be stopped with brakes that exert uniform pressure upon the wheels. It has been known for about thirty years that the coefficient of friction is not nearly so great at high velocities as it is when the speed is much reduced. Owing to this a much greater braking force can be applied when the train is running sixty miles an hour without danger of sliding the wheels, than can be applied at thirty miles an hour.

High speed trains are becoming so common that the necessity for more powerful braking force is becoming daily more apparent and the re-enforced brake has been designed to meet the demand. The Westinghouse Air Brake Co. and the New York Air Brake Co are both offering to railroad companies a re-enforced brake. Both of the brakes provide the means of putting a material increase of pressure on the brake-shoes at the higher train speeds and are so designed that the extra pressure can be released before it becomes powerful enough to slide the wheels.

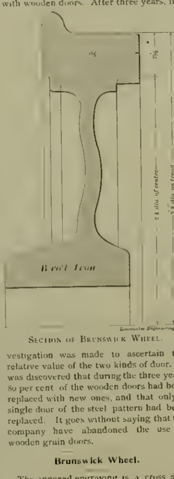
In connection with this important improvement railroad companies ought to realize the necessity for having thoroughly substantial brake rigging. The number of cars still running on fast passenger trains equipped with plain wooden brake-beams is not creditable to the owners. In fact there are few wicked practices due to the ignorance of men in charge of railroad rolling stock that are so dangerous to the traveling public as that of using for powerful air-brakes the same weak connections that were found sufficient to withstand the strains of hand braking. This is not a mere potential danger. We have no doubt whatever that the weak wooden brake-beam has been responsible for more than one of the serious collisions of this winter.

There are so many rods, levers and pins intervening between the brake piston and the brake shoe that the piston must necessarily exhaust a considerable portion of its travel in the taking up of slack. If the brake-beams are not fairly rigid there is imminent danger that the air-brake piston will move up against the head without transmitting but little pressure to the brake-shoes. This is just what is constantly happening. A good steel brake-beam will stand a pull of 5,000 pounds with a deflection of 1/16 inch. Under the same strain the best kind of oak beam will bend 3/8 inch. This amount of deflection is sufficient to make the brakes unreliable, for its yield added to small wear of shoes permits the piston to exhaust its travel without applying the brakes. This happens at a critical moment, the brakes fail to stop the train within a reasonable distance and a crash ensues. The men responsible for keeping in service a form of brake-beam that has long outgrown its usefulness are directly responsible for the destruction of life and property caused by collisions resulting from its weakness.

## The Convenient Wooden Grain Door.

One of the most troublesome parts about a box-car to maintain possession of has been the ordinary wooden grain door. The door, although an absolute necessity in cars loaded with grain, is easily removed, and is a convenient article for many purposes not connected with the keeping of grain inside a car. With cheap attachments it is frequently converted into a shanty table. A bed can be made out of it when the sleepers are not too nice about their resting place it has great capacity for the making of gates and a collection of grain doors has been found built up into a fairly comfortable shed for the protection of cattle. In the hands of a saw and axe carpenter grain doors make very decent hog pens and they make elegant floors for dwellings in the regions where lumber is scarce. When a locomotive happens to be short of fuel the grain doors will frequently do better service than fence rails in helping to the nearest coaling station and we all know that the dry boards make excellent kindling when split up.

With all these attractions to draw grain doors away from their proper destiny, it is not surprising that few of them become old and worn out in the service of grain trapping. There are complaints to be heard on nearly all railroads about the expense of renewing wooden grain doors, but few people realize just how costly this thing is. The Michigan Central Railroad people lately went systematically to find out the life of grain doors and the information obtained is instructive. This was done in connection with claims that it was cheaper to use the Michigan Supply Company's steel grain door, although the latter was more expensive than wood when first applied. The Michigan Central Railroad people had put in steel grain doors into 1,000 new cars about the time that the same number of cars had been equipped with wooden doors. After three years, investigation was made to ascertain the relative value of the two kinds of door. It was discovered that during the three years 80 per cent of the wooden doors had been replaced with new ones, and that only a single door of the steel pattern had been replaced. It goes without saying that the company have abandoned the use of wooden grain doors.




SECTION OF BRUNSWICK WHEEL.

## Brunswick Wheel.

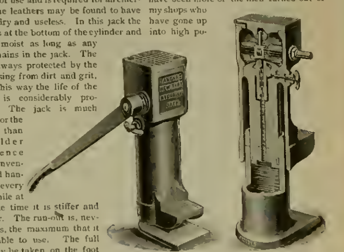
The annexed engraving is a cross section of the Brunswick wheel handled by Page, Newel & Co., Boston. This has a wrought-iron center put in a form to combine strength and elasticity. The steel tire is secured by the Brunswick fastening. The whole thing is seen very clearly in the cut. No bolts are employed about the wheel.

## Use of Dead Blocks.

In a discussion at the New York Railroad Club on "Should dead blocks be applied to freight cars with M. C. B. couplers?" there was considerable diversity of opinion among the car builders present. Mr. George West said that they were putting dead blocks on all cars passing through the shop, and found that they protected the couplers from breakage. But he said they had two lawsuits on their hands; one because the dead blocks caused injury, the other because their absence caused injury. President Blackall reported that they were following a similar practice. They put them on for two reasons—to protect the drawbar rigging and to protect life.

## Tangye's New Type Hydraulic Jack.

It has been objected to the older form that in hot climates, when a jack has been long out of use and is required for an emergency, the leathers may be found to have become dry and useless. In this jack the leather is at the bottom of the cylinder and is kept moist as long as any fluid remains in the jack. The ram is always protected by the outer casing from dirt and grit, and in this way the life of the leather is considerably prolonged. The jack is much shorter for the run-out than the older type, hence more convenient and handy in every way, while at the same time it is stiffer and stronger. The run-out is, nevertheless, the maximum that it is desirable to use. The full load may be taken on the foot as well as on the head, and in each size it can be raised by one man.



The cylinder and base are in one piece, and bored. The ram is fitted at the bottom end with a cup leather, held in place by a guard plate. The pump and plunger are of gun metal. The cistern, outer casing and the foot are cast together, of special hydraulic metal.

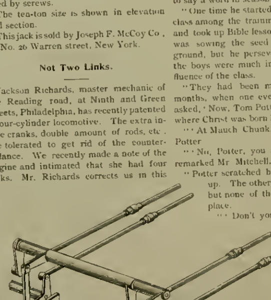
A desirable feature of this jack is the convenience of getting out the pump and valves for repairs, which is accomplished by removing the head-plate, which is fastened by screws.

The ten-ton size is shown in elevation and section.

This jack is sold by Joseph F. McCoy Co., of No. 26 Warren street, New York.

## Not Two Links.

Jackson Richards, master mechanic of the Reading road, at Ninth and Green streets, Philadelphia, has recently patented a four-cylinder locomotive. The extra inside cranks, double amount of rods, etc., are tolerated to get rid of the counter-balance. We recently made a note of the engine and intimated that she had four links. Mr. Richards corrects us in this and sends the sketch of link-gear shown herewith. Only two links are used, but there is an extra rocker of peculiar shape, and the old one has an extra horn on it, and they are not alike—one is left and the other right.



Taking the rig just as it stands, we would take two links in place of it every day in the month.

## On the Lehigh Valley Railroad.

"You all know Alexander Mitchell, superintendent of motive power of the Lehigh Valley," remarked the old member who is scheming to be elected president of the club.

"You all know," he continued, "that Mr. Mitchell invented and built the first consolidated locomotive, but I bet that none of you knew that he learned the machinist trade from me, and from me got the sound start in the business that has made him successful. Why, Miller, there have been more of the men turned out of my shops who have gone up into high positions than those from all the other shops in the country! Why, when I was on the Delaware, Lack—"

"Stop!" exclaimed Gannon, "no more of your Lackawanna chestnuts. What were you going to say about Mr. Mitchell?"

"Nothing much. Just a little anecdote that redounds to Mr. Mitchell's credit. You all know that besides being a good mechanic he is an earnest, pious sort of man, like many of the Scotch-Irish race he came from. Well, he was always trying to say a word in season—not many words.

"One time he started a Sunday evening class among the trainmen at Wilkesbarre and took up Bible lessons with them. He was sowing the seed on rather strong ground, but he persevered, and some of the boys were much improved by the influence of the class.

"They had been meeting for a few months, when one evening Mr. Mitchell asked, 'Now, Tom Potter, can you tell me where Christ was born?'

"'At Mauch Chunk,' readily answered Potter.

"'No, Potter, you are wrong,' mildly remarked Mr. Mitchell. 'Try again.'

"Potter scratched his head and gave it up. The others were appealed to, but none of them could name the place.

"'Don't you remember that in our last week's lesson mention was made that Christ was born in Bethlehem?'

"'Ah, yes,' exclaimed Potter, 'I was sure it was somewhere on the Lehigh Valley railroad.'"

It is reported that a peculiar form of flue tube, called the Mannesmann, is coming into use in Germany. It has the material made in taper form, the tube being thickest at the firebox end. The advantage claimed for this form of tube is that the thin part in the front end conveys the heat of the fire gases more quickly to the water than a thicker tube does. We fancy it would be difficult to estimate the amount of fuel saving due to this arrangement.

## Improvements at the Pittsburgh Locomotive Works.

### Building a New Shop on the Site of an Old One Without Stopping the Work.

[EDITORIAL CORRESPONDENCE.]

Last year the Pittsburgh Locomotive Works found themselves in the uncomfortable, yet not undesirable, condition of having too small a plant for their growing business, and had to face the problem of enlarging their works and at the same time fulfilling their contracts.

Unlike most locomotive works the cramping was not in the boiler shops, the pressure there having been relieved in an easier and better way—which will be mentioned farther on in this article. The need was more room in the machine shop.

To get anywhere near what was wanted a two-story shop 66 ft. longer and 5 wider must be erected on the site of the shop in use—and all the tools must be kept going at the same time.

Superintendent D. A. Wightman knew what he wanted and set about getting it, and to-day the new shop stands where the old one did, and the only shut-down was from Friday night to Monday morning a few weeks ago, and this only to lower the last length of old main shaft—the one carrying the engine belt—as this came directly on a line with the upper floor of the new shop.

The start was made by drawing a plan of the old shop, showing the exact position of every tool in it. Then, over this, the plan of the new shop was laid down. This plan was drawn to a scale of ½ of an inch to the foot, and when we try to reproduce it here very much smallar it does not give a very clear idea of the size of the job on hand, but it does show the general plan carried out. See page 121.

The old shop stood on the street line on one side and faced the yard on the other, so it was determined to bring the outer walls of the new shop inside the walls of the old one just far enough to get in the foundations without disturbing the old walls.

The posts of the other side were 8 feet outside the old wall. This is very plainly shown in the cross-section of the shop, where the M roof of the old shop is shown in dotted lines. Another difficulty was found in the desirability of lowering the floor 10 inches.

Concrete foundations were decided on, and concrete flooring covered with wood. These could be put in easily and quickly, and their use was not liable to stop the work by a building trades strike. A stoppage of the work would have been a calamity in the ripped up condition of things.

Upon the concrete pier foundations a steel frame was erected. This frame carries all the weight of the building, roof, gallery floors, shafting, etc.

On a separate concrete foundation, which is also carried by main piers, there is a brick wall built to inclose the sides, but the brick are very scarce, as their principal use seems to be to support window frames, about 60 per cent. of the sides being glass.

From the plan the location of internal posts can be seen, and from the cross-section it can be noted that there is a wide continuous skylight each side of the ridge of the roof for the entire length of the shop. While on a line with the second story gallery supports there are on each side a line of skylights occupying half the space.

The progress of the work is shown by our reproductions of photographs token when the frame of the new shop was up and the old one in full operation.

One of these shows the posts of the new shop sticking up through the roof of the old one, another shows the opposite side where the posts of the new are entirely outside the old; it also shows the stone foundation for the brick-work. The other view is taken at the end of the shop, showing old and new. The inclined girder at the end supports a stairway from the upper gallery to the drawing office.

These pictures, painted from nature by the sun, tell better than words possibly can just how the work looked as it progressed.

The other picture was taken inside the new shop at the time of my visit, when the work was yet incomplete, but after the last vestige of the old building had been removed.

In the foreground it will be seen that the floor is incomplete. This was the way the work was done: Commencing at the other end of the shop, a strip of concrete floor laid on the natural clay and 6 inches thick was laid; when this set there was a 3-inch oak floor laid on top of it and the tools that were intended to be permanently located there were placed; a section of line-shaft was coupled up and the tools put to work, no tool loosing more than a day's time. This plan was carried out right through the shop.

The line-shafting runs in self-oiling haogers only 6 inches deep, made in the shop, and are the simplest and neatest I ever saw. At the ends of the shop shafting is run at right angles to the main shaft by the use of bevel-gears, and very quiet and orderly gears they are, too.

The trusses for all longitudinal girders in this shop are flat steel bars, 9x1 inches; these interpose the least possible obstruction to belts between the line-shaft and the counter-shafts.

The center of the shop is traversed for 320 feet of its length by a 10-ton three-motor electric-crane of the Morgan Engineering Co.'s latest form, there is enough head-room to carry any part of a locomotive entirely over the bridge between the two galleries, shown in the engraving. There will be ten electric jib-cranes in the shop, eight on one side where the heavy work, such as driving-wheels and cylinders, are handled, only two swing-cranes are in yet.

On either side of the shop are hydraulic elevators of 6,000 pounds capacity, and around them open iron stairways lead to the second floor.

In each gable of the roof there is located a Sturtevant heating apparatus, small engines driving a fan that delivers hot air to the shop.

Throughout the shop and running to the other shops of the plant there is a 24-inch gauge-road, on which small locomotives will haul material.

One end of the upper floor is occupied by the laboratory and testing department, and at the same end of the shop there is a large cellar used for the storage of templates and such other devices as are seldom used. It also contains the wash room for the men.

There is one thing entirely new in this shop; the whole interior is painted white and Mr. Wightman proposes to paint the tools white; the large boring mill in the foreground was the only white tool in the place at the time of my visit, having the honor of being the "first white" born in the place; it had not been started yet. This color will make a great difference in the light in the shop, whether much virginity can be kept in sight, remains to be seen, but I can't see why white paint can't be kept as clean as green

As can be seen on the plan, the stationary engine stood in the machine shop, and for the present it will be left there, but they have made plans for locating a central power house independent of all the


Showing New Structure Outside of Old Shop.

shops, and carry shafts to each shop on trussed bridges.

The boilers used here are of the vertical submerged tubular pattern, about 66 inches in diameter and 25 feet high. They have a cone head at the top, the larger and lower end forming the flue-sheet and the small end the smokestack connection, thus keeping the flues entirely under water. These boilers are in two pieces, the joint being on a line with the crown-sheet; two very heavy cast-iron flanges are bolted together here, the castings having numerous hand-holes for cleaning the crown and lower flues.

When it is found necessary to change flues the whole boiler can be taken apart and cleaned, but the chief advantage to a big plant is that the upper part of the boiler, the shell, can be slung up and kept in its place in the nest, and a whole new firebox end be sent complete from the shop and bolted in.

Speaking about boilers, I think the plan of making boilers at this shop has a great deal to commend it; they come very much nearer to making boilers by machinery than any place I know of.

Back heads, flue sheets and throat sheets are formed at one heat and one operation on a great hydraulic press capable of taking in the largest head on a locomotive and exerting hundreds of tons pressure. This machine also forms steam-chest covers, cylinder-heads, smokebox doors, sand-boxes, dome rings, stack bases, etc.

All holes are laid out and punched or drilled while the sheet is flat, and a huge pair of 10-foot rolls make little work of bending up shell sheets.

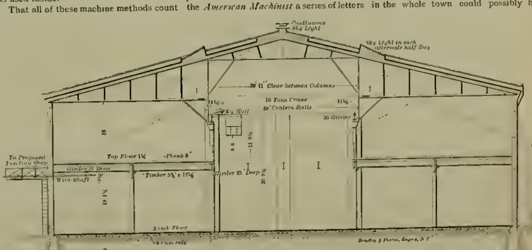
Mr. Wightman's patent stay is used; this is made by hydraulic forged fork-ends tapped to receive the stay-rod, a right and left forming a pair, these are pinned to feet, or double angle iron—also formed by machine—riveted to the shells or heads, and the stay-rod proper is screwed into these fork-ends. This insures the same tension on all stays and is a very great improvement on the old-fashioned, riveted, solid stay where the holes are marked in place and punched, leaving a certain amount for "draw."

Angles, stay-rods and fork-ends being practically uniform for any boiler they can be made and kept in stock, thus saving much time


Showing Old Shop with Frame of New Inside the Old Walls.

They make their domes in two pieces, the flange at the base being very heavy, requiring no stiffening ring and being riveted to the shell of the dome, and the boiler shell is flanged up into it; this makes another riveted seam but puts great strength where most needed and requires shorter rivets than where a forged ring is used inside.

That all of these machine methods count on time is shown by the fact that in these works you can always find completed boilers, they are ahead of their work all the time.




Cross Section of Old and New Shop.

The Pittsburgh Works already possess a model foundry and good boiler shop; they completed a new office building about two years ago, and now the new machine shop takes the pressure off in that direction. A new smith shop is also rapidly nearing completion. The next move will be the new erecting shop and the power house. When these are completed they will have a locomotive building plant second to none in this country for efficiency, and with a capacity of about 300 locomotives per year.

J. A. H.

## Improvident Workmen.

It is some twelve or thirteen years ago since James W. Lee, under the *nom de plume* of "Chordal," began writing for the *American Machinist* a series of letters on mechanical subjects, which formed the most interesting reading ever presented on technical subjects. In one of the early letters we find the following notes of a conversation which, we are sorry to say, applies to not a few shopmen and engine-men of this day and generation:

"While I was in Sackett's shop the other day McMillan came in and asked for money between pay days. Sackett heard him and went for him. Rated him soundly for being in need of money and so careless of the future as to have to draw pay for present necessities. Found he had not been sick, nor had any of his folks, nor had he taken a trip to the seashore, nor bought bonds or real estate—bought nothing. Sackett began to look sick and disgusted. Went and fished out old pay rolls, etc., and showed Mack that he had received and spent more money in the last twelve years than any small store-keeper in the whole town could possibly have made. McMillan couldn't say anything, but it made him feel rich to see what money had gone through his fingers, and awful poor to see what had not stuck to them. Sackett got mad as he thought of

the thing, and finally told Mack he could not draw any pay, but he would lend him $10 for a week; 'but mind you,' added he, 'I am going to make an example of you. There's some excuse for a lazy drunkard with a slouchy wife, or for a smart young chap who dresses and lives proudly, but there's none for you. I never saw you with nice clothes on, and never saw yourself and family out enjoying an evening at a theatre or any other place. I will bet a quarter that you buy heavy sugar at a higher price than sawed block, and pay more for coal oil than I do, and pay more for your clothes. You get good pay, and I am bound that someone around this place shall make some money. If you and your wife, after studying common sense for a year, can't show me a certificate of deposit for $300 you shall earn your butterless bread in some other shop.'"

End View, Showing Progress of the Work.

### Compound and Simple Engines.

BY HUGH SHARP.

The compound system affords a simple and effective means of using steam expansively without the aid of any elaborate expansion-gear. Theoretically, the expansion of a given quantity of steam can be carried out with greater economy in more than one cylinder. The temperature and pressure of steam vary directly. Steam entering a cylinder at a pressure of 160 pounds to the square inch and expanded four times falls in temperature from 360 to 267 deg. Fahr. Towards the end of the stroke a certain amount of condensation takes place. The cylinder metal will become comparatively chilled, partly from radiation and partly from the cooling effects of the four-fold expansion. The inlet of high-pressure steam on the return stroke coming into contact with the cooler metal suffers an immediate fall in temperature and pressure. A double loss here ensues; the condensed steam on the dead side of the piston is re-evaporated owing to the reheating of the cylinder, which means increased back pressure, and to effect this the live steam has been deprived of a portion of its energy. The losses here noted could be reduced by maintaining a more constant pressure and temperature throughout the stroke by cutting off at the latest point practicable and exhausting at a pressure approximating closely to that of the steam as originally admitted. But this exhaust steam would still have stored up in it a large amount of useful energy which would be wasted by discharging it directly into the atmosphere; hence the utility of the low-pressure cylinder, which extracts the balance of this useful energy, and finally releases the steam at only a few pounds above atmospheric pressure. (The admission of steam in the high-pressure cylinder during the full stroke has only been assumed for purposes of illustration. It would seldom be desirable in practice).

From the foregoing it would appear that if expansion can be more economically carried out in two cylinders than one, owing to the lesser range of temperature in each cylinder, by increasing the number of cylinders, this range of temperature would be still further reduced, resulting in increased economy. Within certain limits this is true, and in marine engine practice, where a considerable number of moving parts can be tolerated, triple and quadruple expansion has given very favorable results. In locomotive practice, however, extreme simplicity of detail and the least possible number of moving parts are of the first importance. In a two-cylindered compound locomotive there is little more complication than in the simple, but it remains to be seen whether the employment of four cylinders will prove satisfactory in the long run. The initial cost of such engines is greater; the increased number of moving parts means increased liability to breakdowns, as well as extra wear and tear, and last, but not least, lubrication must be a considerable item in their working expenses.

The compound engine is having a boom in America just as it had in Europe ten years ago. The European boom was followed by a reaction, and compounding has been practically abandoned after being given an extended trial. Two or three years since, Mr. Webb, of the Northwestern Railway, who is one of the few English believers in the compound locomotive, backed one of his patent three-cylindered machines against a fine simple locomotive of the Southwestern. The latter had 19 x 26-inch cylinders and four 84-inch drivers, coupled, and was one of the type employed for working the Exeter Express. The compound was to perform the same duty on less coal and in quicker time. Both engines had about equal theoretical capacity, but when it came to actual practice the Webb engine was hopelessly beaten.

What coal it burnt on the trip was never divulged, but it arrived at Exeter an hour late in spite of the gallant efforts of its engineer and fireman to run to time. When it pulled up the smoke-box was white-hot and the smoke-stack partially melted. (The last two items are from an intelligent Southwestern engineer, who was very likely a member of a London "Ananias Club.") This does not prove that compounding is bad, though Webb's application of the principle is open to serious objections. But where the demands on an engine are variable, as they were throughout this journey, with its severe and frequent grades, the compound will not compete successfully with the simple unless it can be so arranged as to work as a simple on up-grades. This seems to have been ingeniously carried out in the Brooks and Pittsburgh compounds.

It was recently reported that a compound engine on the New York Central indicated one horse power an hour for each 3¼ pounds of coal burnt. This is certainly a good performance, but it has been beaten. In 1850 Sir Daniel Gooche's "Great Britain" exerted the same power on 2½ pounds of coke. Allowing coke to be, weight for weight, 6 per cent. superior to coal as a fuel, the balance is still greatly in favor of the English engine. The experiments during which this remarkable result was obtained were so carefully conducted that no error can have crept in. The engine at the time was cutting off at the seventh inch of the stroke of 24 inches

### Corrugated Pistons.

A Western inventor who has devoted much attention to increasing heating surface by means of corrugations and other protuberances, proposes to increase the area of a piston by the use of concentric corrugations. The writer wasted an hour on the man in trying to explain that the total pressure would not be greater than it would be on a plain surface. It proved to be a case of "a man convinced against his will is of the same opinion still."

Besides being a fallacy, the attempt to increase piston surface by grooves, corrugations and serrations is old, and comes up regularly, like inventions aiming at perpetual motion. It is in line with the tapering of plugs with the belief that less steam or water pressure would be exerted to drive them out.

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They have had to use pilot plows in North Carolina this winter, the first in eight years.

For a full account see Zerah Colburn's "Locomotive Engineering," chap. XVII. The "Great Britain" was one of a number of similar engines built for the Great Western Broad-gauge Railway of seven feet. The cylinders were 18x24 inches, and were suspended with their steam-chests in the smoke-box; exhaust nozzle, 5½ inches internal diameter; total heating surface, 1,800 square feet; weight of engine alone, in working order, 91,800 pounds. It is not difficult to understand that such an engine would be light on coal. The cylinders and steam-chests were thoroughly protected; the large boiler was able to supply abundance of steam without being stimulated by a violent exhaust, and with the 5½-inch exhaust-nozzle back-pressure was practically *nil* when the engine was traveling at speed with an early cut-off. One of these engines, the "Lord of the Isles," is to be exhibited at the World's Fair. During its thirty-four years' active service it ran 1,000,000 miles with the original boiler.

It is safe to say that no compound engine has ever beaten the "Great Britain's" record. Compound engines may certainly be more economical than many of the simple, but this perhaps is not fairly attributable to the compound system alone. A bad feature and a very common one in American simple-engine practice is that of leaving the cylinder ends and steam-chests entirely unprotected. Such engines work at a great disadvantage, for in actual practice it has been ascertained that with imperfectly protected cylinders nothing is gained by cutting off earlier than half-stroke. If a higher rate of expansion is attempted condensation becomes so great, with consequent increased back-pressure, that an actual loss may ensue. There are two features in compound engines which are largely responsible for their economy—completely protected cylinders and a free exhaust. The complete protection of the cylinders is necessary, for any considerable condensation would cause a partial vacuum in the low-pressure cylinder near the end of the stroke. If a free exhaust were not provided back-pressure would exceed that on the live side of the piston. Another good effect of the free exhaust is the saving of some tons of fuel from being blown out of the stack in the course of a year.

A compound engine that can be worked as a simple when desired offers considerable advantages by doing away with the necessity of helping engines on extra steep grades. The capacity of the engine can be temporarily increased 40 to 50 per cent. by admitting steam into the low-pressure cylinder and using sand freely. Such engines are now working and are said to be satisfactory; there is a great danger, however, of their being abused in incompetent hands. But for ordinary express service a simple engine with thoroughly protected cylinders 20x24-in., 6½-ft. driving wheels, 1,600 sq. ft. heating surface and a 5-in. exhaust nozzle should be able to hold its own against any compound.

The heating surface may appear excessive, but this is a good fault; it makes an easy exhaust possible, and tends to prevent priming, which is the invariable result of an overworked boiler and a cause of serious loss.

*Abilene, Tex.*

## Setting Up Wedges, Keying Side-Rod Brasses and Tramming Engines.

BY G. K. W.

The question is frequently asked, what is the proper position for a locomotive engine to stand when the wedges are set up and side-rod brasses keyed?

In setting up wedges for right side of engine, would place engine on straight and level track, so right crank-pins would be on top quarter, then block in front of left driving-wheels, if wedge is back of driving-box; if wedge is in front of driving-box, would block back of driving-wheels; then give cylinders a little steam, so as to move driving-wheels hard against the blocks, and away from the wedges, on the side not blocked. If engine is dead—has no steam—pinch driving-wheels up to blocks hard, and away from wedges. Then get under engine, and set up all wedges on right side tight; make a mark on side of pedestal frame where top of wedges come to; then pull the wedges down a little, so boxes will be loose between wedge and shoe. It is a good idea to try the wedges to see that they are not up too tight, by putting a bar over the frame, and under the spring saddle, and pulling down on bar; if driving-box moves between wedge and shoe, wedge is not up too tight; or you can try them with two pinch bars, one on each side of driving-wheel, and push down on bars, if driving-box moves between wedge and shoe, wedge is not up too tight; if box is tight, pull wedge down until box moves. Take the blocks out from under the left driving-wheels, and block driving-wheels on right side, and proceed on left side same as on right side.

It sometimes happens that the flange on one driving-wheel will wear faster than the other on the same axle, caused by the driving-wheels not being in tram; the wheel with the worn flange is the one that is out of tram, and is always the rear one of the two driving-wheels on that axle, if the tires are all the same size; if not, they will wear bad, and the smallest driving-wheel will wear the fastest, as it has to slip to keep up with the other driving-wheel on that axle, and therefore wears faster.

A good way to find out how much one driving-wheel is out of tram, is to make a center punch mark between the frames on the back and in the center of cylinder saddle, then with a tram made out of a piece of ¼-in. pipe, one end with a sharp point, and on the other end a sliding point, to slip over the pipe, this point to be about 15 in. long, and at right angles to the pipe, and to be held in position by a thumb screw; put the straight point in center of punch mark between frames and set the sliding point to center of front, or main axle, on one side, then try it in center of same axle on the other side. If they tram the same that pair is correct, if they are out (don't tram the same) they should be made to tram together by changing the wedge and shoe so the two centers will tram the same—so both will be the same distance from center punch mark between frames, change which ever is easiest by moving one driving-wheel forward or the other backward. By getting the centers on both ends on the same axle the same distance from center punch mark on cylinder saddle between frames, the wheels will be parallel with

INTERIOR OF NEW SHOP—OLD SHOP ENTIRELY DESTROYED

track, and will not cut the flange. Before changing any wedge or shoe, all side-rod keys should be loosened, as changing the wedge or shoe changes the length of the side-rod. Then tram from the pair of driving-wheels that is correct to the back pair, and then to the front pair of driving-wheels, in a ten-wheel or consolidation engine; if any show out they should be made to tram correct with the others by changing the wedge and shoe.

It is best to have engine hot, under steam, when setting up wedges and keying side-rods, so all parts affected by heat are then in same condition as when in service.

Now that the wedges are up to their proper places, and driving-wheels tram correct, side-rod brasses can be keyed. If side-rods are put up as they should be when engine comes out of the "back shop" from general repairs, they will not need any work done on them for a long time. Just as soon as any side-rod brass on an eight-wheel engine is reduced, it will not be long before all will need reducing and rods lined up again.

Solid side-rods run without changing a long time, and do good work; that is evidence that side-rods can run without having brasses reduced every few weeks, although in a ten-wheel or consolidation engine the side-rod brass on the main pin will wear faster than any other, and will need reducing. Great care must be exercised in reducing all rod brasses. In reducing rod brasses, all except front end of main-rods should be left brass and brass; leave them loose enough so they can be keyed tight and not pinch the pin.

When putting up all rod brasses, avoid as much as possible leaving them loose between brass and end of strap, or stub end of rod, not depending on rod keys to keep brasses in place; have no lost motion between brass and key, so in case a key is lost the brasses cannot move any in strap; make the liners as thick as can be, so as to use as few as possible; brasses should be left brass and brass to do this; by so doing brasses will wear longer, and not get loose in strap.

As the front end of main-rod brass don't make a complete revolution on the cross-head pin, as on crank pins, this brass can be left a little open; the work done by the front end of main-rod brass is nearly a push and pull; this wear is only on front and back of cross-head pin, and that part of brass that wears with this part of pin; as this brass and pin wears it can be keyed, and not taken down and reduced every time it wears loose.

After reducing any rod-brass that goes on a crank-pin, it should be put in the rod strap (don't put strap on rod), and put on pin and key tight; have it move free on pin, but not over $\frac{1}{64}$ in. loose.

When an engine goes out of the "back shop" from general repairs, or gets new brasses, and the crank pins are new and round, a side-rod brass will need very little fitting; when a brass comes from the lathe it is round, and by filing or scraping it will not make it fit any better; if the pin is not round, or parallel, then it may need fitting. Back end of main-rod brasses should have a little filed off brass on top and bottom, as there is very little wear on that part of the brass, and when this brass is reduced, that part will bear heavy on pin and cause it to run hot.

Before putting up side-rods, place the engine on dead center on the side you are to key the side-rod brasses, and be careful that the engine stands on the exact dead center, on the side you are keying side-rod brasses, as this point is the most rigid, and side-rods should be free, so no strain will come on the rods when passing this point. Key the side-rod brass on main pin first for any engine, then the back and front for a ten-wheel or consolidation engine, be careful that you don't key the brasses so tight as to pinch the pin; leave them so they can be moved laterally on pin; move engine to dead center on the other side, and key that side the same, keying brass on main pin first.

Permit me to say here that the best mechanics are those that are the most observing, and we can all learn much by observing the results obtained from the way we do our work. Some persons advocate putting up side-rods on the "eights." I have got better results from putting them up on the dead centers.

### Wootz Steel.

A correspondent in Pittsburgh, Pa., writes: In last number of LOCOMOTIVE ENGINEERING mention is made of the famous Wootz steel of India. This steel has never been surpassed in quality, and it has been made almost since iron was first made into weapons.

It appears to me that the Wootz steel takes away from Hornstman the credit of being the inventor or first maker of cast-steel. Wootz steel is made from a fine quality of native iron melted in crucibles containing a quantity of dried wood or leaves. The weight of the bloom is from one to three pounds. So it is merely a peculiar way of making cast-steel. It is still made and imported for certain purposes.

Indian steel is successfully imitated in Europe. Small pieces of very good Swedish iron are put in a crucible and covered with charcoal, the air being carefully excluded. This mass is exposed to heat until it turns dark gray carburet of iron. This is very brittle and is easily pulverized. When broken up fine it is mixed with alumina and subjected to a white heat, when it becomes white. A certain percentage, varying from $\frac{1}{8}$ to $\frac{1}{16}$, is then mixed with small pieces of good steel and the whole melted in a crucible. The product is a metal which passes for Wootz steel and is just as good for most purposes.

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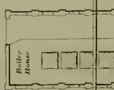
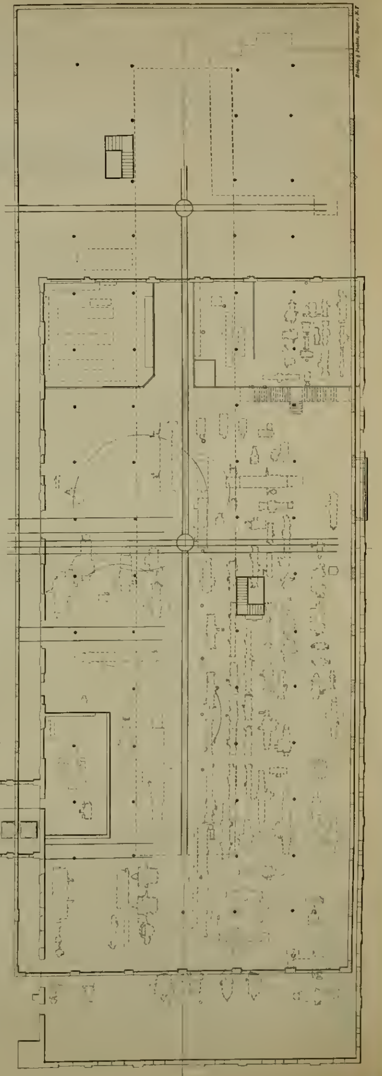
We learn from Mr. F. W. Johnstone, of the Mexican Central, that the note which appeared in LOCOMOTIVE ENGINEERING intimating that he wanted a few technical school graduates with the view of training them for official positions has had the effect of flooding him with applications. The difficulty experienced in the matter was that a young man's characteristics could not be judged from a letter of application or from references. Mr. Johnstone does not wish to invite men to come to the City of Mexico unless he feels fairly certain that they will prove successful, and so he is not likely to engage any applicants until he makes a trip to the United States and can meet the candidates for positions on his road.

The largest steam shovel in the world is digging phosphate in the mines at St. John's Island, near Charleston, S. C. Its weight is fifty-six tons. It can dig ten feet below its track and to a distance of thirty-five feet on either side. The dipper, which can swing through two-thirds of a circle, has a capacity of one and three-quarters cubic yards, and about two dipperfuls can be handled in a minute.




The Linde Ice Machine Co., of Chicago, recently made a test to find out whether or not more coal was consumed when using a smoke preventer. The same amount of coal was used in a given time with and without the smoke preventer, but it was claimed that a little more water was evaporated when running with the smoke preventer.

An engineer writing from the Pacific Coast says: An article in last year's issue was contributed by my wife, in which she stated that it was impossible to get anything out of me until I got through reading LOCOMOTIVE ENGINEERING. She is about right, but she forgot to add that to reverse the case would fit her as well as me, for she monopolizes the paper first.



## Notes from Brazil.

### The Brazilian Central Railway.

BY LEWIS GLEASON.

When that good and progressive man, the late Emperor Dom Pedro II, was ruler of Brazil, his pet hobby was the Dom Pedro Segunda Railway, now known as the "Central of Brazil," he succeeded in making it a first-class road. His successors have tried to follow his example and keep the road-bed and equipment in fairly good condition. The merchants of Rio, however, are not satisfied with the transportation facilities afforded them by the management of the road. Many and bitter are the letters published in the daily papers of the city from the shippers who cannot get their goods sent over the road within a reasonable time. As it is the only trunk line railroad having a terminus in the city, it has a monopoly of the shipping business destined for the interior. Consequently there is a continual freight blockade.

The terminal station is within the city limits, and easily reached from all parts of the city by several street car lines.

The building is a two-story structure containing the usual waiting rooms, ticket offices, etc Everything is so much like an ordinary American terminal station, a detailed description would be merely a repetition of what has been so many times described in regard to our home roads. Automatic switches are used in leads diverging from main lines to train sheds.

The rolling stock is of the American type, so far as the passenger department is concerned. Many of the coaches are built at the shops of the company, but the great majority were built in the States. No upholstery whatever is used in any class of the coaches. Cane makes the coolest and cleanest seat for this climate. The numerous insects with which this country is infested would find too good a hiding place in upholstery.

The principal shops of the company are located at Enghero de Deutra, a suburban town eight miles from the city station As you get off the cars at the very neat and well-kept station, a walk of about five hundred feet brings you to the office building. The building is a handsome two-story structure facing the railway lines, and separated from them by a very neatly-kept lawn, in which are numerous flower beds and fountains Inside the building cleanliness and neatness are apparent on every hand. The offices of the mechanical department are all situated in this building, that of the "Chefe de Locomotive" being a very handsome and neatly-furnished apartment

The superintendent of motive power, Dr Faire, I found to be a very courteous and polite gentleman, who personally conducted me through his extensive shops, where he has worked his way up from apprentice boy to chief

The shops of all the different departments are well stocked with modern tools and labor-saving machinery, a description of which would not interest the great majority of your readers, as they are just the same kind of tools they come in contact with every day. The shops and surroundings are so very much like those on well regulated home roads that a person almost forgets for the time being that he is under the Southern Cross, instead of the North Star. The appearance of the workmen, however, brings him to a sense of the fact that he is in a strange land and amidst strange people Black faces and swarthy complexions are around you, with a large sprinkling of whites, or as near white as a man can be who works around an engine, smithshop or foundry

I have seen some very fine work done here, both in machine, fitting and blacksmith work From the number of engines undergoing repairs (I was informed it was about their usual number), I don't think they will have a suspension or reduction of working hours very soon. No engines in service are kept at these shops except those employed switching. All the engines in road service are looked after at the "deposito" or roundhouse at San Diogo, one mile distant from City Station, of which I will have something to say later on.

I am informed that there are four hundred American built engines in service in this system, and as this is the principal shop, an idea may be conveyed that it is a busy one. All engines in road service are American built. The switching engines in Rio are either English or French They look as if they might at one time have been in road service, but they are behind the times, consequently they are eking out the last of their days, like so many of the men who run them in switching service.

In a corner of the pattern shop, mounted on a pedestal and apparently in excellent condition, is the engine "Baroneza," the first locomotive run in Brazil, built in Manchester, England, in 1852, inside connected 10-inch cylinders, 48 drivers, two pair connected, and weighs 10 tons. The only difference I see between this engine and modern-built English engines in service on the San Paulo Railway is in the items of weight and a cab (such as it is). The old "Baroneza" has no cab, however. The regulation spectacle plate is in its place.

As near as I could find out, the wages of the different classes of workmen vary very much. The best paid machinists get eight milreis per day If milreis were at their par value, this sum would be a little over four American dollars, but at the present rate of exchange it does not amount to more than two dollars and a quarter. Exchange is constantly fluctuating, but it does not exert much of an influence in the cost of living. A milrei has no more purchasing power at present, when exchange is fourteen pence, than it had when it was down to ten pence The cost of living in this country is much more expensive than in the States, more especially for clothing. It is true that a person does not need much clothing in this climate, yet what little is required costs about double what the same articles would cost in New York.

Although this is a government road, and all the employes are placed more or less through the influence of political partisans, yet the "committee man" is not an unknown quantity. The employes have their organization; while "the schoolmaster has been abroad" to a very large extent in the northern part of this immense continent, the southern portion has also felt his influence.

I noticed that the engine that furnishes power to the wood-working shop is of American manufacture and of the Corliss type; the builder, however, either from modesty or other motives, failed to put his name thereon; he therefore misses a first-class chance to get a free advertisement through the columns of your paper.

After having made the rounds of the shops I was shown through the storehouse. Everything requisite for any part of the working of the road can be found here, all of the best quality, and the money value represented must be enormous.

I am under many obligations to Dr. Faire for his courtesy, and also for a pass to ride on his engines; to the chief draughtsman (whose name I unfortunately forget) I am also indebted for his attentions.

I visited the "deposito" or roundhouse at San Diogo, Here I found a substantial brick building of twenty-six stalls, to which is attached machine and blacksmith shop, with a sufficient force employed to keep up running repairs in all engines in road service, also the switching engines. The "chefe de deposito" or general foreman, Mr. Gustave Bion, I found to be a very pleasant and intelligent man, who acquired his mechanical training in France, of which country he is a native

There were twelve engines in the house at the time of my visit, all American built Amongst the number was a four cylinder compound, 8-wheel passenger, named after the President of the Brazilian Republic, "Floriana Peixoto," a very fine looking engine. The engines on this system will compare very favorably with any road in the States. Were I to enter into details concerning them it would make this article of more length than the editors would be willing to give place to.

I was glad to meet here an American engineer, named Samuel Edgar, a native of Ohio, and at one time on the Lake Shore road, he is pulling a passenger train out of Rio, and has been in the service for fifteen years.

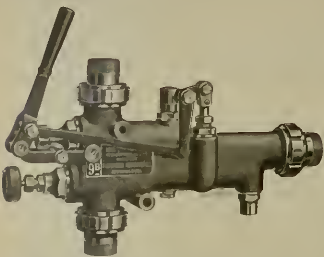
Engineers and firemen are divided into three classes, whose relative rank is designated by the number of gold lace bands on their caps, a first-class man wears three bands, the third-class man one. I am very favorably impressed with the neat uniform worn by the enginemen, trousers and blouse of blue material, with brass buttons, cap of navy pattern with the bands around it as before mentioned, with a circular piece in front in which is emblazoned a locomotive in gold lace; it gives the men a neat and tidy appearance. All train and engine crews are natives, with a few Spanish and Portuguese engineers, and one solitary American.

The pay of a first-class engineer is ten milreis a day, with a premium each month for economy in supplies and a clear record, that is, if he has no accident or breakdown

ON THE PACIFIC EXTENSION OF THE GREAT NORTHERN.

THE

# LOCOMOTIVE INSPIRATOR



These machines are especially constructed for, and adapted to railroad service and

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A series of critical articles describing and comparing the English and American Locomotive in detail, showing their points of resemblance and difference. These articles will be illustrated by general and very full detail drawings of a representative or typical locomotive of English, and one of American design.

## Contributions to Practical Railroad Information.

The very valuable series of articles under this head, by DRS. DUDLEY and PEASE, already published, will be supplemented by a new series describing methods of tests and analysis.

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## Progress in Flying Machines.

This series of articles, by Mr. O. Chanute, Past President Am. Soc. C. E., will be continued and concluded, and the author will show the scientific reasons upon which he, with Professor Langley and other eminent scientific men, base their belief in future success in navigating the air.

Very full notes on the COLUMBIAN EXPOSITION will be published. There will be given descriptions of **NEW ENGINEERING WORKS, NEW MACHINERY, SHOP METHODS** and **PLANTS**, both at home and abroad.

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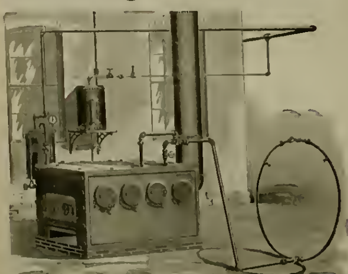
47 Cedar Street, New York.

# APPARATUS

FOR

# Heating, Setting and Removing Tires



A very complete arrangement for putting on new Tires or taking off old ones, without removing wheels from under the engine. Will do all the work connected with tire heating, setting, removing, shimming and replacing. With this apparatus and system of doing the work, less than one-tenth of the time is consumed, and the paint on the wheel centers is not injured.

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during the month. To all worthy and faithful engineers a two weeks' holiday each year is granted, with full pay. After a continuous service of twenty-one years a pension is granted of one-half pay.

A visit to these shops, or a ride over the road brings to view many ideas as to the utilization of worn out rails. As there is no market in this country for old rails and to ship them to a market would be too expensive, therefore they are used to the best possible advantage, in this and other systems in Brazil. They are used for fencing in right of way, telegraph and telephone poles, columns for sheds and station houses and several other purposes, for all of which they make a permanent and by no means a bad looking fabric.

A few words to the readers of this article who may have a thirst for life in foreign lands, as locomotive runners or otherwise, may not be out of place, to all such I have but one word to offer "Don't!" You who are accustomed to run or fire locomotives in the States have the best that can be expected in your respective positions. After a rather extended tour in other countries I consider the States is the best place for either runner or fireman, or any other person connected with train service, not alone from a financial point of view, but from a climatic also. Blizzards and snow storms in the winter season I know are not pleasant things, neither is it pleasant to be in a continual state of perspiration, from which there is no relief, no cool season to look forward to, by way of relaxation; furthermore, my experience in South America leads me to the conclusion that a man misses all or nearly all the comforts for which life is worth living.

Brazil is a grand and beautiful country for those who can endure its climate. Its soil will produce every plant known to the botanist, except those that are indigenous to the Arctic regions. The labor question is the great obstacle to advancement; while the Latin races stand the climate fairly well as out-door laborers, the black man is more at home under its hot sun.

But the negroes of Brazil (like their Northern brethren) since their liberation from slavery, flock into the towns, and as a few days' work each week is sufficient to provide them with food, they do not worry themselves much as to providing for a "rainy day." On account of the scarcity and high price of common labor, the Brazilians are trying to introduce Chinese emigration.

In closing, I wish to speak of the honesty and sobriety of the Brazilian people; if robberies are committed they are gradually traced to some vagabond foreigner, principally West India negroes, and a drunken Brazilian is rarely seen.

*Rio de Janeiro, Brazil.*

## An Interesting Exhibit.

The London and Northwestern Railway Company of England will make a highly interesting display at the Columbian Exposition. Mr. Geo. Chesworth, who will have charge of the exhibit, has arrived in Chicago and is making the necessary arrangements. The exhibit will consist of one of the latest type of Webb compound locomotives and a representative passenger train of the cars now in use on the line. A full size working model of Stephenson's "Rocket," an engraving of which appeared in the December number of LOCOMOTIVE ENGINEERING, will be there. Our readers will remember that the "Rocket" was the first locomotive made with a fire-box and tubular boiler, the combination that makes high speed a possibility. The engine took the prize offered by the Liverpool and Manchester Railway Co. in 1829 for the most successful locomotive. Another curiosity of the London and Northwestern exhibit will be Trevithick's locomotive of 1804. Trevithick is credited by English people as having been the inventor of the high-pressure steam engine, although Oliver Evans in this country worked earlier than Trevithick, and did more than any other early inventor to make a success of the high-pressure engine.

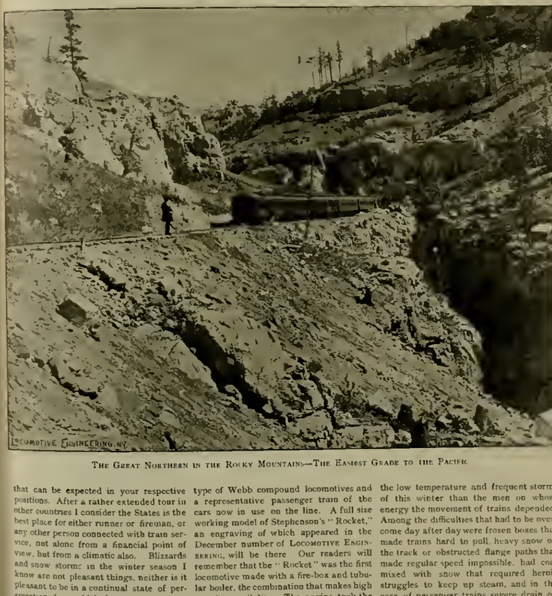
There will be in the exhibit a good representation of the signal and interlocking system used by the London and Northwestern people.

We are informed that the New York Central people made an effort to have the London and Northwestern locomotive pull its train of cars over the Vanderbilt lines, but the required consent was not given.

## An Old-Fashioned Winter.

We have heard a good deal of talk this season about the glories of an old-fashioned winter. The parties who become enthusiastic on this theme are those who do not endure any suffering or discomfort from weather, no matter how cold or stormy it may be. Among that large portion of our readers who work in poorly-heated shops or have to face storm and stress of weather in the cabs of locomotives there is a sentiment entertained that old-fashioned winters are not nearly so pleasant as fancy has painted them. Unless it be the poor people who are unable to procure coal or clothes to keep themselves and children warm, there is no class of men who have suffered more from the low temperature and frequent storms of this winter than the men on whose energy the movement of trains depended. Among the difficulties that had to be overcome day after day were frozen boxes that made trains hard to pull, heavy snow on the track or obstructed flange paths that made regular speed impossible, bad coal mixed with snow that required heroic struggles to keep up steam, and in the case of passenger trains severe drain on the boiler to keep the cars warm. And still in train dispatchers' offices and in superintendents' rooms we have frequently heard querulous complaints because Jones or Smith were not making time. It is much easier to figure on keeping time in a comfortable office that storm and tempest do not reach than it is to do the thing in actual service.

The men who are responsible for keeping the motive power and cars in running order are another class that are not enthusiastic about old-fashioned winters. In a letter to the writer, one of this class draws a picture that is edifying. He writes: "This winter has almost discouraged me. You can look back and remember the last winter when you were foreman, what a terrible time we had then with half the engines we now have and less than half the business to contend with. But this winter has been harder still. Every headquarters of motive power in the Western country is blocked up with broken engines that accumulate faster than they can be repaired. If the weather will only moderate for two weeks I can get my head above water, but if it keeps like what it has been for the last month the look-out will be grim. We have broken driving axles, bent and twisted rods, broken crank-pins, fractured wheels, and everything else imaginable broken or out of shape. We have had to replace four sets of driving-wheels within the last month, and still they come. But I try to console myself as the Irishman did during the great failure of the potato crop. Feeling very blue he went over to his neighbor's field and returned, quite cheerful, saying, 'Thank God, my friend's potatoes are worse than mine.'"




THE GREAT NORTHERN IN THE ROCKY MOUNTAINS—THE EASIEST GRADE TO THE PACIFIC.

## Compound Locomotive Building.

The Committee of the Railway Master Mechanics' Association, investigating the subject of compound locomotives, have received information that 314 of the Vauclain compound are in service on sixty railroads. Eleven of the roads are in foreign countries. The Baldwin Works have orders for ninety-three more of these engines.

The Rhode Island Locomotive Works report having built or having in course of construction thirty-nine compound locomotives, thirty of which are of the two-cylinder type and nine of the Johnstone design.

The Schenectady Locomotive Works report having compound locomotives of the two-cylinder type running on seven railroads. The number in service is about forty.

The Brooks Locomotive Works have built two compounds, one with two cylinders, and the others with four cylinders, set tandem. Rogers' have built one, Pittsburgh one, Cooke one—all of the two-cylinder design.

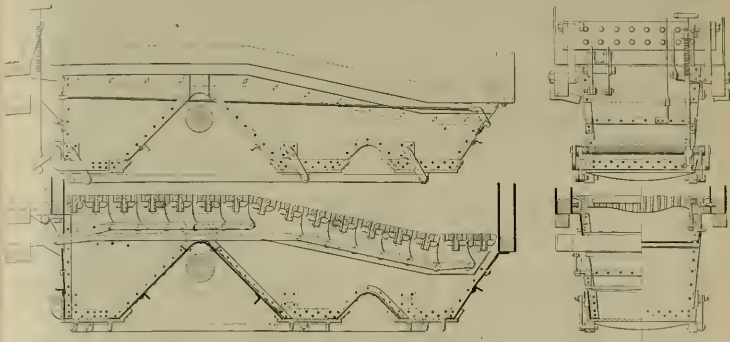
In addition to these there is the Webb compound, belonging to the Pennsylvania Railroad, and one which they built for themselves at Altoona. The Old Colony have built one compound and have one in course of construction. The Chicago, Burlington & Quincy have built one compound.

The inter-continental railway commission has had prepared for the World's Fair a fac-simile in miniature of Central and South America to show the surveys of the proposed railroad intended to unite the systems of North and South America. The work was done by E. E. Court of the Hydrographic Office, and is a faithful representation of the topography of the countries named. It is about twenty-five feet long, and will be sent to the World's Fair as a part of the government exhibit. In addition to the lines surveyed for the railroad the map also shows the routes of the present and prospective steamship lines from North to South America, with the names of their terminal ports and intermediate stopping points, if any.

An article in a Chicago paper says that Lafayette Truman, a locomotive engineer on the Erie, has had the misfortune to kill twenty-two persons since he has been running an engine. In no case has he been considered to blame for the accidents. Most of the killing has been done at level crossings and to persons walking the track. It is quite conceivable that the most careful kind of an engineer should have a run of bad luck of this kind. Every railroad man knows about engines that are always in trouble without there being any apparent reason for it. The same species of hard luck often follows the men running engines.

## Boon's Self-Dumping Ash Pan.

The accompanying engraving shows the arrangements of a self-dumping ash pan designed by Mr. J. N. Boon, and used on certain classes of locomotives on the West Shore Railroad. The ash pan, as will be seen by the cut, is formed into hoppers



Self-Dumping Ash Pan.

are closed by cast-iron sliding doors. These doors are operated by levers worked by a screw and wheel located in the cab. This form of ash pan gives great satisfaction to the men in charge of the engines, and often saves valuable time at stations. Cleaning the ash pans in the old way is getting to be such an inconvenient operation with the numerous attachments that prevent a man from getting under the engine, that a self-dumping pan seems to be greatly needed.

## "Engineer" Applied to Engine Runner.

A correspondent writes: "I see in this month's issue an article of an objection raised by some of the members of the Am. S. M. E., relative to the term 'engineer' being applied to enginemen. These same men seem to forget that bright men can be found in our ranks, and some very poor ones amongst the men with the parchment and differential calculus (in their mind) and that some of our engine-drivers can give them a point or two on that score. I should like to see the gentlemen that design our engines for us come out on the desert where I am at work, with poor coal and the water full of solids, get on any engine and train and make time as we do every day.

"It recalls to my memory a case that came under my observation some years ago, of a mechanical engineer wanting to run an engine. The superintendent of motive power gave him a Baldwin in first-class condition. She had old style Sellers injectors and very sensitive, so our Mr. Engineer *Brown*, as we shall call him, failed to get very much water into the boiler, in fact did not know if he had any when he shut off the throttle. Making a hasty exit from the cab, he left the fireman of five months' experience to find it for him. Returning after some time, he asked, 'How's her water, is she full?' He was discharged for incompetency. That was a case where the fireman was the engineer and the mechanical man the runner. He ran from a bad case of water, a sure case of hydrophobia. I think if some of our mechanical engineers would peruse the pages of Locomotive Engineering for any length of time, they could do so to advantage, and learn how to run an engine. It teaches them how to handle the air-brake now, and later on it will probably tell them how to get water in a boiler and keep it there."

## The Butler's Sand Dryer.

The sand dryer shown in the annexed engraving was designed by Mr. L. M. Butler, master mechanic of the New York, Providence & Boston, and used by him in the engine houses belonging to the road. Sand drying is a troublesome business on all roads, but it is a necessity, and unless it is done well it had better not be done at all. This dryer accomplishes the work properly with the least possible expenditure of heat, and requires very little more attention than the filling of the hopper with wet sand. The drying, as can be seen by the engraving, is done by steam pipes. The sand on getting dry falls into a screen set on an angle. The sand passes through this, and the gravel and impurities pass along the screen and are collected in a bin provided for the purpose. We commend this sand dryer to all the master mechanics who are wrestling with the crude appliances generally used for doing this work.


Butler's Sand Dryer.

The directors of the Columbian Exposition have created an official bureau of public comfort for the purpose of contributing to the convenience of visitors. The officials connected with this bureau arrange for the accommodation of visitors to the Exposition, procuring for them hotel and all other conveniences required. Full particulars may be obtained by application to W. Marsh Kasson, Chicago.

## A Rule With a Purpose.

General Superintendent C. D. McKelvey, of the N. Y., S. & W., has a rule in his book of train rules that a brakeman, after throwing a switch, must walk away about 15 or 20 feet and remain there until the train passes over the switch.

This rule seemed to be a very foolish one to many of the men, who did not hesitate to condemn it as "red tape."

Recently a brakeman, who probably hurried because he was cold, threw a switch under the last car in a train and let the last truck on to the ties.

When he went to see the superintendent the first question asked was

"Were you fifteen feet from the switch?"

"No, sir."

"If you had been could you have thrown that truck off the track?"

"No, sir. I could never see any reason for that rule, but I do now. I see what it is for. Yes, it's a good thing."

"You fellows don't seem to pay any attention to a rule until it saves your own life or the disobedience of it kills some one. I will not punish you for this offense, but I want you and all the men on the road to understand that the next man who ignores that rule will get a vacation."

We have issued a new pocket premium list, giving the cash commission rates and a list of premiums for getting up clubs to Locomotive Engineering. We have some 400 club raisers now, and we propose to have as many more. The book will be sent free.

## Griffith's New Engine.

We lately had the pleasure of examining a remarkably handsome light wheel passenger engine designed by Fred B. Griffith, master mechanic of the Delaware, Lackawanna & Western, and built under his supervision in the shops at Buffalo. The engine has cylinders 19x24 inches, and driving wheels 72½ inches diameter on the tread. To supply steam there are 1624.2 square feet of heating surface, of which 158.7 feet are in the firebox. The boiler is of the wagon-top variety, with the firebox set above the frames, and is made to stand a working pressure of 180 pounds to the square inch. The boiler is 56 inches diameter at the smallest ring. There are 251 2-inch flues, 12 feet 1½ inches long. All the outside sheets are ½-inch steel. The circumferential seams are double riveted, with 4½ inches lap, while the longitudinal seams are single riveted, with covering strips, and two reenforcing rows of ¾ rivets. The crown sheet is supported by crown bars and sling stays. The firebox is 124¼ inches long inside and 42¼ inches wide, with water-bar grates, having a total area of 36.4 square feet. The mud-ring is double riveted. The new type of Boies wheel, with solid steel center, is used for engine truck and tender trucks. The engine is reported to steam very freely and to ride so well that all the men want one just like her. Some of the new big engines are awful hard for the crews.

The Toledo & Ann Arbor are getting ten heavy engines built at Baldwin's.

## Practical Letters from Practical Men.

Facts Wanted. There's a glut of Opinions.

Write on one side of the paper, state your point plainly and briefly, and then quit. We supply the generalities. No letters noticed unless name and address accompany.

### The History of Gauge Making.

*Editors:*

In your issue of August, 1892, in an article on "Settling the Size of an Inch" you recount the history of gauge making in this country, but not completely. The American Standard Gauge Works at Philadelphia were the first to introduce this art here as a regular manufacture, and long before Messrs. Pratt & Whitney made any gauges, had supplied a number of large works, not less than fifty, with not only gauging implements but machines for measuring work, corrective gauges, calipers and other implements.

These works were founded or started in 18[illegible], eighteen years from the time the writer took up the subject and made standard gauges now in use. The standards were derived from careful sources in England and the Coast Survey here in this country, on the Whitworth "touch" system instead of visual, and are believed to be as accurate as any in the world at this time unless, perhaps, it be the late standards produced at Paris by the international commission.

The American Standard Gauge Works were removed to Wilmington, Delaware, in 18[illegible], and are now owned by Messrs. James A. Taylor & Co., who will no doubt, if requested, furnish additional particulars of the manufacture.

More than 50,000 fixed calipers have been made and sold for one thing, and I much doubt if any other company in this country has made half as many. The business is conducted in a quiet manner but has a history much more interesting than the facts you have related.

JOHN RICHARDS.

*San Francisco, Cal.*

### To Foremen Blacksmiths.

*Editors:*

I am very glad to notice in your recent issues that the question of railroad blacksmithing is being taken up and discussed by the craft. I noted with interest the articles by Mr. Lottes on handling steel and the construction of proper fires for this work. The question of handling steel properly to get the best results is, in my opinion, one that requires great care and study on the part of the workman and a great watchfulness on the part of the foreman of the smith shop. This care and watchfulness has been largely neglected by both the workman and the foreman in the past. I think, however, that a discussion on this and other questions through LOCOMOTIVE ENGINEERING would obviate this to a large extent.

What is the matter with an organization of the foreman blacksmiths of the different locomotive and railroad shops of this great country? This would bring about a better understanding of the best methods, not only of handling the different grades of steel, but would also bring about the best and most economical methods for the manufacturing and repairing of the different forgings now in use on our engines and cars, which would cause a large saving in maintenance of motive power and rolling stock.

I think that such an organization of blacksmith foremen would assist largely in bringing about a better understanding as to the most practical methods of doing work under different conditions and circumstances that exist in different parts of the country which many of us know very little or nothing of at present. Many of our craft have some good ideas, and with those good ideas are usually some very poor ones. My notion is that if we could exchange ideas, one with the other, in a short time we would be able to separate the wheat from the chaff, and by this means our trade, one that requires as much skill as any other, would make rapid strides forward instead of going backward, as many think we are now doing.

An organization such as I suggest would meet with the approval of our superior officers in the mechanical departments; they are, I am glad to say, progressive men, and any means whereby the cost of maintenance of rolling stock can be lessened without a corresponding reduction in the life and service of the same will be hailed by them with delight. I would like to hear from some of the foremen through the columns of your paper, or any others—not excepting the editors.

J. J. THORNTON,
Traveling Blacksmith N. P. R. R.

*Brainard, Minn.*

### That Blind Washer Under the Brake-Valve on Second Engine of a Double-header.

*Editors:*

In the last number of your paper, Mr. Bruce asks whether it would be considered good practice to put a blind washer in the train-pipe connection to the engineer's valve in case the pump on the second engine of a double-header should stop working and permit a reduction of the main drum pressure and consequent lifting of the rotary valve. This is supposing, of course, that there is no stop-cock in the train-pipe connection.

I must say I do not see any other good way out of the difficulty. It is a case wherein the best instruction would seem to be, "Do anything not positively destructive of the apparatus in order to make the brake work," for running without

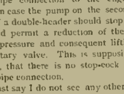


Fig. 1.

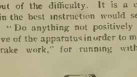


Fig. 2.

brakes is pretty risky business these days of fast time and heavy traffic, and it is especially risky in a case where the office supposes that the train is using air brakes.

The only objection I can see to this suggestion is the possibility of the washer being allowed to remain in the train-pipe through the forgetfulness of some of the men; but this does not seem serious, in view of the fact that the brake could not be used either in taking the engine in or out of the house, and the cause of the trouble certainly would be discovered before the engine was allowed to go out into service again.

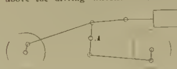
PAUL SYNNESTVEDT.

*Chicago, Ill.*

### An Odd Locomotive.

*Editors:*

A few years ago in the Cumberland Valley yard at Harrisburg, Pa., there was an odd-looking locomotive called the "Utility." I think she was built by Seth Wilmarth, South Boston, and he built some good ones too. The peculiarity about this engine was her connections. She had horizontal cylinders, but they were located above the driving wheels. Power was





transmitted to the wheels through the lever *A*, which was pivoted on the frame. Who can tell us something about her and send LOCOMOTIVE ENGINEERING a cut or photo of same.

W. DE SANNO.

*Indianapolis, Ind.*

### Tempering Tools—Advantages of Uniform Sizes.

*Editors:*

The toolsmith who tries to satisfy his employer and the mechanics at the same time has considerable of a contract on his hands.

It would take a world of argument, however, to convince the average master mechanic or general foreman of the advantage of having on hand a large stock of standard sizes of tools all hardened and ground ready for use.

This can be done by numbering the tools and have one man do all the grinding and keep the stock, so that when a machinist or boiler-maker wants a tool dressed he can exchange his worn or broken one for a new one and not lose any time, keeping his machine in service all the time.

The only sensible argument against this plan is the one of first cost—it ties up a little money in steel. But steel once on hand, the plan saves it, because the toolsmith is not changing a parting tool to a finishing tool, and *vice versa*.

The thing to do is to get the tools ground uniform; this can best be done by one of the tool-grinding machines, Sellers or Gisholt; both of these machine builders send out a chart with their machines that shows a cut of each kind of tool and tells where to move the stops to grind that particular shape; tools ground this way are always alike and uniform.

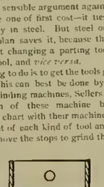


Fig. 3.
Section of Lead Pot.

With a system of this kind the toolsmith can do a good job on tools, if he knows how, and do it in less time, because he generally gets a dozen or two of the same number to do at a time, or, say he gets six different numbers, and twelve of each, he can build him a fire which is most suitable for the work, such as you see in Fig. 1, with back closed.

For all lathe and planer tools a system of this kind makes it a great deal pleasanter for the smith and all hands that have to depend on him for their tools.

It does away with the practice of having three or four men standing around the tool fire all day. Another benefit is, that as the tools are forged they go to the machine shop to be ground and come back in lots of from 50 to 100, and the toolsmith can again take advantage of this by beating his tools in hot lead for hardening, by having a fire with a lead pot in it, as represented in Fig. 2. The lead pot may be made of gas pipe from 4 to 10 inches in diameter and from 10 to 20 inches deep, as represented in Fig. 3. You can heat at least four ordinary tools, such as lathe and planer tools, or chisels, drills and calking tools, where you would be heating one in any other way, and not injure the steel, if you keep your lead at the proper heat and properly covered with fine charcoal, which is put in to keep the hot lead from forming a scum on top, and it will also prevent your lead from sticking to the steel to a certain extent, which is a very important point in hardening such tools as are not intended to be ground after they are hardened. For if you allow the lead to stick to your steel it will show on your steel after you take it out of whatever you quench it in by leaving it full of what blacksmiths generally call "pock-marks," which show very plain after you polish your steel, and looks as though you had overheated it or raised a heavy scale on it. This may not be any particular injury to steel, but it looks bad.

*Madison, Wis.* W. G. LOTTES.

### Testing Stay-Bolts.

*Editors:*

I noticed an article in your paper about the fallibility of the hammer test for stay-bolts, and write to give you a pointer from the practical field.

I have been for some years testing stay-bolts on the Wisconsin Central, and must say that I have the first time yet to mark a bolt as broken that was not found so.

No boiler-maker can rely on the hammer test alone, because if a bolt be broken in the sheet, or even outside of it, and still the ends are firmly pressed together, the hammer will not always tell the truth, but if you put hydrostatic pressure on the boiler, of, say 60 pounds, the sheets will spring apart enough to separate the ends of the broken stay and the hammer finds it at once.

The difference in the radius of the firebox sheet and the shell at the top of the side sheet causes a great many broken bolts in the upper forward corners, and long practice is necessary to enable a man to find them when broken, especially if the boiler is cold and without pressure.

I believe, however, that any company can rely on the hammer test when used in connection with the hydrostatic test.

THOMAS MCCANN.

*Waukesha, Wis.*

### Hollow Stays.

*Editors:*

I have been asked by several foremen boiler-makers, readers of your journal, to give my opinion on and experience with hollow stay-bolts. I presume they mean by hollow stay-bolts a bolt hollow its full length. If so, I am in favor of the hollow bolt in preference to a system of drilling a hole in outside end of bolt, as is done by many railroad shops, for the reason that drilling weakens the bolt at a point where the bolt has to bear the most strain, and very seldom you will find hole drilled in center of bolt. I have seen part of the thread on sheet drilled away, as it is hard to keep drill in center of bolt after bolt has been hammered.

There seems to be very little thought given by boiler-builders to vertical expansion of fireboxes in locomotive boilers, and expansion is the weak point in radial stay boilers, as the firebox sheets, being lighter and exposed to the heat, will expand more rapidly when a new fire has been started in firebox than the outer sheets, that are in most parts exposed to the atmosphere. This has a tendency to strip thread on crown sheet or stay-bolt, or both, pressing bolt through crown or bending bolt. I gave this as my reason when asked by a foreman boiler-maker from Kansas, why flue-sheet in radial stay-boilers crack at top above flue holes.

He wrote me a short time ago that my

theory was correct, as he had tested the matter by drilling a hole in wagon top over the flue-sheet and put in a stuffing-box, through which he passed a rod until it rested on crown sheet. He went in boiler to see that center point at end of rod was in center mark made in crown sheet; this done, he fired up, and when boiler began to show steam, crown sheet had raised rod ⅛ inch, and when boiler showed 50 pounds it went back, or, as I would say, the outer sheet came up to it. This is why I advocate a flexible bolt, as stay-bolts in sides of firebox have this expansion and contraction. I do not mean that a bolt drilled its full length would be flexible, as I contend that a bolt so drilled has the best of the metal drilled away, and the cutting of the thread on outside takes all the springy part away. I have used for over a year a mandrel rolled hollow stay-bolt, made by the Falls Hollow Stay-bolt Company, which comes nearer filling the bill than anything I have seen yet, as by their process they compress the iron externally and internally, and it can truly be said to be elastic, as I have found by testing.

JAMES HERON.

*Chicago, Ill.*

### Forging Locomotive Frames—Handy Blacksmith Tools.

*Editors:*

In my last article I dwelt somewhat on side-rods; in the present article I will direct attention to locomotive frames, and will endeavor to point out one particular agency upon the texture of the chief anatomy of the locomotive, in so far as blacksmiths are concerned, *viz.*, structural imperfections.

As regards the proper length in welding the lower brace of frame, experience and observation have demonstrated that in many instances no attention is given to tension, thus destroying that equilibrium or state of rest produced by the mutual action of the particles in the construction of the frame in welding the lower brace of the frame proper. Before this operation everything is practically normal. For illustration, before the lower brace is welded draw a straight line on the side of top of frame and draw a parallel line on lower brace, then draw perpendicular lines on the inner jaws, intersecting the parallel lines, thus describing a rectangle; now, after the weld is performed try your lines, and if you are working for "general results" nine chances out of ten your lines will assume the shape of a trapezoid. A more practical way is to make a fine tram mark on the lower part of each inner jaw and tram before you make your weld.

I have seen frames after they were welded and cold show a shortage of from ⅛ in. to $\frac{3}{16}$ in. between the tram marks, in many instances in making new frames a sheet-iron template is the only thing used, the only consideration being enough stock for planer and slotter.

Under the circumstances let us take into account the deflection caused by a transverse strain, or, practically speaking, a breaking strain on the upper inside corners of the inner jaws.

Here we have a continuous strain and, in addition to this, violent shocks or concussions which are transmitted to the weakest points—the upper inside corners of inner jaws—resulting in a broken pedestal caused by undue strain.

It is only within about twenty years that much attention has been given to the invention of machinery and minor devices for saving labor in the smith shop. During all the years the blacksmith having skill and ability was obliged to create or produce out of his own hands, so to speak. But the art of forging, like everything else, must keep up with the procession.

A great deal of the work of fashioning wrought-iron, which formerly required the smith's skill, is now done by machinery. There is no doubt that most of the forging belonging to a locomotive can be done by ingenious contrivances far more accurately and in many respects with less abuse to metal, to say nothing as to capacity of production.

I present herewith illustrations of some blacksmith-shop tools which are in successful operation.

Fig. 1 represents a tool for making clamps belonging to switch-chairs or "rail-heads." It is in the form of a mold; the number of pieces that can be stamped or pressed is only a question of how many can be heated and handled. The edge to be trimmed when cold with power shears.

Fig. 3 represents a valuable tool for making clamps or binders for railroad frogs. *A* represents punch sliding on two

Fig. 1

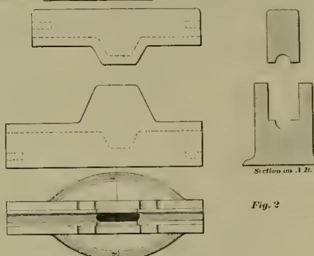




Fig. 2

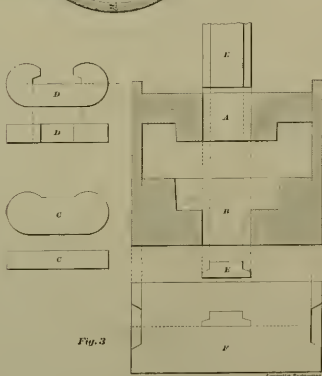




Fig. 3

dovetailed guides. *B* the die, *C* the blank after the first operation of punch *A*. *D* represents the blank after the second and last operation by punch *E*. *F* represents a top view. In my opinion, the best material for frog-clamps is a very mild, ductile steel, and its having nearly like strength in both directions of its plate.

GEO. T. HINKENS.

*Gladstone, Minn.*

### That Tool-Hardening Matter.

*Editors:*

In February number of LOCOMOTIVE ENGINEERING, wherein you published my article on "Hardening Tools," leaving soft center, either your printer or myself omitted two words which greatly changes what is meant. It should have read: "I reduced or hammered the steel to a certain degree, and that has a refining effect, at any rate, *it did not* increase the carbon," instead of "at any rate it increased the carbon."

I thought I would call your attention to the error lest your readers might think that I believed that I discovered a new process for putting carbon into steel.

GEO. F. HINKEN

*Gladstone, Minn.*

### That New Driving-Box.

*Editors:*

Allow me to say a little in regard to the proposed new frame and driving-box.

I quite agree with Mr. De Sanno that the movable wedge for taking up the wear of driving-boxes could be dispensed with, but do not think it would be necessary to make such a change in frames as Mr. De S. proposes.

I think that with good materials and careful fitting the present style of frames would do. It might simplify the work if the jaws were parallel. The feature of the new frame providing a double wearing surface is very good. It has been found necessary with the present style of frame and box to let shoe and wedge fit loosely between flanges of box, and in addition to this to widen space between flanges at top and bottom making it slightly bell-shaped, this is done to prevent flanges of boxes being broken by engine passing over uneven track, as is well known. It is not uncommon to see springs carrying one side of engine considerably higher than the other owing to unequal strength; this would tilt boxes of the new style, throwing bearing on one edge and thereby cause severe heating, unless some means are provided for the self-adjustment of boxes, as in the present style.

It is hard to tell what would be the result of an engine with the new frame and box passing over a Wharton switch, where one wheel is raised high enough for flange to pass over main rail in going in side track; this would throw a severe strain on box and studs. Then, again, in a machine that has to do the work that is expected of a locomotive, and the shocks it has to stand, I think the fewer parts and joints it is made up of the better. It will be seen that the proposed new style provides us four extra joints for each box. Take it all around, I do not think this would be very good company for the solid rod, as I am afraid it would tend to offset the good qualities of the rod.

*Sanford, Fla.* A. DIXBY.

### How to Tell Mushet's Steel by the Emery Wheel.

*Editors:*

I want to call the attention of brother machinists to a trick worth knowing, *i. e.*, how to tell Mushet's steel after tools get old, mixed up with other tools, or in some other way lose their identity. I do this on the emery wheel.

Mushet's will throw a stream of dull red fire when ground, and without flying sparks. Ordinary steel throws brighter sparks and more of a shower of them. Cast-iron grinds something like Mushet's, but still has brighter sparks.

I don't like Mushet's so well for wrought-iron and soft steel as for cast-iron, and for the roughing cut on tire it is "best and goes farthest." CALIPERS.

*Mt. Savage, Md.*

### Traveling Crane in Havelock Shop (B. & M. R. in N.) Near Lincoln, Neb.

*Editors:*

The machine shop of the above-named company, located at Havelock, Neb., is 400 feet long. A standard gauge track is laid the entire length of the shop, along each side of which the heavy tools are located and served by one crane, of which the following is a description.

This crane is operated by a pair of reversible engines, run by compressed air, at a pressure of 60 to 80 pounds per square inch. The engine power is communicated to the front axle by friction, as shown on plan. The car is moved by turning the lowest three-way cock, admitting air to the cylinders of the engines. The reversing valve is so arranged that the engines are always in back motion, and by pressing the foot lever on platform air is admitted to the opposite end of reversing cylinder working tumbling shaft and the motion changed. The operator stands on the platform attached to mast and from this position controls all movements of the crane. The swing motion is performed by turning second three-way cock, which admits air to the cylinder under the car, operating rack and pinion in connection with mast of crane.

Raising and lowering is controlled by upper three-way cock, which admits air to the lifting cylinder, 13 inches in diameter and 7 feet stroke, at top of crane.

The air storage is distributed as follows: one main reservoir 42 inches in diameter and 6 feet high, three nine-inch tubes, supported over lifting cylinder and suitably connected, mast, stay and jib connected by openings in tubes and castings as shown in section; all are connected with service pipe, which is fastened to mast and to which are attached throttle, swing, lifting and reversing valves, gauge and alarm whistle. Different sizes of hose are used where flexibility in connection is required. This arrangement stores 85 cubic feet of air on crane, which is sufficient to permit of the crane being run out of shop to platform, or cars, pick up a pair of heavy driv-

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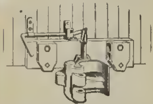

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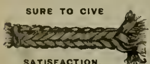

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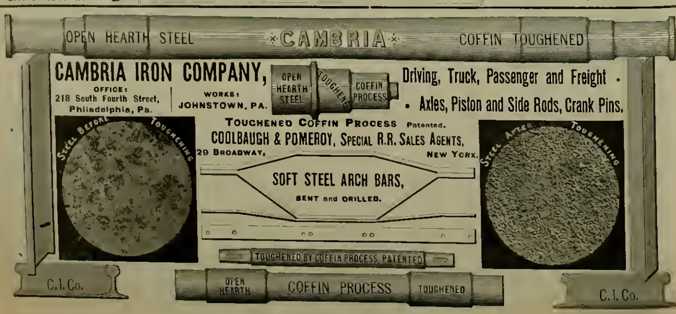
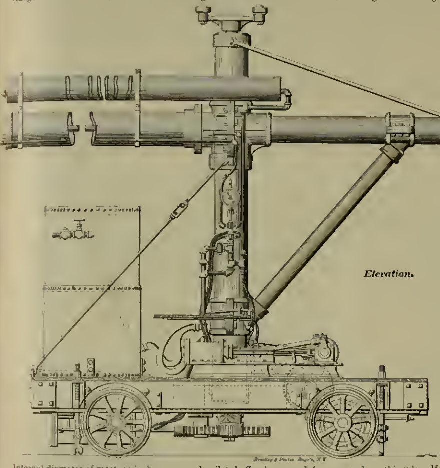


ers, a cylinder or other heavy casting, and take same into the shop to a machine or otherwise, as desired. The air is supplied by a Norwalk air compressor and convenient pipes and couplings are placed in shop for charging crane when necessary.

Capacity of crane, 4 tons.
Maximum lift, 7 feet.
Air pressure, 60 to 80 pounds.
Air storage capacity, 85 cubic feet.
Diameter of wheels, 28 inches.
Gauge of track, 4 feet 8½ inches.


*Elevation.*

Internal diameter of mast, 13 inches.
Internal diameter of jib, 10 inches.
Internal diameter of stay, 6 inches.
Internal diameter of air tubes, 9 inches.
Internal diameter of air reservoir, 42 inches.
Internal diameter of lifting cylinder, 13 inches.
Total height above rail, 15 feet 10 inches.

As will be noticed in section, an internal tube 4½ inches in diameter is rolled into ends forming jib, acting as a guide to piston rod and chain; and leaving the surrounding area for air storage. The same method is also employed where piston rod passes through mast.

The rollers on castings on top of crane receive a double channel iron between them, which is fastened to girders in the shop and act as a steady to crane when serving machines. For outside use, when necessary, there are four adjustable rail clamps, two on each side at ends of car, to be used for taking side lift.

The special features of this crane are its adaptability to the large variety of lifting and carrying in locomotive shops, being independent of external power.

This crane was designed and built at the company's shop at Plattsmouth, Neb.

D. HAWKSWORTH,
Superintendent Motive Power.
*Plattsmouth, Neb.*

### An Injector Problem.

*Editors:*

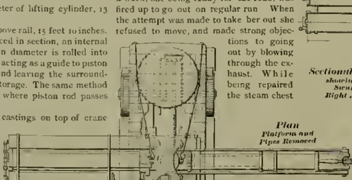
I am running a Baldwin engine with saddle tank, feed boiler with two Rue injectors. During the recent cold weather my injectors refused to work. I made an investigation and found plenty of water in tank, injectors all right, steam-pipe, discharge-pipe and overflow all right—everything all right, from tank to boiler. Now, what was the reason it would not work?

*Houtzdale, Pa.* C. L. DENNIS.

### A Peculiar Accident.

*Editors:*

An engine once collided with some freight cars with the usual result, front end, pilot, buffer beam and frames used up. Her cylinder and steam-chest casing were not injured. The collision happened not far from the roundhouse. She was towed in without disconnecting. In about a week, she being ready for the road, was fired up to go out on regular run. When the attempt was made to take her out she refused to move, and made strong objections to going out by blowing through the exhaust. While being repaired the steam chest covers were taken up and everything found all right, but on her refusal to move under steam the cylinder-heads were taken off, when the lower half of both piston heads were found to be broken off. The piston heads were of the solid type. One piston rod was slightly bent, the other one was straight.


*Plan*
*Platform and Pipes Removed*

What broke those heads?

My theory is that he plugged her so hard she filled the cylinders with water. Cylinder-heads were not started.

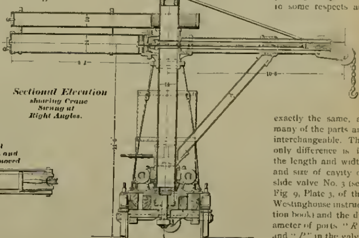
W. DE SANNO.
*Indianapolis, Ind.*

### An Unfair Rule.

*Editors:*

The item on page 63 of February relative to, or headed, "Southern California Engineers," is what I want to make some inquiries about. You are in favor of such rules, but I do not think you would indorse them if you were a freight man. Usually when an engine in passenger service gives out her place is filled with a freight engine. The regular man assigned to this run takes her out. What will the man do who is assigned to this regular freight engine? Of course he will be obliged to lay off. I am in favor of the old men having the preference, but not to that extent. This rule gives them full time, year in and year out, and gives freight men a living when their engines are not required on first-class runs. I have worked under this rule for two years, and nothing has ever been introduced on the Chicago & Erie that has ever kicked up so much disturbance among the men as this rule. If you can say anything in defence to this I would be pleased to hear from you.

*Huntington, Ind.* A READER.


*Sectional Elevation*
*showing Crane Swung at Right Angles.*

### What Was Wrong with This Air Signal?

*Editors:*

I coupled on to a train of eight passenger cars sometime ago and the conductor could not blow the air-whistle from any car but the one next to the tank. We examined all cocks in the train line, found them all open, had to run that way to destination. When we arrived at destination we coupled on to the opposite end of the train, the whistle acted the same way, that is, would only blow from car next to tank. What was the matter.

PETER M. MCCARTY.
*East Mauch Chunk, Pa.*

### Why Do These Valves Break?

*Editors:*

I would like to ask through the medium of your paper what causes the wings of the lower discharge-valve of the 6-inch air-pump to break, the upper discharge-valve being in good shape, and the left not excessive. I have seen several cases of this kind, but have been unable to find a cause or construct a theory.

Yours truly,
*Winona, Minn.* G. S. HALE.

### A Question for Runners.

*Editors:*

Please allow me to ask if the pump governor can get into such a condition as to cause an emergency application of the brakes after a slight reduction in service stop, say just enough to cover the leakage groove? Also, do we run brake-valve in running position to get excess pressure only, or for safety? In other words, could an accident happen while running the brake-valve in released position that could not possibly happen while running it in running position? "NYPANO."

*Meadville, Pa.*

### Who Knows? Difference Between Freight and Passenger Brakes.

*Editors:*

Referring to an article in February journal relative to difference between Westinghouse freight and passenger triples.

The feed-groove in a freight triple is only about one-half the width of a groove in a passenger triple. The reason for this, I would judge, is to prevent auxiliaries on forward cars of a long freight train from filling before those on rear cars. After forward auxiliaries were charged to maximum pressure, there would be danger of setting brakes on forward cars by rear auxiliaries taking air from train-pipe, especially when engineer's valve was in running position, or on lap.

*Nashville, Tenn.* J. A. JISSON.

*Editors:*

In answer to Mr. Synnestvedt's question, would say a standard, quick-action freight triple valve and a standard, quick-action passenger triple valve in some respects are exactly the same, as many of the parts are interchangeable. The only difference is in the length and width and size of cavity of slide valve No. 3 (see Fig. 9, Plate 3, of the Westinghouse instruction book) and the diameter of ports "*R*" and "*P*" in the valve seat.

In the passenger triple valve the cavity "*N*" in slide valve is a little larger and the face of valve is about 1/8-in. larger both ways, and ports "*R*" and "*P*" in the valve seat are 1/16-in. larger than in the freight triple valve. The passenger brake cylinder being of larger diameter than the freight brake cylinder, the ports in passenger triple valves are made larger so that when both kinds are used in one train the brakes can be applied and released more evenly than if both triple valves were alike. On some roads they take out the emergency valve piston No. 8, and put a small brass bushing in its place. When this is done, it is to prevent brakes from being applied too severely where the old

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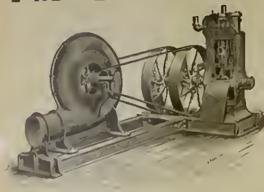

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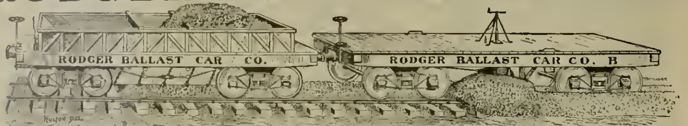


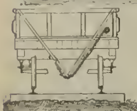

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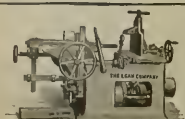

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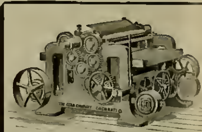

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three-way cock is used in place of the equalizing discharge valve.

M. E. WATTS.

*West Nanticoke, Pa.*

THE ANSWERS.

*Editors :*

The difference between the Westinghouse freight triple valve and the standard passenger triple valve is in the port openings. The freight or passenger triple valve must not be used in the opposite service for the reason that in making an emergency application of the brake the air would not equalize and close the check valve between the auxiliary reservoir and the brake cylinder. Therefore the triple valves must correspond with the different sized brake-cylinders, in order that the brakes on all cars may work in harmony in the same service.

"NYPANO."

*Meadville, Pa.*

*Editors :*

The difference is mainly one of size, due to the fact that the passenger reservoir and cylinder are larger than those used in freight service.

It is necessary that both freight and passenger brakes be so constructed that they can be used together in the same train.

They should act together both in application and release.

Because of the difference in size of the reservoirs and cylinders, the port through which the air passes must also differ. Hence the passenger triple is larger than the freight in the following parts .

1. The feed groove from the train-pipe to the reservoir.

2 The ports from the reservoir to the cylinder.

3. The feed valve controlling the graduation.

4 The recessed cavity in the bottom of the slide valve and the co-acting ports.

5. The slide valve.

Besides these differences the passenger triple valve has a threaded exhaust port on one side only, whereas the freight triple has one on each side. This is for the connection to the pressure-retaining valve which is not used on the majority of passenger cars, but almost always found on freight.

PAUL SYNNESTVEDT.

*Chicago, Ill.*

### That Tank Brake.

*Editors :*

Concerning the problem propounded in your last issue on a tender brake-lever arrangement, I should like to say a few words.

If the point *E*, shown as the middle of the cylinder-lever, is a fixed fulcrum, the braking power cannot be figured at all, for a lever cannot operate at all with two fulcra, and that would be approximately the condition of affairs after the slack on one or the other truck had been taken up by movement of the piston. The arrangement shown is such that nearly the whole braking power would be thrown on either one truck or the other as the slack was looser on one truck or the other. Mathematics is an accurate science, and cannot be applied to guess-work such as would be necessary to get any idea of the strains brought on any of these brake-beams. It the fulcrum *E* be taken out and the cylinder-lever allowed to swing or pivot on the end of the rod *B*, as a fulcrum, then the strains can be calculated.

This calculation I have made, but as it does not meet the conditions of the problem as given, I shall not insert it unless some one wants it.

I notice also that the piston travel is given, and should like to ask whether the 50 pounds specified is reservoir pressure before equalization, or full equalized pressure.

Except in determining the equalization, the travel is not necessary, as its only practical effect is in altering slightly the position of the levers with reference to the angle they make with the rods.

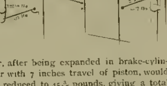
It might also be noted that if the slack on the back truck be taken up tightly, there would be great danger of breaking the beams on that truck. Let us hear from Mr. Gonware again on these points.

PAUL SYNNESTVEDT.

*Chicago, Ill.*

*Editors :*

Allow me to offer a solution of the strange brake-rig-for-tender problem that appeared in the last issue of your paper. I base my calculation on 50 pounds train-pipe pressure, a 12 x 30 inch reservoir, and an 8-inch brake-cylinder. This volume of



air, after being expanded in brake-cylinder with 7 inches travel of piston, would be reduced to $45\frac{3}{16}$ pounds, giving a total pressure on piston of 2,275.25 pounds. The forces applied at the different points will be shown in the sketch.

*Sanford, Fla.*

A. DERBY.

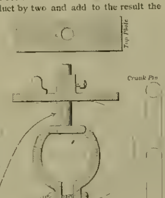
### A Tool for Setting Eccentrics.

*Editors :*

In your last issue a reader wants to know something about laying out keyways for eccentrics before they go under the engine. I made a special tool for this purpose that works very well ; this for a class of engines where the line of eccentric rod connections is on a line with axial line of cylinder.

To plumb, I scribe a circle on the end of axle the diameter of the pin and with a double plumb line set pin directly over center of axle as shown in sketch, and then block the driver. Now I put my tool on the axle between the eccentrics and level the top plate and then fasten secure , you will see the clamp bears on the axle in three places.

I have a rule for setting the top plate the proper distance above the axle, as follows Subtract the diameter of the axle from the diameter of eccentric, divide the product by two and add to the result the




amount of lap and lead—the result will be proper distance to set plate above the axle, as shown by arrows. Example : Diameter of axle, 7½ inches ; diameter of eccentric, 16 inches .

$7\frac{1}{2}$—16=$8\frac{1}{2}$÷2=$4\frac{1}{4}$ <lap 1" lead $\frac{1}{16}$"=$5\frac{5}{16}$.

I now move the eccentrics up until they touch the top plate, and lay out my keyways. I also use this device where line of motion is not paralleled to axial line of cylinders.

F. WELLS.

*Frankfort, N. Y.*

[Our correspondent's device requires the putting on of the eccentrics, while the plan shown by F. S Hill does not, and can be used any time after the axle has been quartered for keyway, and before the wheels are keyed on a new axle.]

### Campbell's Valve Setting.

*Editors :*

In your February issue Mr Campbell tells your readers why centers for valve-setting are taken from the rods instead of wheel covers. He also *tries* to tell how to set valves, and succeeds in one about as well as in the other.

Most machinists when setting valves by pinching try to get the engine on a piece of track that is somewhere near level, for it is no worse to have the wheels drop into a hole and away from the tram center than it is to have them carry the center along with them while leaving the links suspended to the frames, which they will do if the track is uneven, and thus change the length of the blades.

One advantage in using a center on the side-rod is in putting it on the top of the rod and having a tram bent on one end only (thus ⌈) ; this will be found quite convenient when working at night, as it gives you the use of one hand to hold a torch, otherwise I could never see as it made any difference which you used.

In telling how to set valves he says that he catches the centers on one side and uses the quarters on the other. Will he please tell how he finds the amount of lead on that side, or changes it if necessary.

I never was able to set an eccentric without getting the dead center. Will he call his niggers back and have them pinch five minutes more, or will his machinist and foreman do it ?

He gives "the boys a nut to crack" in telling them how to keep the eccentrics and blades proper for a long time by putting a liner in the front of the main wheels, but does not tell them that if they put liners in the main shoes they will have to do the same with the rest of the wheels or else change the length of all the rods.

I think every one of your readers will admit that it is easier work and less of it to shorten the eccentric blades, especially if the engines are slim gauge, as they are on the H., E. & W. Texas.

F. C. CHARLES.

*Cedar Rapids, Iowa.*

### Using Air on Head End of Train, M., K. & T. Instructions.

*Editors :*

In perusing your valuable paper I learn more and more every month. There is one subject of great importance which, if discussed in your paper by other roads and by experienced men, would probably benefit M., K. & T. men.

Some time ago the M , K. & T. put up bulletin orders forbidding engineers to use air only in cases of emergency ; it must be coupled up and in condition for use, but must not be used unless in emergency. Brakemen will not set brakes among airs. So, in going up to water tanks or following trains, before brakeman can go from seat on fireman's side over train to first brake behind air, we are in a close place and it becomes necessary to lay brake-valve around in emergency, so all our stops are emergency stops, which is hard on brakes, cars and everything generally. The cause of this order was on account of trains breaking in two behind air and running together, which was laid to air, which I claim had nothing to do with it. I know that a train going over the road with 6 cars air in good working order can be handled to perfection, making all stops and slowing up and down all hills, and if train crews attend to their duty when train breaks off they will not collide.

I will ask some of your correspondents where brakemen ride on their roads. Here on a train equipped with six or eight or even four cars of air, we handle trains perfectly and head brakeman rides on fireman's seat, in his way, and engineer has to fire him out or ask him "if they are all coming." Sometimes he will look out, but it's owing to what kind of weather it is outside whether he will venture his head out or not. If the M , K. & T. R R. will put up a bulletin like this, and enforce it, engineers will use their own judgment in using and handling air and trains and will keep sharp lookout on approaching places where they expect to stop or slow up, and head brakeman should be on top of train and be sure that all are together and conductor and rear brakeman should be out on top of train and be ready to notify head man if train has parted, and engineer, fireman and each brakeman and conductor shall be held responsible for trains running together when parted. I have handled air trains and broke in two in close places, but have never let them collide, and I attribute it to carefulness and watchfulness and making head brakeman keep a close watch. On a dark, rainy night train crews will not even look out, and it is necessary that the darker the night the more carefully should they be strung out on top at every stopping place and be able to help keep train together. Brakemen should look the train over for cracked pins and links

Where officials do not know how to run or pull trains themselves they should be willing to leave such things to the judgment of the men—retaining in service only such men as can "get there" and show results.

M. K. & T.

*Dennison, Texas.*

### The Pontiac Slipper.

*Editors :*

Answering Pontiac, Mich. I should judge from the description of the 15 in. x 22 in. locomotive engine complained of, that there may be many reasons for the engine acting in the manner complained of by Pontiac It may be the engine is over-cylindered with a short lap valve, lots of swap, as the boys call it. The fault may be with a set of hard, slippery driving tires, or too much counter-balance in driving wheels, or perhaps the counter-balance unevenly distributed. With either of these things the engine will act as complained of. I would advise Pontiac to test his engine, see that the driving wheels are not twisted on driving axles, or that the driving axles or crank pins are not bent Counterbalance the driving wheels against ⅔ the reciprocating weights, take off driving tires and anneal same. If the engine valves are line and line inside, put in a set with $\frac{1}{32}$ in. inside lap, and a longer outside lap ; I think the trouble will be removed. If the engine is found all right as regards axles, tires, crank pins and counter-balances, which I have every reason to doubt, try a valve with ⅛ in. to ¼ in. more outside lap, I think the ghost will disappear

*Cedar Rapids, Iowa*

OBSERVER.

### Front Brasses Filed Open.

*Editors :*

Answering W. De Sanno The philosophy of filing front end main rod brasses open, is to avoid filing brasses often. It is the practice in a great many places to file front end main rod brasses open in joints, and are run successfully with care. I approve of filing all connecting-rod brasses to key close in joints.

*Cedar Rapids, Iowa.*

OBSERVER.

A correspondent sends us some interesting notes about the career of Mr. H. A. Whitney, whose retirement from the position of mechanical superintendent of the Intercolonial Railway of Canada we mentioned in a recent issue. Mr Whitney had been in the railway service for over forty years, thirty-five of which had been on the Intercolonial. He began railway work as fireman in 1852, and five years later went to the Intercolonial as engineer, when the road was only thirty miles long. Rising slowly through various grades he reached the head of the mechanical department of the road, which has now 1,200 miles of track. He was highly popular with the rank and file on the system and was entertained at a banquet by the engineers, firemen and machinists when he left.

Part V of the Consolidated Car Heating Company's Catalogue has reached us. It treats of coil and disc drum systems and baggage-car equipment. It forms a comprehensive hand-book on the subjects treated.

## The Greater Santa Fe Trail.

[EDITORIAL CORRESPONDENCE.]

A PIONEER TRADE CENTER.

One of the oldest routes of intercommunication in the United States was the Santa Fé trail. The ancient city of Santa Fé, built by the Spaniards shortly after they took possession of Mexico, was the storehouse of trade for a civilized region long before any permanent settlement was made in the Atlantic States. The town was built on a spot that rendered it a natural distributing point for trade, besides the center of supplies for a district which supported a thriving population.

When the settlement of colonists on the eastern seaboard developed so that the people had something to sell, they naturally looked for a market in the Southwest. There are always enterprising spirits ready to push the gospel of trade to the remotest markets of the earth, and there was not wanting men ready and willing to undertake the transporting of merchandise by mule or wagon over the vast territory that intervenes between the Missouri River and the Rocky Mountains. The route adopted was that presenting the fewest physical difficulties, at the same time providing means of subsistence for man and beast. This was the Santa Fé trail.

MORE DANGEROUS THAN FREIGHT-BRAKING.

In the whole history of human endeavor there are few pages that display more stirring and dramatic scenes than the experiences of those who carried on the work of transporting merchandise over the Santa Fé trail. The men who engaged in this early line of express business took their lives in their hands, and every day of their tedious journey were liable to be called upon to meet death in its most terrible forms. The most stupendous difficulties that animate and inanimate nature could present had to be overcome. Treacherous rivers had to be crossed with the crudest floating apparatus, savage lurking foes haunted the trail, and animals scarcely less ferocious than the human enemies were often encountered. Thirst and hunger had often to be endured in the long journey over the arid plains, and the terrors of storm and tempest were frequently increased by the precarious foothold provided on paths that wound round shelves of giddy precipices. But over storm-swept plains, over almost impassable mountains and through fearful gorges these pioneers of trade forced their foot-trains and led the way to more imposing methods of transit.

ENTERPRISING RAILROAD BUILDERS.

When the daring enterprise of joining the Atlantic States to the Pacific slope by the friendly bonds of a transcontinental railroad was first advocated the Santa Fé trail was urged as the natural route. Surveys were made which proved that the route was one of the best that could be followed, but considerations other than engineering ones sent the first railroad another way. Even while railroad men were almost unanimous that one railroad would be sufficient for all business that could be offered for transportation between the Atlantic and Pacific States for half a century to come, men with clearer vision were ready to venture their means in building a railroad over the Santa Fé trail. For this purpose the Atchison, Topeka & Santa Fé Railroad Company was organized in 1863. The enterprise made little progress for a few years, but by 1873 360 miles of the road was completed and the State of Colorado reached. Through the hard times which followed the panic of 1873 it was difficult raising money to push railroads into the wilderness, but this road kept pushing out its terminals year after year till not only the original goal, Santa Fé, was reached, but remote territory traversed never dreamt of by the organizers of the company. This is the modern Santa Fé trail.

THE ATCHISON, TOPEKA & SANTA FE SYSTEM.

The new and greater trail is wonderful in many ways—wonderful for the number and extent of its tentacles, wonderful for the vast territory it traverses and wonderful for the revivifying influences it is exerting on the communities reached by its lines. The lines twist over Kansas like the tracings of an intricate web. One terminus is in Chicago, another is in Guaymas in Mexico, half way down the Gulf of California. A leg goes to Galveston on the Gulf of Mexico, and it gives direct connection with Salt Lake City, in Utah. Los Angeles in Southern California is the Western terminus, and there are many smaller terminal points that are now the jumping off place while waiting for additions to the track that will lead to new fields.

This railroad system has nearly 10,000 miles of track extending through fourteen States and Territories. The corporation owns over 1,300 locomotives and about 40,000 cars. Its track drops to the sea level in three different States, and in Colorado crosses a mountain at an altitude of 11,528 feet—over two miles in the air.

PASO DEL NORTE, MEXICO, RAILWAY STATION.

OUT WITH AN INSPECTION PARTY.

In September and November last the writer spent three weeks on the Atchison, Topeka & Santa Fé system. The time was too short to see more than a few of the main line trunks, but it was long enough to give the impression that the whole of the lines could not be thoroughly explored in less than a year. Three or four days were spent with a party out on an inspection tour. The principal members of the party were General Superintendent Nickerson, Superintendent of Motive Power Player and the superintendents, engineers and road masters of the division under inspection. A special train was used and it was stopped at every bridge, culvert and shop, or any other place where cuts or embankments were likely to be out of order. The work was very thoroughly done. Those interested went down beneath every bridge and carefully examined the condition of the structure and of the foundations. The track was kept under constant scrutiny, and where rails or ties were considered unsatisfactory, stoppages were made and orders issued for renewals or repairs. The roundhouses, car repair shops and yards and every place where maintenance of any material was to be found came in for attention. Slovenliness or indications of waste brought down upon the devoted head of the man responsible sneers and reproaches that were not likely to be forgotten soon. The party managed to get over the road at the rate of 100 miles a day.

This practice of constant inspection by heads of departments keeps the men in charge vigilant, and there is very little cause for complaint about yards or shops being dirty. The policy followed is to convert all scrap into money or into new metal with the least possible delay, and there is very little idle capital to be found lying around in the shape of overgrown scrap heaps.

OVER THE MAIN LINE.

From Topeka westward we were the guests of Mr. Player in a "business car." All through Kansas, Colorado and New Mexico he followed the inspection practice at every place where there was an engine-house or car-repair shed. If the train stopped only fifteen minutes, a run was made to the engine-house or repair-yard, and it was wonderful how orderly every place was. Even in the most remote parts of New Mexico, where workmen are hard to hold and where order and cleanliness are notable for their absence about the houses of the people, the railroad establishments were examples of neatness that gave practical preaching of a gospel badly needed on the frontiers of civilization.

MODERN METHODS OF THANKING BENEFACTORS.

I had been over the Santa Fé route before, and was fairly familiar with the appearance of the country, but there has been wonderful development within the last twelve years. Vast stretches that in 1880 offered merely a scanty herbage for stock during a portion of the year are now covered with fertile farms that raise bountiful crops of wheat, corn, alfalfa and other kinds of agricultural riches. A wise English statesman once received great praise for saying that, "the man who made two blades of grass grow where only one had grown before was a benefactor to mankind." If our people were to take that view of human actions, they would credit railroad companies with being the greatest benefactors of the human race. Just reflect on the vast increase of comfortable homes due to the railroads stretching out into the unbroken prairies of the West. Praise has little part in the reward they receive f r the favors done. Modern ideas of freedom tend to the abuse of anything that stands higher than the average individual. A railroad company is the most conspicuous embodiment of capital, and many of those who have gained the most by its enterprise are ready to howl against its receiving common justice. This is becoming the American way of requiting favors enjoyed.

ENCOURAGING BUSINESS.

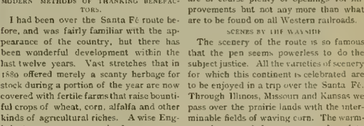
The present management of the Atchison, Topeka and Santa Fé are following a most enlightened policy of encouraging the development of the natural resources within reach of the company's lines. All sorts of mining enterprises are developing rapidly, advantageous rates being given for the transportation of the products to market. But the most striking line of development is in agricultural and horticultural products. The soil of many districts of Kansas, Colorado, New Mexico, Texas, Arizona and California contains in great riches the constituents that sustain vegetation, but the elements have lain dormant for centuries for want of water. Irrigation works are now supplying this want, and vast tracts that seldom receive a shower of rain are supplied with all the water needed for raising fruit and cereals. Under this influence the desert is really coming to blossom as the rose.

WELL EQUIPPED FOR TRAIN RUNNING.

The railroad is surprisingly well equipped for handling the growing traffic of its numerous feeders and far-reaching connections. The rolling stock compares favorably with anything to be seen anywhere. A large percentage of the freight cars have air-brakes, and through trains of stock and perishable freight or time merchandise are pushed along faster than passenger trains. The track of the main line from Chicago to Los Angeles is nearly all maintained in shape that makes express speed perfectly safe. Long stretches of the track are laid on stone ballast, on broken slag or on good clean gravel. The worst ballast used is sand and there is not much of that. There are of course plenty of openings for improvements but not any more than what are to be found on all Western railroads.

SCENES BY THE WAYSIDE.

The scenery of the route is so famous that the pen seems powerless to do the subject justice. All the varieties of scenery for which this continent is celebrated are to be enjoyed in a trip over the Santa Fé. Through Illinois, Missouri and Kansas we pass over the prairie lands with the interminable fields of waving corn. The warmest admirers of the prairie are forced to admit that it grows monotonous to the eye, but even in this respect the prairie is improving. Twelve years ago one could ride for hours in Kansas without seeing brush or brake to vary the sameness of the view. Now there are groves and plantations of trees everywhere dotted over the country, and many of the grove marked hillsides are pretty as the rural landscapes that painters have made familiar to art admirers.



IN THE STATION COURT, PASO DEL NORTE, MEXICO.

When Colorado is reached the scenery, animate and inanimate, becomes of a more picturesque type. The dignified Mexican who tamps gravel under the track and handles the tamping rod as if it were a spear is picturesque with his broad sombrero and red shirt; the adobe houses, with chattering brunettes squatting about the door, their scanty garments thrown on with an eye to pleasing effect that displays the innate taste for the decorative part of art inherited by so many of the race

to which Bartolomé Esteban Murillo belonged; the loose-limbed Mexican basking in the sun, galloping on the skinny bronco, or performing laboring work with the dignity of a nobleman, are common sights of the mountain regions. These, with women, large and small, lolling around, their humble apparel worked out for supreme display, the swarthy faced urchins clad in little more than their own sense of native modesty, the demure donkeys that appear to be intimate members of every household, the flocks of goats and the general sleepiness that prevails tell the traveler that he has found a different character of civilization from that established by the restless denizens of the Atlantic States. The peaks and gorges, the rock broken torrents and silver lakes and all the novelties of mountain scenery are pleasant to look upon, but they do not by any means monopolize the sights picturesque to be seen on the Greater Santa Fé trail.

A. S.

### Kingsland Shops.

The Delaware, Lackawanna & Western are getting five locomotives built at Cooke's, two of them 8-wheelers and three moguls for handling the heavy milk trains run into New York. There is talk of making some badly needed extensions of the shops at Kingsland. They have only eight stalls for doing the work for 160 locomotives, so the work is done at great disadvantage. Part of the roundhouse is taken up for a paint shop and for the repairing of tenders, and the running engines are crowded out of doors. A new building for paint and tender shop is among the improvements planned. They have got a number of new tools in the machine shop lately but a few more could be used to advantage. Mr. Lewis is putting heavier frames in the locomotives as fast as he can get the work done and he finds that the change reduces the repair bills very much. He is using a great many cast-steel driving-axle-boxes and speaks very highly of their durability. A liner of brass is put inside the box to prevent cutting the wheel-hub and an oil hole is drilled through the top of the box to supply lubrication to the rubbing plate. The wear is very small.

They expect to put an electric lighting plant into the shops this season. When this is done an electric motor will be employed for moving the transfer table.

### The Latest "Rotary" Wheel.

The engraving shown herewith was made direct from a photograph taken in the locomotive works of Henschel & Son, at Cassel, Germany, who are the European builders of the greatest American snow shoveler.

This wheel is the first of a new design, and is 18 inches narrower than the old wheels, but having the same capacity. The center cone is short and curves directly into the vanes of the wheel. Part of the depth is saved by flattening the channels at the back; this gives them a broader bearing, with more rivets to the disc, and does not decrease the capacity, as it merely changes the shape.

The knives have a chisel near the outer hinge that keeps a four-inch ring cut out of the snow ahead of the breast, so that it is easier for the knives to cut it out.

The German builders are quite proud of their work on this device.

### A Wholesale President.

There are some positions in railroad life in which a man appears to be more influential than the President of the United States. As an illustration of this we might instance Mr. Allan Manvel, president of the Atchison, Topeka & Santa Fé, who according to the *Railway Age* is a director in fifty-four railroad companies and president of forty-nine of them.

### Manipulating Boiler Plates.

A great deal has been written of late on the behavior of steel plates when worked at the blue heat point, also more or less concerning the mysterious cracking of firebox sheets, and more or less blame laid at the door of the manufacturer; whereas, the punishment the steel has received at the hands of the boiler-maker, has well-nigh been lost sight of, and in this day of cheap first cost a great many bad practices have crept in unawares, until now it is quite common to hear of firebox plates being punched, and in the hurry, very little attention has been paid to annealing, so that the following from a noted authority, Thos W. Traill, F. E. R. N., engineer surveyor-in-chief to the London Board of Trade, is both instructive and timely.

PLATES WHICH HAVE BEEN HEATED OR WORKED.

Plates which are not heated uniformly in one operation, or heated and worked, no matter how they may be heated, should after such treatment be immediately and in one operation heated to a bright red, and allowed to cool gradually. When this has not been done, plates have in many instances cracked, sometimes within an hour; in other cases hours and days, and even weeks and months, have elapsed before the plate cracked; in some cases they have cracked without being touched at the time; while in others they have cracked when struck a slight blow, the plates being of a mild description—that is, of moderate tensile strength, and having good elongation. The failures which have taken place with steel plates of good quality have in nearly all cases been traced to the treatment which they received, and in every case when the plate had been satisfactorily proved to be of good quality before it had been heated or worked, improper usage or want of proper treatment had been the cause of failure. Steel should not be worked when hot below a red heat.

FLANGING.

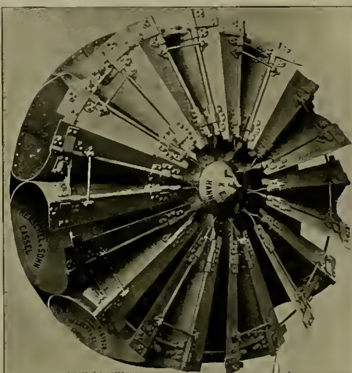
All flanging, so far as practicable, should be done in one operation; hydraulic appliances are the most desirable, and the plate immediately after it has been flanged should be heated to a bright red and allowed to cool gradually.

DRILLING AND NOT PUNCHING.

Plates should not be punched, as such treatment has been found not only to impair the strength of the material, but also to make it dangerously unreliable, which is much more serious than if it only reduced the tensile strength. With suitable drilling appliances, boilers can be constructed at less cost than by the barbarous method of punching the holes; and no boiler works can now be considered as a first-class establishment which has not suitable appliances for drilling the holes in place. It has been proved in several good boiler works, that the cost of construction is less when the holes are drilled by suitable machines than when they are punched. Good machines can be obtained which will soon repay the outlay and ultimately effect a saving of labor; moreover a reliable and safe boiler can be turned out instead of one in which, when the holes are punched, no confidence can be placed, and which may explode without giving warning, through the material having been ruined by punching.

PUNCHING AND BORING.

Punching plates and afterward boring them is not recommended, but if this is done care should be taken that a sufficient quantity is bored out so as to remove as far as possible the very injurious effect of punching. It is found that when ½-inch plate is punched $\frac{9}{16}$-inch it requires to be bored out to fully $\frac{11}{16}$-inches, and a 1-inch plate punched $1\frac{1}{16}$ inch requires to be bored out to $1\frac{3}{16}$ inches to remove the pernicious effect of the punch on the plates, and consequently plates of greater thickness require to have more bored out so as to remove the injurious effects of punching. There is nothing gained by punching and afterward boring, and there is also more or less risk of the injury done by the punch not being removed, and therefore such a barbarous tool as a punch should never be used to steel plates.



"ROTARY" WHEEL, AS BUILT IN GERMANY.

PUNCHING AND ANNEALING.

Punching plates and afterward annealing them is decidedly an objectionable method, and before it is done the special assent of the engineer inspector should be obtained; if he assents, it is essential that he should satisfy himself that the annealing is done perfectly and in a properly constructed furnace.

LOCAL HEATING.

Local heating of the plates is very objectionable, and should be avoided, as many plates have failed from having been so treated. If this be not attended to, serious accidents are likely to result

ANNEALING

All plates that are punched, flanged, or locally heated, should be carefully annealed after being so treated. The plates should be heated all over at one operation in a properly constructed furnace, and then allowed to cool gradually.

BENDING PLATES WHEN COLD.

Plates should be bent when they are cold to the required curvature for cylindrical shells, receivers and domes, etc. Plates which will not stand bending when cold should not be used, there are rolls well adapted for such work, being capable of bending large plates, and thicker than any yet used for shells of boilers.

STEEL SERVICEABLE AND RELIABLE.

Notwithstanding the peculiarities of mild steel, it is a material which may be used with safety and advantage, if proper precautions be taken and due consideration given to these peculiarities; possibly it has fewer infirmities than iron; and there can be no doubt that it is a better and more serviceable material for general use in the construction of boilers.

### Profit Sharing.

H. K. Porter & Co., Pittsburgh, distributed a share of profits to their employés last month. Along with the notice the following circular was issued

"We are especially gratified that the amount distributed is not decreased, as we supposed it would have to be. The conditions of business the past year have been very trying, and in many respects discouraging. Prices were less throughout the year than in 1891, and the output for the first six months was very small, but as soon as the demand increased the output largely increased, and by your efficient co-operation, so soon as you had the opportunity to put it forth, we largely recovered the lost ground. This proves to us what we believed before, that practical co-operation is a positive benefit to every one of us, and that it pays us partly, if not fully, in the item of dollars and cents, to make this distribution. We have often said to you that it is only on this basis that we can hope to make such distribution a permanent annual thing. But such reasonable return to us only makes us the more gratified to recognize your efficient and cheerful service, and to be able to give you this additional remuneration for your faithful labor. We hope that in receiving this sum, each one of you is conscious of having deserved it by having rendered the best service in his power, and that the money will be a positive good to each one, and to all dependent upon you."

Brake slack adjusters are passing through the Patent Office in a manner that rivals the car-coupler. Among recent inventions of this kind we notice as well worthy of notice a brake slack adjuster invented by William W. Holmes, and assigned to the Consolidated Brake Adjuster Company, Chicago. It has a threaded connecting-rod, on which there is a ratchet, operated by a reciprocating pawl. When a certain degree of slack is worn the pawl engages the ratchet and moves it, taking up the lost motion. The device looks as if it would do the work automatically.

The rates of pay of engineers and firemen on Western roads are, for firemen, \$2.25 per day of eight and a quarter hours for the first half year, \$2.50 per day for the second half year, and \$2.75 for the third year and after, for engineers \$3.50 per day of eight and a quarter hours for the first half year, \$3.75 for the second half year and increasing 25 cents per day per year for the next three years until for the fourth and succeeding years the rate of pay is to be \$4.50 per day.—*Engineer.* Not quite. This is the proposed pay on the Chicago Elevated. No doubt if this pay was offered on a surface road for eight and a quarter hours work, they would have to open an application bureau.

All traveling engineers should correspond with W. O. Thompson, Secretary of the new Traveling Engineers' Association, at Elkhart, Ind.

## ? A. What You Want to Know. ? A.

Don't ask questions that simply require a little figuring to determine; make each question separate. No notice taken of anonymous questions.

(23) A C S. Hoisington, Kan., asks

In locomotive practice, why does the go-ahead eccentric follow the crank-pin when engine is running ahead. *A.*—This is a foolish question—the eccentric follows the pin because it must be in this position to move the valve at the proper time. It follows the pin only in engines having a rocker.

(24) B. R. M., Scranton, Pa., writes

I have found that several kinds of steel are self-hardening. What ingredient or physical property causes this? *A.*—This self-hardening property is caused by peculiar combinations, carbon, manganese and tungsten in the steel Chromium also appears in some kinds of steel to be used as a mixture which gives the self-hardening property

(25) F. S., Brooklyn, says:

What would be the bore of a low-pressure cylinder for a compound engine if the high-pressure cylinder is 11¼ x 20 inches *A.*—That depends on the ratio of cylinders required. A common ratio is to have the low-pressure twice the area of the high-pressure piston. In that case the diameter of the low-pressure cylinder would be 15.9 inches

(26) M. B. O., Sheldon, Ia., writes

Please advise through columns of your paper as to the practicability of taking a course of mechanics through the Correspondence School of Mechanics, Scranton, Pa *A.*—We receive many letters asking for advice on this question, and we take this opportunity of answering publicly that we consider the course of instruction given by the school named as being both practicable and valuable. We are acquainted with parties who are taking the course and they speak in the highest terms about the help they are receiving.

(27) C. A. R., Syracuse, N. Y., writes

I heard the expression, "the efficiency of a firebox," made use of, and I am at a loss to understand what it implies. Please help me out. *A.*—The expression is used to indicate several things. For instance, the firebox may be very small or quite large in proportion to the boiler. In such cases the efficiency of the firebox in relation to the boiler is estimated or speculated about. The expression is used in another way in estimating the heat generated in the firebox as compared with the total heat in the fuel burned.

(28) W B., Philadelphia, says

We have some compound locomotives on the road, and one of our shop men who has been at a mechanical school argues that steam-jackets are necessary for the cylinders of compound engines. I have never heard of steam-jackets being used with locomotives, and I should like to know if they are of much value *A.*—Steam-jackets have been repeatedly tried on locomotives, but without showing any advantage The ability of the steam-jacket is doubtful, except with engines having low piston speed. A locomotive is a poor subject for a steam-jacket. If the condensed water is not removed quickly the jacket becomes a condenser instead of a means of keeping the cylinder hot.

(29) A. J. Ford, Sedalia, Mo., writes

We have several Baldwin ten-wheel engines here that have eccentrics on shaft of front driving-wheels; these engines have several times been towed in, owing to something happening that required all side-rods coming down. Many of our runners claim that these engines, under above condition, would bring themselves in the same as if eccentrics were on main shaft. *A.*—Engines of this class have been brought in without side-rods, where the distance was short, but it is bad railroading, they are liable to slip and become helpless at once. When engines having eccentrics on other than the main driver are crippled so as to require the taking down of side-rods, they should be towed in. It is taking the fewest chances.

(30) W. J. B., Houston, Texas, writes

1. If the valve of engine having link motion could be made to open half as quick again as at present, and you should work at 12 inches, how near would cylinder pressure come to boiler pressure. Would the cut-off at 12 inches make the engine as strong as the slow motion at 18 inches? *A.*—So much depends on piston speed, size and shape of steam-pipes that no positive answer can be given to these questions The chances are that the working of the engine would not be changed materially. 2. When an engine cuts off at 6 inches with $\frac{5}{16}$-in. lead, and a change should be made reducing this lead to $\frac{5}{32}$-in., maintaining the same port opening, how much would this increase the engine's speed, and would it reduce the fuel account? *A.*—It would not increase the speed any, and the likelihood is that the fuel consumption would be increased. The effect of changes of this character could not be settled except by experiment.

(31) L. M., Cheyenne, Wyo., writes

I am informed that red lead and white lead are both the same substance, oxide of lead. What causes the difference in their appearance? *A.*—They are not the same substance. Red lead is oxide of lead, the other is carbonate of lead. Red lead is made by keeping a thin layer of melted lead on a reverberatory furnace and passing the gases from the combustion of coal over its surface. This action converts the lead into litharge, which is protoxide of lead. This compound is then taken out, ground and thoroughly washed to take out metallic lead and foreign substances. The mass is then returned to the reverberatory furnace and again subjected to a current of corbonic dioxide which converts it into red lead. This is oxide of lead. To make white lead the litharge is washed in water until it is converted into an impalpable paste. A certain quantity of chloride of sodium (common salt) is then mixed with it which precipitates an insoluble chloride of lead. This is allowed to settle and is treated with carbonic dioxide which converts it into white lead

(32) H. F. M. P., Fort Madison, writes:

After reading three books on mechanics I am still at a loss to understand the "Law of Falling Bodies," viz. "Under the influence of gravity alone, all bodies fall with equal rapidity." For if you take the penny and feather experiment and make the feather of the same area as the penny, then in an exhausted air chamber, they will both fall in the same time, but in the atmosphere the penny will reach the ground first owing to the resistance of the air being greater on the feather than the coin, now why should the feather offer more resistance to the air than the penny, both being of the same area? For if the resistance of air is not dependent on the size of the surface of a body, but on the weight, then how is it that we have a common velocity for all falling bodies, namely 32.5 feet per second? If this number applies only to bodies in a vacuum, then what good is it in actual practice when every body will have a different velocity? *A.*—Why a light body of equal area does not fall as fast against the air resistance as a heavy body involves a question in dynamics. The heavy body immediately after starting to fall has more energy to push itself through the air than the light body

(33) L. K., Truro, N. S., writes

1. Please explain the meaning of working steam expansively? *A.*—This cannot be done within the space available in this column. It will be found explained fully in a chapter beginning on page 353 in Sinclair's Locomotive Engine Running. 2. What is a Corliss engine? *A.*—One of the best class of automatic engines. Particulars of construction can be found in any modern book on the steam engine. 3. Is there any difference of weight on the truck of an ordinary eight-wheel engine when pulling a train up a grade from what there is when running down the same? *A.*—Yes. There is a little more weight on the truck when the engine is descending a grade. 4. Is a ten-wheel engine harder to slip than an eight-wheeler with the same weight on the driving-wheels and same size of cylinders? *A.*—No. Not if the driving-wheels are of the same size 5. Why will an ordinary Mack injector not work hot water? *A.*—For two reasons. 1. Because the steam from the hot water prevents the injector from creating a vacuum to raise the water. 2 Because the hot water will not condense the steam passing through the injector, and unless the steam is all condensed the water will not be solid enough to maintain the velocity which puts it into the boiler

(34) P. M McC., East Mauch Chunk, Pa., writes

We have about 20 engines equipped with the Allan Richardson balanced valve I am running one. Why is it they will not run free shut off going down hill? The one I am running will not make over 20 miles per hour on 90 feet grade. The rest act the same way; they also work the fire pretty hard when fire door is shut. *A.*—The action of the valves spoken of is not far different from a plain D-valve. When the lever is in its corner the action of the piston tends to draw air out of the steam chest and force it out of the nozzles. If there is a relief valve on chest there is no doubt that more air is thus pumped through the cylinders and this causes the draft on the fire. If there was no relief valve on chest there would be a partial vacuum there as the piston receded, but this would instantly be supplied with air through the exhaust port and nozzle, when the piston neared the end of the stroke, and the exhaust port was opened This movement of air back and forth from the cylinder to the exhaust passages never caused any great trouble in the old engines, and is, we think, better than drawing a large quantity of cold air through the chest and cylinders. Some mechanics advocate large cylinder cocks that can act as relief cock, and some contend that these should be run wide open, but this would be annoying, to say the least, and apt to carry into the cylinders a great deal of sand and other ballast Just what prevents the engine from running down hill we can't see, unless the lever cannot be run in the corner, in this case the port would close before the piston reached the end of its stroke, and the air ahead of it would be compressed enough to retard very seriously. With an ordinary valve it would simply be lifted off the seat; the balanced valve cannot lift more than 1-16, if that There are hundreds of engines equipped with balanced valve that run down hill freely; from this we are led to believe that there is some local cause that does most of the mischief for which the valves are blamed.

### High Train Speed of the Future.

An article on railway development has been contributed to the New York *Commercial Advertiser* by Vice-President Webb, of the New York Central, from which we quote

"I have no doubt at all that early in the next century there will be a number of trains on some of the greater roads whose schedule time will call for as much as 100 miles an hour. I have no doubt that a traveler early in the next century will be able to get his breakfast in New York and his evening dinner in Chicago.

"We have already learned how to construct locomotives which are capable of making ninety miles and more an hour, and we have learned how best to utilize their enormous powers. Given the perfect locomotive—and we have nearly secured the perfect machine of this sort—we need only two or three other conditions. There must be a perfectly constructed track and roadbed. It must have inappreciable grades and very slight curves. It must be so made as to be elastic and yet withstand easily the strain caused by high speed Then we must have a perfect signal system. That I am sure will be developed.

"The block system of to-day is sufficiently thorough to make the high rates of speed attained by trains on my own road for instance, possible. There should be no grade crossings—these eat up time dreadfully sometimes—and passenger cars must be light but very strong, and the number of them limited to a high-speed train. We need the best coal and, of course, highly trained employes. With these conditions—and they are sure to be obtained early in the next century—I feel safe in saying that regularly scheduled daily trains running 100 miles an hour will be advertised by many of the railway companies.

"The question of safety and of popularity will be no more considered than are the same questions when a person enters an ordinary express train of the present time. With the conditions that I have described above, a train running 100 miles an hour is just as safe as one running forty. In either case, if an accident happens it is likely to prove disastrous. The tendency of the time is toward rapid travel, and it has already been discovered that these fast trains are not an experiment, but are put on the roads in response to a public demand."

### Never Touched It.

"When Irvin Baker was on the Park, remarked the old-timer as he lit his pipe, "I heard him git even with Jim Kirk, the master mechanic. Jim allers objected to the boys callin' the Mason-Fairlies 'Jim-Crows.'

"These little yard-wide engines were loaded down with a Nesbith stack, a balloon thing with a sub-treasury for sparks and a 36-inch cone with a wrought-iron petticoat to it—awfullest thing you ever see to git sparks through.

"Well, one morning Baker brung one of 'em into Leadville and left her for the hostler. Kirk was in town, and went to the roundhouse, when Baker went up to the house to borrow enough hemp from some Rio Grande feller to pack—the Park never bought nothin'—Kirk was waiting for him.

"'Did you look this engine over when you come in?' says he.

"'I allus look over a "Crow." They'r liable to lose something.'

"'Well, just look at that truck wheel, got six inches broke out of the rim, wonder you didn't go into the Arkansas.'

"'That don't hurt nothin', don't touch.

"'Don't hurt? don't touch?—what 'd'y mean?'

"'Well, sir, when you'r workin' her hard up the hill the exhaust hits that cone so hard it kinder lifts up the front end so's the wheels don't touch 'ceptin' on curves.'"

The practice of admitting the feed-water in the back end of locomotive boilers, which has been tried so often with unsatisfactory results, has been adopted by Mr. W A Foster, of the Fall Brook Railway, under a peculiar arrangement. The usual plan has been to convey the cold water to the front of the boiler in a pipe, which soon gets choked up with sediment and scale. Mr. Foster employes a capacious trough to convey the water, which can be used a long time before filling up. He speaks highly about the performance of the engines that are equipped with this improvement

LOCOMOTIVE ENGINEERING
A PRACTICAL JOURNAL of RAILWAY MOTIVE POWER AND ROLLING STOCK·



VOL. VI, No. 4. NEW YORK, APRIL, 1893. 20 Cts. Monthly, $2.00 Per Year.

## Group of Members of Association of Railway Locomotive Engineers of Great Britain.

Superintendents of motive-power, master mechanics and masters of machinery are unknown in the British Isles

They call the head of the motive-power department a Locomotive Engineer and the man we call locomotive engineer is there called a driver.

There are not so many railroads nor so many officers of this rank in that small country as in this, and the group here shown is small compared with the yearly assembly to "be took" at our annual Master Mechanics' meetings.

This picture was taken at the last meeting of the British Association at Red Bank, over Grassmere, England, June 24, 1892, and shows an intelligent-looking lot of railroaders.

Commencing at the left the men may be identified as follows

*Front Row.*—J. H Hosgood, Barry Docks & Railways; J A. F. Aspinall, Lancashire & Yorkshire, T G. Clayton, Midland Railway (Carriage & Wagon Dept.); J. C. Park, Great Northern, of Ireland, W. Wainwright, South Eastern (Carriage & Wagon Dept.); W Dean, Great Western; H A Ivatt, Great Southern & Western of Ireland, J. Stirling (Sec. of Association), South Eastern Railway.

*Second Row.*—T. H Riches, Taff Vale Railway; B. Malcolm, Belfast & Northern Counties; J. J. Hanbury, Metropolitan Railway, R. J. Billinton, London, Brighton & South Coast Railway, S W. Johnson, Midland Railway; W. Adams (President of Asso.), London & South Western Railway; James Manson, Glasgow & South Western Railway.

*Back Row.*—Hugh McColl, Secretary's Clerk; R. Mason, Furness Railway, T. Whitelegg, London, Tilbury & South End Railway; M. Stirling, Hull, Barnsley & West Riding Junction, T Parker, Manchester, Sheffield & Lincolnshire Railway, M. Atock, Midland Great Western Railway, W. Kirtley, London, Chatham & Dover Railway, F. Attock, Lancashire & Yorkshire (Carriage & Wagon Dept.).

Two of the best-known heads of railway mechanical departments in Great Britain are not shown. Mr. F. W. Webb, of the London & Northwestern, was away, and Patrick Sterling of the Great Northern was sick at the time of the meeting.

MEN IN CHARGE OF THE ROLLING STOCK OF THE RAILWAYS OF GREAT BRITAIN.

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The authorities who control the rate-making power on our railroads are making a bold front to convey the impression that no demoralization of rates will happen in connection with the rush toward Chicago. In fact, superficial observers would conclude that full fares are liable to be charged both ways. In the meantime, tourist companies in the British Isles are advertising rates of first-class passage from Liverpool to Chicago and return for $85, including meals, sleeping-car berths and entrance to the World's Fair. We calculate that $10 of this sum would be devoted to railroad fare from the seaboard to Chicago and back. It is all right to encourage foreign visitors, but it seems passing strange that our own people are threatened with the exaction of high rates. In this connection it would be interesting to find out on what plea of justice immigrants can get from New York to Chicago for $7, while residents here pay double the sum when willing to accept the same dirty accommodation.

## Some Experience with Balanced Slide-Valves.

BY JOHN H. COOPER, M. E.

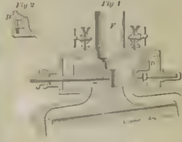
Patents and plans for balanced slide-valves exist in great number. Few of them have realized the hopes of their inventors, and fewer still have made commercial successes. Complexity having reigned supreme in the make-up of many, brought such to early failure, and some that were simple enough neither disburdened the valve, prevented leakage nor endured the service, all of which results they were designed to accomplish.

The triple problem of least leakage, least friction, coupled with greatest endurance, is difficult of solution. If any form of balancing device applied to a slide-valve can lay any claims to simplicity of construction, correctness of principle and sustained ease of working, that which is defined and illustrated in the following review has at least features that promise well for these.

In the year 1851, M. Desgrange applied a steam-packed ring to the back of a plain slide-valve, which was used for steam distribution in the cylinders of locomotives as built by the Messrs Buddicom & Co. of Rouen (for detailed account of which see *Armengaud, Publication Industriell*, Vol. 8)

This ring and valve are shown in section in Figs 1 and 2, the ring is fitted to an annular groove formed in the back of

Fig 2 Fig 1



the slide-valve against the outer rim of which it is packed tight to prevent leakage into the interior which forms the exhaust way to the pipe *P* above the valve, communicating with the stack in the usual way

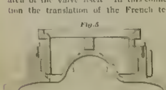
There is no exhaust port on the ported face of the cylinder casting.

The peculiarity of this ring, to which attention is called, is the increased diameter like a flange, of the part *D*, which comes in contact with the under face of the steam-chest cover, the same being surfaced to a parallel plane with the working valve face on the cylinder casting

The inside of this ring is turned out to a diameter about equal to the outside diameter of the packed part in the valve, shown distinctly in Fig 2 of the *Armengaud* illustrations The result of this form is to expose a certain amount of the surface of the ring to the upward pressure of the live steam in the steam-chest, surrounding it an area which is just equal to the surface of the ring in contact with the cover, into which the fluid pressure creeps from the steam-chest, and for this reason it would seem to maintain a steam-tight joint between the steam-chest and exhaust-pipe, the one pressure being equal to the other and opposed to it, the whole arrangement forming a balanced ring floating in the steam

The next point to be determined is the relative area of this balanced ring to the area of the valve itself In this connection the translation of the French text

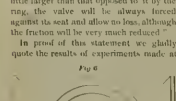
Fig.5



says "If it be arranged in such a manner that the surface of the slide-valve be a little larger than that opposed to it by the ring, the valve will be always forced against its seat and allow no loss, although the friction will be very much reduced"

In proof of this statement we gladly quote the results of experiments made at

Fig 6



Boulogne, which showed a saving of $\frac{1}{12}$ of the coke used for steaming, by the use of this form of valve over the ordinary steam-burdened slide-valves, when everything else remained the same

In the March number of the *Journal of the Franklin Institute*, for 1870, is an article on the theory and practice of the slide-valve (by Thomas Adams, C E, of England) which was read before the Institute in May, 1869

Mr Adams' experiments were numerous, were tried under varying circumstances on locomotives in use, and during long periods of time

His treatment of the subject reads as if by one working in earnest for the solution of a difficult problem Mr. Adams says he discovered the law of balance between two free surfaces wholly in molecular contact when immersed in steam. The benefits of this law are realized when the area of contact is opposed by an exactly equal area of the same fluid pressure In plain terms Mr Adams says that steam will go between two surfaces in ordinary contact when it has free access to the joint and cannot be kept out until a counter pressure be applied which is equal to the area of the surface multiplied by the steam pressure upon it.

In Mr Adams' valve we have the same form and proportions of ring as found in the Desgrange valve, which were applied fifteen years before

Your writer repeated the Adams form of balancing ring in a design of valve arranged as shown in Figs 3, 4 and 5, which present a longitudinal section, a

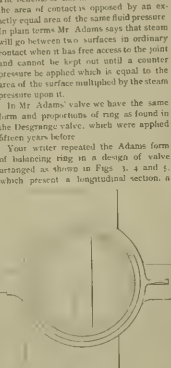


Fig 4

transverse section, and a plan of a twin valve, that is, two of these in reversed position on the valve stem were used in a long steam-chest, having short steam-ports at the extreme ends of the cylinder, and beside each an exhaust-port which are united into one common exhaust-pipe.

The overhung joint surface and flange are plainly seen, and this little trick is the key to the secret of this valve's success

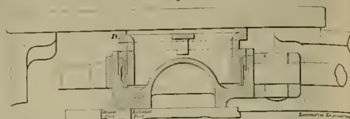
This packing-ring has a bar cast across its upper diameter with a pendant pin which is embraced by a spiral spring, resting upon the back of the valve, this is for holding the ring against the cover with a gentle pressure and is only of service when the steam is absent. This ring is steam-packed to the valve by the usual three-ring metallic packing, which is held in place by a bolted follower Live steam has access to the space behind these packing rings in order to balance them to the creeping pressure of the steam in the chest trying to get to the interior of the ring. This group of packing rings is turned smaller in diameter than the balancing rings, so as to hug it closely at all times

The valve can be lifted from its seat to give relief of pressure in the cylinder when necessary, and will readily return to its normal place without injury to any part. If there be any leakage into the interior it may be vented into the exhaust port or through the steam chest cover, making itself known to the engineer. The valve-stem yoke encircles the whole affair, and being freely fitted will also permit the valve to lift The bump formed in the walls of the exhaust way in the valve was a necessity of the space already provided by an existing steam chest, but it serves the purpose of additional strength to the valve, as well as vent to the exhausting steam.

Your writer, with his efficient draughtsman (A D. Emery), being a little enthusiastic in the matter of balancing side-valves at that time, endeavored to improve on the preceding designs, from which effort there issued a form of ring shown in Figs. 6 and 7, which we patented July 23, 1872, and to the description here following we call the reader's attention

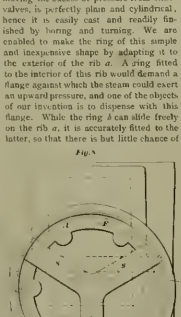
Our invention has for its object the im-

Fig.3



provement, both as regard simplicity in construction and practical efficiency, of disburdened slide-valves of a well-known type. The nature of our invention may be briefly described as follows, reference being had to the vertical section, Fig. 7, in the accompanying drawing, in which the line *A* represents the face of the steam-cylinder, *B*, the inner face of the steam chest cover, and *D* the slide-valve, on the back of which is cast an annular rib, *a*, adapted to the plain cylindrical ring *b*, the pressure of steam on the lower edge of the latter being exerted on an area equal to that of the upper edge of the ring, which bears against the steam-chest cover. The French patent of Desgrange (March 10, 1851) affords an early example of disburdened or so-called balanced slide-valves of this class It will be understood, therefore, that no new principle is involved in our invention, which is restricted to a specific construction of parts and adaptation of these parts to each other. The ring *b*, unlike the rings heretofore used for removing the excess of pressure from slide-valves, is perfectly plain and cylindrical, hence it is easily cast and readily finished by boring and turning. We are enabled to make the ring of this simple and inexpensive shape by adapting it to the exterior of the rib *a*. A ring fitted to the interior of this rib would demand a flange against which the steam could exert an upward pressure, and one of the objects of our invention is to dispense with this flange. While the ring *b* can slide freely on the rib *a*, it is accurately fitted to the latter, so that there is but little chance of

Fig. 8

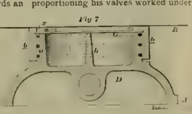


the steam penetrating between the two; but to prevent the possibility of such penetration of the steam, we place, in grooves formed in the rib *a*, light rings, which, owing to their expansible property, bear with a constant pressure against the interior of the ring *b*. In order to insure the contact of the ring against the steam-chest cover under all circumstances, a spring, *G*, bears upon a central projection, *h*, of the valve, extends across the annular rib *a*, and each end enters a groove in the ring *b*, upon which the spring exerts a constant upward pressure, the spring being always maintained in its proper position by its adaptation to recesses *x* in the upper edge of the annular rib. The rib *a* extends very nearly to the steam-chest cover, hence the valve is prevented from being forced from its seat when steam is excluded from the chest, and the movement of the engine is continued.

A noteworthy observation important to be made is, that Mr. Adams changed the construction as shown by his earlier valves, from equal areas of the balancing ring to an increased area of contact with the cover over that of the steam acting to lift the ring, with what results cannot here be given.

The precise proportions with reasons therefor were not gone into; the writer in proportioning his valves worked under the

Fig 7



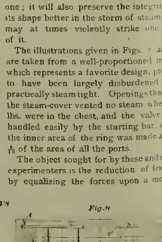
belief that all that detail had been well gone over, therefore, with confidence in the designs already established, the simpler form of valve-ring with equal areas was made and applied to several stationary mill engines with good results, prior to and during the year 1876.

Of course a thicker ring will wear longer and "stand the racket" better than a thin one; it will also preserve the integrity of its shape better in the storm of steam that may at times violently strike one side of it.

The illustrations given in Figs. 8 and 9 are taken from a well-proportioned model which represents a favorite design, proven to have been largely disburdened and practically steam tight. Openings through the steam-cover vented no steam when 80 lbs. were in the chest, and the valve was handled easily by the starting bar, when the inner area of the ring was made about $\frac{1}{16}$ of the area of all the ports.

The object sought for by these and other experimenters is the reduction of friction by equalizing the forces upon a moving

Fig.9



ring or sliding plate in fluid under pressure and they have tried to solve this problem in about the same manner and by very similar means.

Attempts were made early in steam-machinery time to get a perfectly balanced packing ring. Tredgold, in 1838, said "The rubbing surface of a piston must be pressed against the cylinder with a force at least equal to the pressure of the steam it confines, otherwise the surfaces would separate and the steam escape."

Very naturally, equal pressures of the same fluid when exactly opposed to each other would result in a complete relief of resistance to the sliding part, if *capillarity* did not interfere—a phenomenal force not suspected in this case—the existence of which could only be proven by experiment.

The weight of evidence presented by these authorities seems to favor the results of Prof S. W. Robinson's carefully conducted experiments and of Mr. Adams' later constructions, which point to the conclusion that the pressure in a joint, called the *creeping* pressure, is about half—per square inch—of the pressure of the same fluid when freely acting in an opposite direction.

Nevertheless, a practically tight and free working valve was made and used in 1872, by your writer as referred to above, and this was done by a balancing ring having equal and opposite areas exposed to the same fluid pressure.

Fig. 8 gives a plan of a plain *D* slide-valve *V*, to which a cylindrical ring, *B R*, is fitted. A section of the same is shown in Fig. 9, through the axis of the valve-stem, the opening for which is plainly seen at *L* on both views, with facings for the nuts upon the stem, by which latter the valve is adjusted and moved.

A circular rib is cast upon the back of the valve to which a follower *F* is fitted and bolted. The outer face of this rib is recessed for the reception of packing rings, two of them fitting against the inner face of the balanced ring, and one of them within the aforementioned two rings; all three are cut, fitted to break joints and are turned to set firmly against the inner face of the balanced ring, to which they are also assisted by steam from the steam-chest, which reaches a recess turned in the rib on the valve, back of the inside packing ring, through small drilled holes beneath the edge of the balanced ring, one of which is shown. The follower *F* keeps the packing rings in place in the same manner as is done for steam pistons.


UP IN THE WORLD. THE HIGHEST RAILWAY BRIDGE ON EARTH. ERIE RAILWAY.

The balanced ring has a groove turned in its inner face, into which the ends of three flat springs *S* project. These springs are bolted to the radiating tri-rib of the follower, the whole so fitted as to permit the balanced ring to play up and down a small distance upon the rib on the valve, and to have such a set to the springs as to maintain a gentle contact of the top edge of the ring to the steam-chest cover, to which it is made to fit steam-tight, and on which it will freely slide.

The normal position of the balanced ring is to *just touch* the face of the steam-chest cover when no steam is on.

This particular valve design is for a stationary engine, having the face of the valve vertical; in which case there would be no tendency of the ring to part from the steam-chest cover by gravity. With an horizontal valve face the *weight* of the ring must be carried by the springs

At *A*, the inner corner of the ring is turned out, this slightly reduces the contact area of its upper edge, giving the steam an advantage, by its pressure upward, on the lower edge, which has now become relatively greater, thus insuring contact and tightness of the ring to the cover.

It will be noticed that, so far as principle goes, this valve does not differ from the Adams or the Desgrange valve It simplifies and cheapens and offers a design more readily and effectively applied to existing conditions of cylinders and steam-chests, with which we have to deal.

This valve is shorter—motion-wise—at its middle than at its ends, this was done to admit steam and cut off the same *gradually*, the only object being to *quiet* the working of the engine, which it accomplished most effectually.

In some of Adams' valves for locomotives, two of these balancing rings were placed upon the back of one valve—one on each side of the stem.

Adams' valves were used on locomotives on several roads in England satisfactorily, as reported by *Engineering* for November 9, 1866.

It will be noticed that, for and upon locomotives, this form of equilibriated slide-valve was first tried.

Valves which have different strokes at different times should be fitted with a lip or flange to the top edges of their balanced rings, to be made wide enough to cover the difference of strokes, in order to prevent wearing a shoulder upon the working face of the steam-chest cover.

This whole subject is much a matter of history, and will serve as a lesson to those who intend to solve this difficult problem.

To the writer there are two details of a steam engine which, perhaps more than any other, because invisible while working, need careful designing and better workmanship; these are a free-running, yet always steam-tight, piston and a disburdened slide-valve, which shall act as a relief to compression in the cylinder and which will never leak steam during normal running.

*Philadelphia, Pa.*

### Growth of the Boring Tool.

A writer says "The first boring tool may be assumed to be an awl of some kind. Pliny states that Dædalus invented the gimlet in 1240 B. C. It was destitute of a screw point, but it may have had a hollow pod, and a cross-head forming a handle. Awls are shown in Egyptian tombs of 1700 and 1490 B. C The screw point was added to the gimlet in course of time, and within our own recollection the twisted shank, which makes it self-discharging. The hint was taken from the auger proper, which may be called a magnified gimlet, now that their specific features have become so closely assimilated in form and function. The auger (*terebra*) was a Greek tool From the early descriptions, the auger seems to have been considered a shipwrights' tool. It formerly had a curved, sharpened end, and a concavity to hold the chips; this was a pod auger. To this a lip was subsequently added for some kinds of boring, and in course of time the depression grew into a spiral, which allows the chips to escape while the boring proceeds, instead of withdrawing the tool as the pod becomes filled. The twisted auger is the American invention, and was made by Lilley, of Mansfield, Conn., about the beginning of the present century, and afterward by Gurley, of the same place. Augers may be classified as augers, annular augers, taper augers, augers with secondary bores, reamers, or countersinks, or having expansive cutters."

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The Reading Railroad is celebrated in several ways, and the affairs of few railroad companies receive so much attention from newspapers. The most interesting thing about the road to us is the number of its boiler explosions The company owns about 700 locomotives, many of them very old, and it is difficult preventing some accidents to boilers, but having a boiler explosion every week or two indicates gross mismanagement in some quarter. There have been two boiler explosions on the Reading since our last issue was published, both resulting in loss of life. Explosions at rare intervals happen through gross carelessness of the engineer, but 99 per cent. of such disasters are caused by weakness due to deterioration which thorough inspection would detect It is a convenient explanation to say that a boiler explosion was due to low water, but low water very seldom causes an explosion, even when crown-sheets and upper tubes are destroyed. One railroad company we know of has had hundreds of crown-sheets burned and no explosion. Broken stay-bolts and furrowed sheets are what nearly always cause sudden rupture of sheets that start an explosion. This is preventable. It is a disgrace to the State of Pennsylvania that fatal boiler explosions happen weekly, and no successful effort is made to locate the responsibility for this species of murder.

The *Electrical Review* (New York) people have got out a special number of nearly seventy pages to celebrate the beginning of the tenth year of the paper. The number is handsomely illustrated and contains a great many interesting articles on electrical subjects. Parties interested in electrical matters would do well to send for this paper.

### To Help in Making Boilers Safe.

"Drilling the ends of stay-bolts is not a reliable means for detecting breakage," remarked a bright master mechanic during a recent visit to this office. "When breakage takes place," he continued, "the fracture is gradual, and leakage into the drilled opening is just sufficient to permit that so-called safe-guard to get filled solid with lime. The lime prevents leakage as completely as if the bolt was solid. Drilling the stay-bolts is a little worse than useless, because it makes the men in charge of the boilers neglect inspection and rely upon the holes to show when a stay-bolt breaks. The plan may be all right for roads that use soft water, but it is no use where the feed water is heavily charged with lime."

This statement was very much of a surprise, for we had heard the plan of drilling holes spoken of very favorably by master mechanics of Western roads. We incline to believe that the real lesson of this experience is not to rely implicitly upon any single method of detecting such a dangerous weakness to a boiler as broken stay-bolts. For a time the hammer tests were in great favor for the detection of broken stay-bolts, but observing men noted, when many fire-boxes had to be put in, that numerous stay-bolts were found broken, although they had passed the hammer test as giving sound. When this condition of things began to be realized there was a sudden reaction, and the hammer test was denounced as worse than useless. The real trouble was that the hammer test, like many another mechanical operation, is of no value when done by an unreliable workman. When performed by a skillful, conscientious man the hammer test is one of the best methods of finding out the condition of stay-bolts.

We incline to think that the drilled hole is a very useful aid in detecting broken stay-bolts, but it requires attention. If it is considered sufficient to drill the hole and let that go as a complete safeguard, without constant vigilant supervision, the plan is likely to fail. If fireboxes having the drilled stay-bolts are inspected minutely at short intervals, an expert will find indications that are likely to identify those that are broken. It is a good plan to employ a man as inspector who has brains enough to induce reasoning from effect to cause. One of the richest men on this continent laid the foundation of his fortune by reasoning from effect to cause in a case which others supposed to be trifling. He was almost a boy, but had found himself floated by the gold fever to California, and was sitting with a group of others beside a mountain stream eating a scanty lunch. The luck of the camp where he was had been wretched, and the place was supposed to be on the outside edge of the gold fields. As the party sat beside the stream the youngest noticed a cork floating past. He instantly reasoned, if a cork comes from the unknown regions above there must be civilized men there. So with his partner he started up stream next day and struck it rich.

The boiler inspector requires to have this faculty of acute reasoning. With an incompetent man a small congealed tear at the end of a stay-bolt hole means nothing, while a man of brains reasons that it has come from the inside and that therefore the bolt must be cracked. The same line of reasoning applies to all distortions of form that indicate internal breakage and to numerous other signs of weakness soon liable to become dangerous. There is too much tendency in railroad shops to assume that any boilermaker is competent to act as a boiler inspector. A man to fill this position successfully must be selected with much care and good judgment.

A good many railroad companies and locomotive builders have adopted the practice of making the stay-bolts flexible at the points where breakage occurs most readily, and we believe that no case of breakage has occurred where the bolts are made to adjust themselves to the movement of the sheets. This practice appears to be worthy of general adoption. But this or any other improvement ought not to lessen the stringency of inspection. Flexible bolts, drilled ends or hollow stay-bolts, the hammer test, the hot-water-pressure test and systematic inspection are all needed to make boilers safe under the intense working pressure becoming common.

### Re-keying on Eccentric Sheaves in Wheel-Shop.

BY A. A. MAVER.

There is no doubt the most reliable method of setting sheaves is to set them by the motion under each individual engine, but cutting key-ways under an engine is awkward, and therefore slow work, and often causes delay when the engine is otherwise ready to be hustled out of shop.

To set them in the wheel-shop to a staff marked by calculation is not always trustworthy, as there may be some peculiarity about the motion which will cause the position of sheaves to vary from the calculation.

We key on all our sheaves in the wheel-shop, and find it satisfactory practice.

Our method may not in all cases be so absolutely correct as the first mentioned, but I have never found it to vary from accuracy sufficient to be of practical importance, and it has advantages over the other which more than compensate for what it may lack in perfect accuracy.

We mark a staff for each class of engine from sheaves that have been set under the engine by the motion; a new engine or one that has been thoroughly repaired and with parts to standard is used for the purpose.

In order to make it quite clear, I will describe in detail our method of marking a staff for the use of wheel-shop.

We will suppose an engine has had thorough repair, a new driving-axle, and all parts to standard, the sheaves have been set by the motion, and the straps have been removed preparatory to taking off the sheaves to cut the key-ways. Before the sheaves are disturbed, we place one of the cranks on the forward center, and level center of crank with center of axle; we do this by describing a circle from center of axle the same diameter as that of the crank-pin at crank-hub, and then level by placing plumb square on crank-pin and to top of circle on axle. The staffs we use are 31 x 2¼ x ½ inch, made of well-dried cherry and varnished.

We now place one of these staffs level on two planks, which have been laid across the pit and under the forward gear-sheave. A line is then hung over this sheave with a weight at each end, a similar line is hung over the axle close to sheave, the staff is then marked with a square where the lines on the sheave touch its edge, the axle lines are marked in the same manner.

The crank is then put on the back center and leveled, the staff is reversed end for end, and the axle marks placed to the axle lines; the sheave line is then hung over the back gear sheave and in most cases it will be found to coincide with the forward gear sheave marks, but if they do not, mark the staff to the back gear lines. I herewith inclose a copy of one of our staffs where the marks do not coincide; in this case, were the back gear-sheaves set to the forward gear marks, the lead of the back gear would be double that of the forward gear. And herein lies the advantage of marking a staff from sheaves which have been set by the motion; for if there is any peculiarity it is discovered in this way.

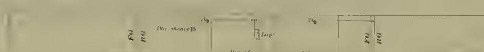
The staff being marked as described is used in wheel-shop when keying on sheaves for this class.

A North Countryman, in describing how sheaves should be placed on axle in wheel-shop, used to say "Standin' between the wheels, mak' the richt crank-pin twal' o'clock, and iv the motion's indirec' set the throw of the back-gear sheave aboot twal' meenits to twal' an' the fore-gear sheave aboot twal' meenits past; reverse the posections on the left side," which is a fair guide when putting sheaves on axle, prior to finally setting by the lines and staff, each crank is then leveled in turn, the lines placed over sheave and axle and the staff placed with axle marks to axle lines, the sheave is then moved on axle until sheave lines coincide with sheave marks, and to this position it is keyed. Before closing I will mention another advantage in this practice.

An engine comes in with broken, bent or twisted driving-axles, requires a new one, the motion is half or partially worn, to set the sheaves accurately by this motion would necessitate its being overhauled, and to set them by it in its worn condition would mean resetting them next time the engine is generally repaired in order to give the proper lead.

By keying to standard we put them on precisely as they had been on the old axle.

*Grand Trunk Locomotive Works, Stratford, Ont.*




STAFF FOR SETTING ECCENTRICS.

### No Spark Arresters the Best Spark Arrester.

At the New York Railroad Club the question was discussed: Is any device using a netting a real spark arrester? If there were absolutely no laws on the subject except that roads should pay for damage done by fires caused by locomotives, would any of us use extension fronts or diamond stacks? The discussion turned principally on the merits of different kinds of spark arresters. Mr. Dixon, of the Rogers Locomotive Works, mentioned a case where he had seen an engine worked without any spark arrester, and he testified to the free steaming properties of the engines. Mr. Angus Sinclair had handled engines without any spark arresters what ever, and others with what are regarded as the best spark arresters. He never found a locomotive working hard that did not throw sparks, but he believed that an engine having no spark arresting obstructions to the draft could be made to steam with such large nozzles, that no more sparks would be thrown than what pass through the best spark arresters. Mr. D. H. Neale, who has had extended experience with engines with and without spark arresters, agreed with the views of Mr Sinclair.

THE CRACK FAST TRAIN OF IRELAND—THE DUBLIN-BELFAST MAIL.

### The Dublin-Belfast Mail.

The picture shown herewith explains the make-up of the fast mail between Dublin and the north of Ireland.

On the side of the first car can be seen a large iron frame covered with a heavy rope-net that is used to catch mail-sacks with. This device catches the sack so far from the side of the car that they are subject to severe shocks, and are often broken off.

The mail-cars are eight-wheeled, with a swiveling truck, with the exception of the rear one, which is an old-fashioned six-wheeler.

The engine is the regulation "single" used on all fast trains on the other side.

One of the firemen on the "smooth line" of the U. P.—the old New Orleans road—writes to say that, though it is claimed their road is behind on account of using the Fisher joints, they do beat the Rio Grande once in a while. He seems to think the reason they get away with the Rio Grande boys is because their diamond stacks do better than the "smooth bores."

### Sleeping Cars for the Masses.

The railroad companies expect to reap a golden harvest this season in carrying passengers to and from Chicago. An effort will be made to keep the rates sufficiently high to give the companies some profit on the business done, but the indications are that the minds of managers and general passenger agents will be exhausted scheming attractions intended to draw patronage. From what we have seen and heard of the novel attractions offered, we are under the impression that one of the best cards in the railroad pack is about to be neglected. Every effort is making to induce workmen and people of slender means to visit the World's Fair, but no railroad company is making systematic provision for carrying these people comfortably during a journey that lasts longer than a day. They must either sit up all night or pay the price of an ordinary sleeping car. Sleeping cars are not popular with the masses because they cannot afford to pay $2 for a berth, and sitting all night in a day-car is a hardship that many people dread to encounter. If a railroad company with a through line to Chicago would make clean, comfortable sleeping cars similar to the tourist cars run on some Western lines, and give this extra accommodation without charge, they would secure all the passenger travel they could accommodate.

This matter of sleeping-car accommodation is badly in want of reform. The lavish outlay for costly upholstery and the profusion of embellishments designed for mere display and to gratify snobbish tastes, keep up the expense of this accommodation, and is carrying the sleeping-car business away from the people and into the hands of the luxurious classes. The luxurious sleeping-car service has built up interests which oppose the introduction of less costly cars for the accommodation of people who cannot afford to pay high rates. The number of the latter class far exceeds the class which pays the prevailing rates, with or without a murmur. The wise policy for railroad companies to follow is that of accommodating the greatest number when the business pays. No attempt has ever been made to find out how well it would pay to give the common passenger decent night conveniences. The majority rules in this country, and some day the majority of travelers will make demands for justice in a fashion that will brook no refusal.

There is some talk among air-brake inspectors of forming an association of their own, but we doubt the wisdom of such a move. The Traveling Engineers' Association have offered the air-brake inspectors full membership in their order, and quite a number of them have already become members. Every air-brake specialist should write to W. O. Thompson, Secretary of the T. E. Association, Elkhart, Ind., for particulars and application blanks, and get into the new educational body at once.

### Brake Leverage.

BY WILL W. WOOD

The standard air-brake equipment is generally accepted as all right if the triple valve does its duty and the brake piston moves out with sufficient force; for instance, a 10-inch brake-piston should transmit to cylinder lever at its point of attachment a force of about 4,000 pounds full service application, and can be depended upon to do it every time at a two-thirds piston travel. There is great interest taken in the mechanism that supplies the power and little or none in the correct distribution of the braking power to the shoes. It may be too light and the road is not getting full benefit of the price paid for the equipment, or it may be the power is so great that wheels and the company's pocketbook are flattened.

THE PAST.—FINE (PASSENGER) WOOD BURNER OF THIRTY YEARS AGO. No. 1. SOUTH CAROLINA RY.

Sometimes one finds the push-rod attached direct to a *dead* cylinder-lever, in that case it is likely that the trucks at one end of the vehicle receive too much braking power and the other trucks too little.

The brake people guarantee that their brake pistons will push out with a certain force, but they cannot guarantee anything further unless their standards are followed to the wheels. The W. A. B. instruction book gives rules and formulæ for finding out just what a brake is doing. It may be simplified, however, as they refer to levers of three kinds and give four formulæ, when really there are but two kinds of levers and six formulæ are necessary to calculation.

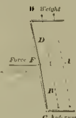
The instruction book shows a lever having power applied at an end, weight depending at opposite end and fulcrumed intermediately, and calling it a lever of the first kind, while the same lever, but with weight and fulcrum reversed, is called a lever of the second kind. Now, levers of the first and second kind may be classed as one, for it makes no difference in calculating their dimensions or power which of the second and third points of the lever is fulcrum or weight.

A cylinder-lever, for instance, at one end the push-rod connection is the point of power, the two pull-rods of the brake are connected with the lever and give the points of fulcrum, and weight and any problem relating to dimension or power of a cylinder-lever may be worked out per formula for either a lever of the first or second kind.

I would divide levers into but two classes and give six formulæ as there are six points, any one of which may be unknown, viz.: force, weight, fulcrum, length of lever, length of lever between force and weight and length of lever between weight and fulcrum. (Lever of the second kind.)

Any lever having force applied at an end I would class a lever of the second kind, indicating the point of leverage nearest the force as *weight* and the farthest point of leverage, *fulcrum*, thus:


When force is applied between the points of *fulcrum* and *weight* it is a lever of the third kind and the three points of leverage bear in the same direction. A brake-beam is a good illustration of a lever of this kind. The two brake-shoes are *fulcrum* and *weight*, but they do the same work and either may be called fulcrum or weight.

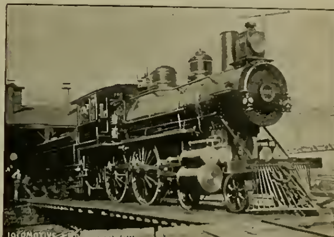



The complete formulæ for calculation of each kind of lever are

$$W = \frac{f \times b}{a} \qquad A = \frac{f \times b}{w}$$

$$F = \frac{w \times a}{b} \qquad B = \frac{w \times a}{f}$$

$$C = \frac{f \times d}{a} \qquad D = \frac{c \times a}{f}$$



THE PRESENT.—FASTEST ENGINE IN THE WORLD. No. 385. COMPOUND. CENTRAL R. R. OF N. J.

### California Redwood.

A visitor to the railroad car shops in California is apt to be struck with the splendid timber in use for car building purposes in the shape of redwood. This timber is remarkably good in all respects for car building, and it has the quality of being slow to ignite or burn, which ought to commend it for the building of passenger cars in the East as well as in the far West.

The people connected with wood-working in California appear all to be proud of the great redwood tree, which does not grow north of the State line. Its largest body, amounting to 500,000 acres, according to estimate, is in Humboldt county, extending about fifty miles north and south of Humboldt bay. This body contains more timber than all the other redwood forests in the State. Redwood has been manufactured on Humboldt bay for thirty-five years, the present output being about 200,000,000 feet in a year. Most of the lumber is marketed in San Francisco and the interior valleys of the State—though considerable shipments have been made to Australia, the Pacific islands and the west coast of South America. But with the exception of Eureka, the coast towns are built up in large part with other woods, redwood being mainly employed for finishing purposes. Eureka, however, is built up of redwood almost entirely, and is claimed to be the only city on the coast of any age that has not suffered seriously by fire. All the cities that have been swept by fire were constructed mainly of fir—so-called pine.

The trees are so large that in comparison logs of white pine are contemptuously designated poles. The redwood grows on every quality of soil in the State, on the river bottoms, on the tops of the highest ridges or on steep side hills, flourishing everywhere. Nothing definite can be told about the amount of redwood standing in Humboldt county, because in approximating it it would be necessary to estimate each quarter section separately, owing to local variations. Some estimates are gross exaggerations—others far below the truth. Quarter-section claims that will cut 16,000,000 feet, are by no means unusual, even on hill land, while a yield of 50,000 feet to the acre is called fair. Fifteen trees to such an acre would be very small for redwood. Some trees yield as high as 25,000 or 30,000 feet, while a single log, 12 or 14 feet long, often contains from 4,000 to 6,000 feet. It is a daily occurrence in the woods when steam engines and block and tackle are employed simply to roll over the larger logs, and fourteen or sixteen oxen will strain all their energies to haul three or four redwood logs down hill.

In the course of a report made to the general manager of the Cincinnati Southern on a test of simple and compound locomotives, Mr. James Meehan, superintendent of motive power, directs attention to the difference in evaporative power of good and inferior coal. He says the difference is 33 per cent. in favor of the good coal, and this is by no means offset by the difference in price. This is a subject that deserves much more consideration from railroad managers than it usually receives. It is quite common to find coal differing in heating power all the way from 25 to 50 per cent., and yet they will hesitate to pay 10 per cent. more for the superior coal.

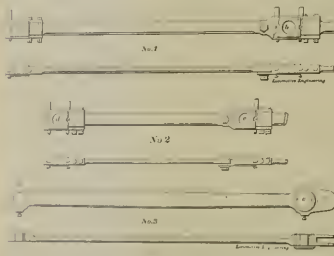
Did you ever try cleaning a greasy smoked head lamp chimney by filling it partly with clean sand, then holding your hand over one end fill nearly full of water, closing the other end likewise, shaking thoroughly, rinsing out with clean water, giving the outside a rubbing with your gritty hand while so doing. Try it once and you will be surprised at your job and the case with which you did it, after which you will throw no more dirty globes away because you cannot get them clean.

## Shop-Work—Side-Rods.

BY OBSERVER

In this day of improved locomotive construction we would almost be made to believe that the day of faulty design had become a thing of the past, but inasmuch as we have the locomotives of the past to contend with, practical experience has to determine the economy and convenience in repairs of the different constructions.

The inclosed sketches are side-rods of three different builds of six-wheeled connected 18 x 24-in. locomotives. No. 1 has adjusting keys on middle connection rod, which reduces the strength of strap at the part where strength is most needed. I have known of three locomotives with side rods constructed like sketch No. 1 to break strap through key-way at *A*, breaking driving-wheels on main axles, pulling driving-wheels partly off front axle, and in one case breaking main driving-wheels, and breaking pedestals and bottom braces out of main part of engine frame. During a few years' service of engines equipped with side-rods of this construction, twenty-five middle connection straps had to be replaced, as the straps were found to be cracked through corners of key-way at *A* and *B*. The new straps were constructed like No. 2, with adjusting keys on back strap, in no case where the middle connection straps were changed in construction from Fig. 1 to Fig. 2 had a middle connection-strap been broken.




Good service can be had by dispensing with inside adjusting keys and using the two outside keys, but it requires a little more care in adjusting rods.

Although No. 1 is defective in the construction of middle connection-straps, No. 2 also has its defects; the butt end of middle connecting-rods of No. 2 are smaller than butt end of rods in No. 1, and do not admit of as large crank-pins. The diameter of side-rod journals of middle connection of No. 1 are $4\frac{1}{4}$ in., where in No. 2 the diameter of crank-pin journals are but $4\frac{1}{2}$ in., the crank-pins are frequently broken with No. 2 rods, but no middle connections have been broken; the reverse is the case with No. 1.

Middle connection-straps are broken, but no crank-pin, by enlarging the butt end of connecting-rod, strap and crank-pin of No. 2 to dimensions of No. 1, and changing construction of strap of No. 1 to that of No. 2, better results will be obtained.

No. 3 is, in my judgment, the best construction of a locomotive side-rod; they are less expensive to make, are much easier to repair, and less expensive to maintain; they also have their defects. Engineers will neglect them, and, like every other part of machinery when neglected, they will run hot. When the brasses do run hot, the brass expands more than the eye of the rod, the brass becomes compressed in the eye of the rod when hot, and when cooled off the brass is loose in the eye and tight on the crank-pin. To repair the brass after having once run hot, the usual way is to put a liner around the brass, press the brass back into the eye of the rod and ream out hole in brass to fit crank-pin, but as the holes in eyes of rods are of a size all the way through, and the liner will wrinkle when the brass is being pressed into rod, it is rather a difficult operation to press a brass with liner into a solid side-rod and have the liner fit solid the length of the fit of brass in rod. If the hole in eye of side-rods were bored to a taper of $\frac{1}{8}$-in. to the foot, it would be much less work to repair brasses with liner.

It is not always convenient to get new brasses, it is good practice when connecting-rods are taken off for repairs to have them taken to the blacksmiths' shop, heated to a dull red heat and examined for cracks. A small crack can be found in this way when any other mode of inspection has failed to determine any defects.

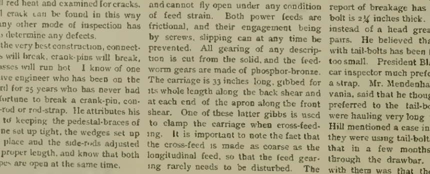
With the very best construction, connecting-rods will break, crank-pins will break, and brasses will run hot. I know of one locomotive engineer who has been on the footboard for 25 years who has never had the misfortune to break a crank-pin, connecting-rod or rod-strap. He attributes his success to keeping the pedestal-braces of his engine set up tight, the wedges set up in their place and the side-rods adjusted to their proper length, and know that both sand-pipes are open at the same time.

Not long ago, January 24th, so say three correspondents, a N. P. freight engine took a dive off the big ferryboat between Kalama and Hunters Landing, on the Columbia River. The train, a freight, was run on the boat and the crew went to lunch at the lunch-counter aboard, as is the custom. When nearly across it was discovered that the engine was missing. The story seems almost incredible, but it is vouched for by railroad men on the coast. How the engine could dive off the boat without the pilot seeing it, or the crew of boat or train not feeling the shock of her desertion, is more than we can understand.

## Bogert's Improved 20-inch Engine Lathe.

The annexed engraving illustrates Bogert's 20-inch engine lathe, a tool well worthy of the attention of railroad mechanics. Swing over top of cross-slide, $14\frac{3}{4}$ inches; length of bed shown, 10 feet 3 inches.

The head-stock has carefully fitted adjustable boxes, lined with the best phosphorized babbitt metal. The front bearing is $3\frac{1}{2}$ inches in diameter by $5\frac{5}{8}$ inches long, and its cap is held down and adjusted by four $\frac{3}{4}$-inch bolts. The live spindle of very hard crucible steel has, unless otherwise ordered, a $1\frac{1}{4}$-inch hole through its axis, carries a four-step cone for a $3\frac{1}{2}$-inch double belt, and a front gear $14\frac{1}{4}$ inches in diameter. Its end thrust is taken upon hardened tool-steel collars with sides ground perfectly parallel. The ratio of the back gearing is 12 to 1, which, taken in connection with the diameters chosen for the corresponding steps of the over-head and main cones, makes the speed of rotation of the live spindle decrease in exact geometrical ratio from the fastest to the slowest. A very accessible rocking device on the back end of the head-stock enables the direction of the feed to be instantly reversed without disturbing the change gears. The lead-screw is $1\frac{3}{16}$ inches in diameter, cut three threads to the inch, and is made as accurate in every way as practically possible. The usual variety of threads from one to sixteen per inch can be cut with the change gears without compounding. The thread of the lead-screw is used only for screw-cutting, the longitudinal and cross feeds being driven by means of a large key-way or spline. The half-nuts are opened and closed by one-third of a revolution of two single-threaded screws of large diameter, and cannot fly open under any condition of feed strain. Both power feeds are frictional, and their engagement being by screws, slipping can at any time be prevented. All gearing of any description is cut from the solid, and the feed-worm gears are made of phosphor-bronze. The carriage is 33 inches long, gibbed for its whole length along the back shear and at each end of the apron along the front shear. One of these latter gibbs is used to clamp the carriage when cross-feeding. It is important to note the fact that the cross-feed is made as coarse as the longitudinal feed, so that the feed gearing rarely needs to be disturbed. The cross-slide, $20\frac{1}{4}$ inches long, is fitted with one of Bogert's patent double-screw tool posts. A telescopic slide by its movement protects the cross-feed screw from chips in any position of the tool. The tail-stock may be set over, to line the centers, and is clamped to the bed by two $\frac{3}{4}$-inch bolts. The tail-stock spindle is $2\frac{3}{8}$ inches in diameter, and $10\frac{1}{2}$ inches long. The center-rest will admit work from $\frac{1}{2}$ of an inch to 9 inches in diameter, without change of jaws. The follow-rest is made either with adjustable jaws or with a split hole, to clamp bushings. Bogert's improved friction clutches and Bogert's improved method of oiling loose pulleys are features of the counter-shaft. Counter-shaft pulleys, 15 inches in diameter and 4-inch faces, should make from 160 to 180 revolutions per minute; the backing pulley should be run at least as fast as the latter speed for screw-cutting. When the nature of the work makes it necessary or desirable, Bogert's improved compound rest may be applied to the top of the cross-slide, without any change in its construction. Tapers up to four inches to the foot can be readily and accurately turned with Bogert's improved taper-turning attachment without disturbing the allignment of the centers. This device must be provided for in the construction of the lathe. The bed, owing to a proper distribution of metal, is stiff and rigid, its design and arrangement of cross-bracing being the result of the careful thought and experiment of years. In 1882 Mr. Bogert made the first drawing for a machine tool with its bed deeper in the middle than at the end, and in 1885 tapered the ends and at the same time brought the legs nearer together. His uniform practice in the case of lathes is to make the inside edge of the upper surface of one of the legs plumb with the front end of the head-stock, and locate the other leg the same distance from the other end of the bed. An elliptic curve to the lower edge of the middle portion makes the elevation symmetrical, and best provides for the strain of use.



NEW ENGINE LATHE. JOHN L. BOGERT, FLUSHING, L. I.

## Tail-bolt or Yoke?

There was a discussion at the New York Railroad Club on which offers the most security for automatic couplers, a tail-bolt or a yoke attachment? Mr. C. A. Smith, of the Union Trunk Line, said that they have about 2,000 cars equipped with a tail-bolt that has two keys and no head. They have been in use over two years and no report of breakage has been made. The bolt is $2\frac{1}{4}$ inches thick. The use of a key instead of a head greatly facilitates repairs. He believed that all the trouble with tail-bolts has been from making them too small. President Blackall said that his car inspector much preferred a tail-bolt to a strap. Mr. Mendenhall, of the Pennsylvania, said that he thought the strap was preferred to the tail-bolt on roads that were hauling very long trains. Secretary Hill mentioned a case in the South where they were using tail-bolts with small heads that in a few months wore their way through the drawbar. Another trouble with them was that the tail-bolt turned half round and the key dropped out. Mr. Montgomery had seen many tail-bolts broken but never a tail-yoke.

In almost every large railroad shop in Europe a visitor, who is allowed inside, is given a small print showing a ground plan of the works. On this is mapped the route that will be taken, into this shop and out and into that, until a complete circle is made. This path is shown by a dotted line and an occasional arrow. The plan seems a good one and is a nice memento for visitors to carry away. The different shops are marked, sizes are given, etc. Would not this plan pay in this country?

### Confusion about Meum and Tuum.

A report from Chicago that a smoke-stack 34 x 4 feet had been stolen, and that no clew to the thieves could be obtained, testifies to the purloining ability displayed in the windy metropolis. What we wonder at is that the thieves did not carry away the factory as well as the smoke-stack. There is a growing dullness of perception in not a few western communities as to the distinctions between "thine" and "mine." In New Mexico and southwestern States generally, there is a growing idea that railroad property belongs to those who care to take possession of it.

The Santa Fé Railroad Company have lately been wrestling with an organized band of robbers, consisting of trainmen, station agents and others, who stole freight by the wholesale. They used to stop trains at out-of-the-way points and take out of the cars any articles they could dispose of. In one case they tried to steal a grand piano, and had a wagon ready to carry it away, but there were not enough men on the train to lift the instrument. About fifty persons have been arrested for connection with this thieving set, but the sympathy of the people in New Mexico is so strongly in favor of those who despoil railroad companies that there is no likelihood of any conviction.

People in these parts consider it the duty of railroad companies to supply them with coal without charge. There was nearly a riot in one town when the Union Pacific fenced in their yards to prevent people from driving in to carry away coal any time they wanted a load. The better classes of western communities consider stealing coal by the wagon load to be slightly reprehensible, but for a poor man to wheel away a barrow load or to carry away a sackful is regarded as right and fair. A railroad company that would object to have coal carried away in small quantities of this kind is considered mean enough to put locks and bars on its freight-houses.

The junior philosopher of this journal once, in an unguarded hour, revealed how he had been duped by a verdant-looking ranchman in a coal operation. "Coming it strong" was never more brazenly imposed upon "Truthful James." Our J. P. had his engine in a yard in Colorado one evening, just before dark, and an innocent looking native of the plains came up and asked if the engineer would be so kind as to push a certain coal car up to the end of the yard. The J. P. was ready to oblige, and pushed the car to the point desired. In the morning he learned that the coal belonged to the company and the man wanted it set at a point where people would not be likely to see that he was stealing it. The car was empty when the sun rose upon the scene.

### Loose Nuts.

In an article which we published last month on diverse sizes of taps and dies, we pointed out some of the evils which result from the practice of ordering these articles different from the correct dimensions. We notice in a speech made by Mr. A. M Waitt, general master car builder of the Lake Shore Railway, at a club meeting, corroboration of some of the points made in our article. He says: "I have in my office two draft-timber bolts that were applied to a Lake Shore car a few weeks ago by a large connecting line that has adopted M. C. B. standards. The bolts are standard size, but the nuts are so loose that by just a little impetus they will unscrew over nearly two inches of thread. They are therefore in such condition that when the nut is screwed up a little jar will cause it to fall off."

This is what comes of making the tap a little larger than the standard size and the die a little smaller so that more service will be obtained from them before they wear out. Strange kind of economy this is. Every railroad track in the country is strewn with nuts that fall off cars and locomotives, and much of the slacking back is due to loose fits. We wonder how many expensive wrecks have been caused by the practice of using big taps and small dies for economy's sake? It would be a profitable theme for those who are trying to save money by deviating from standard sizes, to speculate on how many people have lost their lives in wrecks that were directly due to the loss of nuts or bolts that held running gear together. There is an old rhyme telling that, for want of a nail a shoe was lost and for want of a shoe the horse was lost, with many other expensive consequences. The nut on a car's running gear performs more important functions than the nail in the horse's hoof, and the consequences of this little member of the machine being badly secured are too serious to be trifled with.

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Those who have seen composite car bolsters and transoms in use on cars running in extremely dry climates are not likely to be favorably impressed with any advantage of using a combination of wood and iron in one piece. The alternate shrinking and swelling of the wood disintegrates the parts made of material having so little natural unity as wood and iron, and the call for repairs is greatly magnified.

### Iron Tender Frames.

Metallic members are gradually forcing their way into use for all parts of railroad rolling stock, but there is intense reluctance displayed by many designers to change from the shrinking, rot-inclining wood to the firm and durable iron and steel. This is very well illustrated in the reluctance that so many railroad men display to adopting iron or steel frames for tenders and in the inexplicable clinging to wood for parts of trucks for which the material is conspicuously unsuitable. There are very few wooden tender frames now made by the leading locomotive builders, but a few railroad companies still specify them. How this is done shows the force of a tradition and shows how slowly fallacies are rooted out.

GREAT LOOP, COLORADO MIDLAND, WINDING UP THE ROCKIES NEAR HAGERMAN TUNNEL.

THE BIG TRESTLE ON THE GREAT LOOP, NEAR HAGERMAN TUNNEL COLORADO

At a Master Mechanics' convention many years ago, when iron tender frames were coming into use, a speaker criticised the practice on the grounds that iron tender frames would be difficult to repair in case of a wreck. There was the usual opposition to a radical change so well known among our conservative railroad men, and the objection that a wrecked iron tender frame would be costly to repair was accepted as an inspiration. The belief has passed as gospel ever since. Yet it is false doctrine, as any one may readily find out on roads where wrecks and well-designed iron tender frames are found in company. The metal tender frame stands wrecks much better than wooden ones, but if it did not that would be a poor argument against the material, for rolling stock is not designed with a view to making it successful in a wreck. The real test is how it behaves on the track. The metal tender frame has come to stay, and it is preparing the way for car frames being made of the same kind of material.

A committee of the Railway Master Mechanics' Association has just issued a circular calling for information about tender frames. We should like those who can speak from experience to send in all the facts in their possession about the relative value of wood and metal for tender frames. It would be well to mention how the iron tender frames behave in wrecks. The wooden one generally goes to pieces.

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California has passed a law making it a misdemeanor for newspapers to claim more circulation than they have. We sincerely wish that this law could be passed in every State. If the newspapers of this country don't obtain money under false pretenses, in claiming ten times as much circulation as they have, we miss our guess.

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## Causes of Breakage.

In the course of a discussion at one of the railroad club meetings some edifying information was given about the breakage of tail-bolts of draw-bars that to the reflective mechanic is applicable to all parts of machinery that are given to breaking. No means of attaching the draw-bar to the plates connecting with the draft timbers has been so simple and so satisfactory as the tail-bolt, especially when repairs have to be made. This attachment, with all its merits of simplicity, is gradually falling out of use, a complex yoke taking the place of a single round bolt. The change has been brought about by the tendency of the tail-bolt to break. It is not our purpose at present to discuss the short-sighted policy of abandoning a simple form for a complex one without exhausting all means to render the former as strong as the latter. Our subject is the cause of breakages generally.

There is no subject connected with the operating of machinery more important than how can all parts of a machine be made so that there will never be any failure from breakage? The problem is peculiarly important in its relation to machinery used in transportation, for the comfort and lives of those who travel by land or by sea are greatly dependent upon machinery and mechanical structures being free from breakage. The answer to the question of why a piece of machinery breaks, was covered in a reply given by the well-known mechanical engineer, Dr. Coleman Sellers, when asked at one of the Railway Master Mechanics' conventions, What is the cause of boiler explosions? He answered, because the sheets of the boiler are not strong enough to resist the pressure inside. That answer, of course, failed to explain why boiler-plates, which were strong enough yesterday, fail to-day. A kindred inquiry has been asked frequently during the past winter, viz. Why has a rod failed to-day which stood for years without showing the smallest sign of weakness?

When a skillful engineer designs a machine, he carefully studies every shock and strain that has to be resisted, and proportions all the parts to have a wide margin of strength. He calculates not only all the external forces that will come into action to disintegrate the machine, but also takes into consideration the molecular internal forces within the material employed and provides against their breaking influences. It might be supposed that a machine of this character would be like the one-horse shay, and would last until every part was worn out. This is not how it comes out in practice. Care in design tends to make machines and mechanical structures durable, but forces begin work on a machine the day it is put in operation which will sooner or later lead to breakage unless the proper remedies are provided.

The shocks and strains incident to railroad operating subject the leading parts of the machinery used to blows and pulls that strain the material beyond its elastic limit. When a load is put upon a bar it will stretch a certain distance in the same way that a rubber band or coil spring does, and on the load being removed the bar will go back to its original length. The limit within which a bar will endure a strain and return to its original length after the strain is taken off is called the elastic limit. When a bar or any other form of metal is strained beyond its elastic limit, it receives damage which if repeated often enough will result in breakage.

When engineers first began experimenting with the strength of material, it was believed that a bar was not injured in any way by sustaining loads within the elastic limit; but more experience proved that if loads within the elastic limit were applied and taken off many times breakage would ensue. From this it was concluded that a molecular change was induced in the metal by strains, even within the elastic limit, which seriously weakened it without making any apparent physical change on the article affected. This is spoken of among engineers as the fatigue of metal.

There are two distinct forms of stresses which machinery and structures are subjected to with very different results. Let us take a truss rod which is helping to support the roof of a building. A certain load is put upon this rod and it remains constantly there. That rod is carrying what is called a static load. On the other hand, we will take the load or strain which a crank-pin or connecting-rod must be strong enough to sustain. This load is constantly changing on and off. Engineers speak of this as a live load. It has been found that a bar or structure will endure a statical load much better than a live load.

Wöhler, an eminent German engineer and physicist who is a recognized authority on strength of material, made a great many experiments with bars of steel and iron, putting on and taking off the loads alternately, careful means being provided to record the exact results. It was found in every instance that the breaking stress of the material thus tested was away below the statical breaking load. A bar of steel having a tenacity under a steady load of 110,000 per square inch, broke under 64,000 pounds when the load was completely removed and replaced 170,000 times. The trend of the experiments went to show that a bar would break with an alternating stress of about one-third the statical breaking strength of the material if the repetitions of strain were sufficiently numerous. The test department of the Pennsylvania Railroad have repeatedly corroborated the correctness of Wöhler's discoveries regarding the effect of alternating stresses. There is still a great deal to be learned about the influences which reduce the original strength of metals; but there are numerous evidences tending to prove that so long as strains are below a certain portion of the elastic limit no damage or fatigue will ensue no matter how often the stresses may be applied.

The lessons of the experiments and discoveries are: Give a good margin of the calculated strength to material that has to withstand alternating loads, and keep the eyes of vigilant inspectors upon axles, crank-pins, rods and other parts that have to endure what is known to be a destructive character of service. Breakages like that of the tail-bolt referred to in the beginning of this article have been very common in railroads since the prevalent tendency to overload engines and cars came into vogue. Frequently the remedy is looked for in the wrong direction. We have lately found several railroad companies introducing the use of bronze eccentric straps because the cast-iron straps gave annoyance from breakage, and the same thing is going on with driving-axle boxes. This is substituting a strong material, but the purpose would be equally well accomplished by increasing the size of the piece made from cast-iron. We have in mind a road that was greatly troubled with valve stems breaking, and numerous fancy remedies were suggested without relief till a hard-headed foreman urged making the stems stronger, and that plan being tried the breakage ceased. If parties using tail-bolts in their couplers would strengthen the bolt instead of looking for complex remedies, the result would probably be more satisfactory in the repair yards. Where side-rods and crank-pins and rocker-arms and piston-rods keep breaking the chances are that a stronger article is needed, although in some cases vicious forms provide the conditions that cause breakage. A piston-rod made with a sharp shoulder puts a varying bending strain on one point which reaches up towards the elastic limit. Every bend given to the rod is a step towards destruction, and the end comes with as much certainty as the end of a division is reached in a given time at a certain speed. All other parts subject to breakage are controlled by similar influences. If the metal is distributed so that the strains are uniform, the article will be durable; if bad form concentrates strains on one point it will be short-lived. If the material employed is of good quality it will resist destructive strains longer than substances of inferior quality; but good material and perfect form will not long prevent breakage when the article is too weak for the strains to be borne.

## Safety Appliances Made Compulsory.

What has been popularly known as the Car Coupler bill has passed Congress at last and is now a law. The measure is much broader than the popular name for it indicates, as it provides that after January 1, 1898, every locomotive used moving interstate traffic must be provided with driver-brakes and appliances for operating a continuous train-brake, that all trains must have a sufficient number of power-brakes, so that the engineer can control the train without requiring brakemen to use hand-brakes.

In regard to couplers, the law requires that all cars must be equipped with couplers that act automatically by compact and which can be uncoupled without the switchmen going between the cars.

The hand-hold at the ends of cars, which is a standard of the Master Car Builders' Association, and which many friends of humanity have been vainly urging for general adoption, is made a compulsory attachment by the new law. The neglect of many railroad companies to provide this inexpensive safety appliance is one of the strongest arguments we know of in favor of compulsory legislation.

Another highly important enactment which ought not to have been necessary is in regard to the height of draw-bars. The law provides that within three months after the passage of the act, the American Railway Association is authorized to designate to the Interstate Commission the standard height of draw-bars for freight cars, and fix also the maximum variation from that standard height. There has been a standard height of draw-bar since 1872, but many railroad companies pay no attention to it, although the diverse height of draw-bars has been a fruitful cause of accidents in the coupling of cars.

The act provides that violations of its provisions will be punishable with a fine of $100 for each offense. It also exempts railroad employés from contributory negligence in case they are injured in the handling of locomotives or cars not provided with the appliances required in the act.

There is nothing in the new law which a railroad company wishing to be fair toward its employés and toward humanity ought to object to. Most railroad companies will find the law no hardship, because they are gradually meeting its provisions. Others will do nothing till the day of reckoning comes, and then they will raise demands for longer time. These are the kind of companies that bring all corporations into disrepute. They have struggled to prevent the Act from passing and they have delayed it for years. Companies of this kind do nothing to conserve life without the spur of compulsion. They deserve no consideration.

## Slow Progress of Standards.

Every railroad man who possesses business conceptions combined with mechanical knowledge is aware that one of the most desirable improvements that could be carried out on railroad rolling stock is the general adoption of standard parts so that the material for effecting repairs might always be at hand no matter how far a car might be away from its home yards. Nearly all railroad officers admit the advantages that would accrue from a reform of this kind, yet very few of those in authority are prepared to sacrifice the smallest tittle of prejudice to bring about uniformity. They are all willing that others should adopt their particular forms, but there is little disposition to give and take in the promotion of this good cause.

The railroad mechanical associations have been struggling for years to establish certain standards, but it is surprising how little good has been accomplished by the protracted efforts in this direction. Men contribute testimony to committees of investigation showing how great the advantages of standards and uniformity would be; they raise their voices in the conventions in favor of standards and vote for their adoption by letter-ballot, and then consider that their full duty has been performed. They use no effort whatever to make their own practice conform to the standards they have helped to establish. Of course in some instances the mechanical men cannot help themselves, because the policy of their companies is to hold to their own established forms no matter what the associations may do; but in many cases the failure to make progress towards standards is due to the apathy of the master car builders and master mechanics. This apathy is not worldly wise. More than one man has come to grief for neglect of this duty to his company, and others will fall by the wayside when their managements come to realize the losses due to the lack of enterprise that obstructs necessary improvements.

## Government Boiler Inspection.

On another page one of our correspondents discusses in a very fair spirit and intelligent fashion the subject of Government inspection of locomotive boilers. He sees no reason why locomotive boilers on railroads should be exempt from Government inspection and supervision when the boilers of steamers are subject to this kind of control. We entirely agree with this view of the case, and we cannot see why any other person should think differently. The lives of passengers on railroad trains are certainly as valuable as the lives of those who travel by steamers. The practice of requiring marine boilers to be systematically inspected by competent men has proved one of the best safeguards ever introduced, and it ought to be extended to all steam boilers. A change of this kind would be better for every one who comes within reach of a boiler. It would be a merciful thing to the men attending boilers, and in many cases it would benefit superintendents and owners.

## The Underpaid Mechanical Engineer.

Railroad companies have their own share of poorly paid employés, although, on the whole, railroad men are fully as well remunerated for their services as any class of workmen or officials going. We have lately been studying the pay received by the various classes in railroad service, and have concluded that the mechanical engineer is the worst paid man in the business, considering the training and education necessary for the position. There are only a few railroad companies that have ostensibly a mechanical engineer, but nearly every railroad company has a man performing a mechanical engineer's work without the title being attached to the duties. Railroads are too much in the barbarian era yet for scientific attainments to be treated with deserved respect; but the necessity for certain kinds of work being done scientifically—that is, according to correct principles—is slowly becoming recognized. The complexity of mechanism that tends towards simplicity or automatism in railroad operating is constantly calling for the services of a designer or semi-inventor as an attachment to every mechanical headquarters. Duties of this kind were formerly all done by the master mechanic, but they have now become too numerous for that official to perform. The next man in order is naturally the draughtsman. There is nothing in connection with train mechanism, signal apparatus, electrical appliances, or the thousand and one mechanical articles used on railroads that the draughtsman is not considered competent to design attachments for. He is supposed to have perfect knowledge concerning the strength of material, he must know how to calculate strains transmitted in the most complex of shapes; he must understand a great deal about heat, electricity, the behavior of gases under various circumstances, and a great variety of other knowledge must be in his possession for use at any moment. His daily duties require much manipulative skill, and the work he is called upon to perform as a designer requires the exercise of much good judgment and aptitude for displaying what some one calls "modifying power."

The education and training necessary to prepare a man for performing the high and diverse duties of a mechanical engineer are costly, but yet by perversity of judgment railroad officers nearly all consider that the work of a mechanical engineer is of small money value. Many brakemen and switchmen a few weeks away from working on the section receive better pay than men performing the scientific business of a mechanical engineer. We believe that nearly all heads of the mechanical departments who have to employ men to do the work of mechanical engineers appreciate the value of the services performed; but they cannot convince those above them that good salaries ought to be paid. There are too many officers on our railroads whose training has unfitted them to understand the value of scientific work. Clamor and brute force on one side and obedient stupidity on the other fulfills their idea of railroad service. This is the class that has made combination essential to those who were anxious to get in sight of fair play. It is passing away, but its influence helps to depress the market price of brains and knowlege.

## Disrespect to Railroad Managers.

Some points made by Col. N. S. Haines, president of the American Railway Association, in a pamphlet on legislation relating to railroad safety appliances, might be studied to advantage by the lawyers and public speakers who pretend to know more about railroad management than those raised to the business. Col. Haines rose from brakeman to be a railroad president. His views on railroad problems are therefore of the greatest value, yet they have not always been treated with respect when delivered before Congressional committees.

Concerning this object, he says: "If members of Congress who are lawyers could see before them a body of railroad managers undertaking to argue and decide issues involving fundamental principles of law, they would understand how they appear to railroad managers when they undertake to argue and decide fundamental questions in the operation of railways. Let a lawyer of recognized reputation appear before a Congressional committee and his views are received with respect, his words carry the weight of authority, but an expert railroad manager, who has acquired his experience by slow and laborious promotion from the lower ranks, and whose every word among his peers would carry conviction to their minds, will, in the same committee room, feel that his arguments have fallen on deaf ears, and perceive that his printed statements are not even read."

## Partial Car Repairs on Defect Cards.

A circular letter has been issued by Mr. A. M. Waitt, general master car builder of the Lake Shore & Michigan Southern, making proposals concerning defect cards, which appear to offer an easy solution of a difficult problem. Certain roads are requiring all cars having defective air-brakes that require immediate repairs to apply a separate card for each defect. This is likely to cause complications, disputes and delays, and some cars are likely to be all covered over with defect cards.

Mr. Waitt's plan of making partial repairs is to use one card for all repairs necessary, and when partial repairs are made to draw a red line through the words calling for the repairs that have been done. When this is done an M. C. B. card or preferably a special partial repair card, shall be filled out duplicating reading on the original card, with the same items crossed out as are shown thereon, this duplicate to accompany the bill for partial repairs as voucher.

The plan is simple and comprehensive, and we think it would be a wise plan for the M. C. B. Association to adopt it.

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The Boston & Albany have lately put in service some freight cars with collarless journals, that are encouraging profanity among the Western connections of the road. During a recent visit to Buffalo we found among the car building and inspecting fraternity complete unanimity in condemnation of the new B. & A. axle and oil-box. The subject was like Banquo's ghost and would not be downed. Whatever subject of conversation was introduced drifted with certainty to the iniquities that have been inflicted upon other railroad men by the B. & A. axle. The side movement of the axle is supposed to be controlled by an end stop of wedge form. This wedge is reported to be regularly missing and the ends of the boxes are knocked out in consequence. We should advise friend Adams of the B. & A. to pay a visit to the interchange yards, Buffalo, Cleveland or Chicago, and he will learn something that is worth knowing.

## BOOK REVIEW.

SWITCH LAYOUTS AND CURVE EASEMENTS. By Augustus Torrey, *Railroad Gazette*, New York. Price, $1.

This useful little book is intended for the use of section foremen and assistant engineers, and is prepared in a shape simple enough to be understood by men of very limited education. The author, who is acting chief engineer of the Michigan Central Railroad, has prepared the book from the notes of his own practice. It consists of written directions given very plainly, and diagrams giving complete directions for section foremen. The publishers say that no similar book has ever been published before. It is an essentially practical and necessary manual for trackmen. We think that every young man ambitious to be a section foreman ought to make this book a pocket companion.

THE TABOR STEAM ENGINE INDICATOR. Ashcroft Mfg. Co., New York. $1.

The book is evidently the work of our well-known contributor, Mr. Harris Tabor, who is inventor of the indicator described. There is first an introduction telling about the purpose of a steam engine indicator, and then comes a clear, concise and interesting description of the Tabor instrument. After that comes a division or chapter devoted to "the management and care of the Tabor indicator," which is followed by a discourse on "the essential features of the indicator diagram." A chapter on "the uses to which the steam engine indicator may be applied," brings us to details of the every-day work done by the indicator, embracing valuable information on making tests of steam engines, and how to detect defects. In this chapter the author is unusually frank for a writer on indicators, and tells plainly what the indicator will not do as well as what its uses are. He says:

"The matter of leakage of valves and pistons in steam engines is one of importance. In the testing of engines it is often overlooked, and in the ordinary working of a large number of engines it is the cause of much waste of steam. It is quite a common belief that the indicator diagram is useful for the purpose of showing the condition of an engine in regard to leakage. This belief is erroneous. The diagram is useful for no such purpose. Leakage of steam, except in rare instances, has so little effect upon the lines of the diagram that it can scarcely be detected. The only satisfactory way to determine the tightness of an engine is to take it in hand when not in motion, apply a full boiler pressure to the valves placed in a closed position and to the piston as well, which is blocked for the purpose at some point away from the end of the stroke."

Railroad men will particularly value the portion devoted to "the use of the indicator on locomotives," and that where directions are given for "combining the diagram from compound engines." In the former chapter diagrams are given showing the distribution of steam in locomotives that have the valves set by measurement, and others where the valves are set by the indicator. The difference is very striking, and ought to be a strong argument in favor of more general use of the indicator on locomotives.

Besides the information referred to there are many useful facts about steam engine matters to be found in the book. There are of course methods of finding the horse-power from the diagram, methods of calculating the steam used and very carefully prepared tables relating to steam. A useful thing to find in a book relating to the indicator is a table giving the area of circles. The working of Amsler's polar planimeter is very plainly described in a fashion that will make the action of this useful instrument apparent to those who cannot get personal instruction in using the planimeter.

The publishers, who are manufacturers of the Tabor indicator, give the book with every instrument sold. To others a charge of $1 is made. It would be difficult to get the same volume of information at the low price named were the book not prepared in connection with a manufacturing business.

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The Consolidated Car-Heating Co., of Albany, N. Y., have recently placed on the market a very efficient electric heater for electric street cars. This device is located under the seats, weighs but 14½ pounds for an entire car equipment. Mr. McElroy, the inventor of their leading features of steam heating, is the inventor. This heater is clean, instantly controlled and safe—a pity they cannot be used on our passenger coaches.

## PERSONAL.

Mr. J. J. Frey has been appointed general manager of the Atchison Topeka.

Mr. W. G. Tuller has been appointed purchasing agent for the Atchison, Topeka & Santa Fe.

Mr. T. F. Butler has been appointed master mechanic of the Pennsylvania road at Wellsville, O.

Benj. Parker, one of the oldest engineers on the Missouri Pacific, recently died at Little Rock, Ark.

Mr. H. E. Chipman has been appointed master mechanic of the Oregon Pacific, with office at Corvallis, Ore.

Mr. E. M. Neel has been appointed superintendent of the C. C. C. & St. L., with headquarters at Mattoon, Ill.

Mr. A. Tait has been appointed superintendent of the Guatemala Western, with headquarters at Retalhuleu.

Mr. Daniel Deeter has been appointed road foreman of engines of the main line of the Philadelphia & Reading.

Mr. E. P. Lord, superintendent of motive power of the Cleveland, Cincinnati, Chicago & St. Louis, has resigned.

Mr. Joseph McWilliams has been appointed superintendent of the Texas Central, with headquarters at Waco, Tex.

Mr. J. C. Slater has been appointed master mechanic of the Nevada Central, with headquarters at Battle Mountain, Nev.

Mr. J. Q. Van Winkle has been appointed general superintendent of the C. C. C. & St. L., with headquarters at Indianapolis.

Mr. C. H. Smith has been appointed general manager of the Pittsburgh, Marion & Chicago, with headquarters at New Lisbon, O.

Mr. G. W. Miller has been appointed general foreman of the locomotive shops belonging to the Pennsylvania, at Columbus, O.

Mr. T. L. Clarke has been appointed acting superintendent of the Atlantic & Western, with headquarters at Orange City, Fla.

Mr. S. M. Prevost has been appointed general manager of the Pennsylvania Railroad. He was formerly general superintendent.

Mr. G. E. Husted has been promoted from freight agent to be superintendent of the Lake Shore & Michigan Southern at Toledo, O.

Mr. Henry Gould has been promoted from assistant to acting superintendent of the New York Central, with headquarters at Buffalo, N. Y.

Mr. A. F. Priest has been appointed master mechanic of the Duluth, Messabe & Northern, with headquarters at Iron Junction, Minn.

Mr. Daniel Coxe, superintendent of motive power of the D. S. & S. Railroad, is spending the winter in Florida, being in delicate health.

Mr. G. E. Coleman has been appointed superintendent of the Owensboro Falls of Rough & Green River, with headquarters at Owensboro, Ky.

Mr. R. B. Agnew has been appointed superintendent of the Chicago, Rock Island & Pacific, with headquarters at Colorado Springs, Col.

Mr. E. McNeal, assistant to President Sage, of the Iowa Central, has been appointed general manager in place of Mr. C. A. Ackert, resigned.

Mr. A. J. Frasier has been promoted from train master to superintendent of the Alabama Great Southern, with headquarters at Birmingham, Ala.

Mr. H. A. Worcester has been promoted from train master to superintendent of the Lake Shore & Michigan Southern, with headquarters at Lansing, Mich.

Mr. A. B. Elliman has been appointed general manager of the Nevada Central, with office at Austin, Nev. He was previously treasurer for the company.

Mr. J. N. Sanborn has resigned the foremanship of the C. M. & St. P. roundhouse at Sioux City to accept the position of road foreman of engines for the J. C. Ry.

Mr. Charles H. Stanton has been appointed general superintendent of the New York & Massachusetts Railroad, with headquarters at Poughkeepsie, N. Y.

Mr. George P. Randolph has been appointed general traffic manager of the New York & New England. He was formerly a freight agent on the Philadelphia & Reading.

Mr. B. Fitzpatrick, master mechanic, has been transferred from Wellsville, O., to take charge of the Cleveland & Pittsburgh division shops of the Pennsylvania at Columbus, O.

Mr. Myron Cooper has been appointed master mechanic of the Seattle & Montana, Fairhaven & Southern and New Westminster Southern roads, with headquarters at Fairhaven, Wash.

W. D. McKelvey, who for some years has pulled the Chicago limited on the Pittsburgh division of the P. R. R., has been promoted to the position of roundhouse foreman at Altoona, Pa.

Mr. Otto Miller has been appointed superintendent of the Hutchinson & Southern with headquarters at Hutchinson, Kas. He was formerly a superintendent on the Chicago & Northwestern.

Mr. J. M. Keith has been appointed master mechanic of the Western Railway of Guatemala, with headquarters at Retalhuleu. Mr. Keith was for several years on the Mexican Central.

Mr. S. P. Bush has been promoted from the position of master mechanic of the Pittsburgh, Cincinnati & Chicago shops, at Columbus, O., to be superintendent of motive power at the same place.

Mr. George L. Potter, master mechanic of the Fort Wayne shops, has been promoted to be superintendent of motive power of the Northwest System of the Pennsylvania lines west of Pittsburgh.

Mr. Frank Bruce has been appointed master mechanic of the Montana Central, with headquarters at Great Falls, Mont. Mr. Bruce has been on the Great Northern lately and was formerly on the Santa Fe.

John McLellan, roundhouse foreman for the P. R. R. at Altoona, Pa., has been made master mechanic at Blairsville, in place of W. B. Norris, promoted. The men give "Jack" a good name and wish him success.

Mr. Walter R. Woodford has been appointed general superintendent of the Cleveland, Lorain & Wheeling, with office at Cleveland, O. He has been general superintendent of the Wheeling & Lake Erie for four years.

W. B. Norris, until now master mechanic of the West Penn. division of the P. R. R., at Blairsville, Pa., has been made assistant to H. D. Garrett, master mechanic at West Philadelphia. This is a promotion to larger responsibilities.

Mr. John Forster, for several years roundhouse foreman on the Atchison, Topeka & Santa Fe, at Fort Madison, Ia., has been promoted to be master mechanic of the Panhandle division of same road, with headquarters at Wellington, Kas.

Mr. W. H. Fry has been appointed superintendent of the car department of the New York New Haven & Hartford and Consolidated roads. Mr. Fry has been employed in the Pullman works for several years as superintendent of repairs.

Mr. J. P. Graham, who was appointed master mechanic of the Iowa Central some time ago, learned his trade on the C. C. C. & I. under L. S. Young. He has spent several years on the Pacific coast and rose to be master mechanic on a division of the Union Pacific.

Mr. Daniel B. Robinson has been elected first vice-president of the Atchison, Topeka & Santa Fe, and he will have charge of the operation of that system of roads. He is an excellent railroad man, and has pushed himself up from the bottom by the force of ability.

Mr. Charles Graham, Jr., master mechanic of the D. L. & W. Ry., makes a very neat job of worn valve-stems by fitting a copper tube over them. The ends of the tube fit snugly against the yoke and the socket of the valve-rod making a steam-tight joint. This plan prevents the weakening of the stem by continual wearing and turning down, as when the copper covering is worn badly it can be removed and a new one substituted without machine work and with very little expense.

The consolidation of the motive power and car departments of the Long Island Railroad has released Mr. W. H. McKaig from the position of master car builder. Mr. McKaig has experience which ought to make him a valuable man for some railroad company. He learned the business in Jackson & Sharp's, and had experience in some of the best car shops in the country. He was assistant foreman in the Pullman works for upwards of five years. He was two years M. C. B. on the Long Island road.

Mr. William Garstang has been appointed superintendent of motive power and machinery of the Cleveland, Cincinnati, Chicago & St. Louis in place of E. P. Lord, resigned. This is a case of a man returning to his old love, for Mr. Garstang never ceased to display a warm interest in the affairs of the C. C. C. & I., now part of the Big Four, from which he was taken to be superintendent of motive power of the Chesapeake & Ohio. Mr. Garstang was for years master mechanic in charge of the Brightwood shops of the C. C. C. & I. before going to Richmond. He is first vice-president of the Railway Master Mechanics' Association.

Mr. Theodore N. Ely, the well-known general superintendent of motive power, has been created chief of motive power by the directors, and his headquarters has been changed to the general office of the company, at Philadelphia. Mr. Ely will have general supervision of the mechanical department of all the Pennsylvania lines and it is understood that he will act as advisor to the presidents in all matters relating to machinery. Mr. Ely leaves Altoona universally regretted. Few heads of departments have been more popular, and he performed the delicate duties that connect the operative with the mechanical department of the Pennsylvania with much success. A most estimable characteristic about Mr. Ely has been his readiness to credit subordinates with work done. This has always insured an able and loyal staff of assistants and much of his success has been due to them.

A good illustration of the force of habit was displayed at a recent meeting of the New York Railroad Club. Mr. T. B. Purves, Jr., master mechanic of the Boston & Albany at East Albany, had been elected a member and was invited to speak. Mr Purves is a young man of pious proclivities with a taste for Sunday-school work, and he is superintendent of a Reformed Presbyterian (Auld Lichts) Sunday-school. On being called upon to speak at the club meeting, Mr. Purves began to catechise the members as to what they knew about boilers. He floored H. L. Leach, puzzled M. N. Forney, started A. E. Mitchell figuring, and put every other member upon the anxious seat, when his course was suddenly checked by a suggestion from President Blackall that he answer some of his questions himself. It was a new experience, but the introducing of Sunday-school methods into a club meeting was decidedly sensational.

Once in a great while it's comical to look like some one else. A. E. Mitchell, superintendent of motive power of the Erie, has a twin brother, a supervisor on the Pennsylvania's western lines. They say that when A. E. goes over the Pennsylvania the conductors just nod to him and put down the number of his brother's annual. He could make things interesting for his brother by charging meals "until I come up next week." It wouldn't be so funny if some cannibal recently dismissed by the supervisor took occasion to "get even" in an interview, and should happen to strike A. E. On the whole, when you are a twin it will pay to lead a strictly correct life and be careful that your brother tells no lies and makes no enemies. If we had a twin brother soliciting advertising, we should crawl under the table every time the door opened.

Mr. Edward B. Wall, for several years superintendent of motive power of the Pittsburgh, Cincinnati, Chicago & St. Louis, at Columbus, O., has been made assistant to the president of the Pennsylvania lines west of Pittsburgh, with headquarters in Chicago. Mr. Wall is peculiarly well fitted for his new duties, as he is an excellent organizer and a good executive officer, as any observing man could see who visited his headquarters. He is a graduate of the Stevens Institute of Technology. While at college he devoted much attention to car construction, and his learning in that direction led him into railroad employment. He has been a famous member of the Master Car Builders' Association, and has fought the battles of the Pennsylvania Railroad very successfully in different conventions. His efforts and skillful management did more than the labors of any other man to turn the vote of the Association in favor of a vertical plane coupler.

Mr. F. D. Casanave, who has been superintendent of motive power of the Fort Wayne divisions of the Pennsylvania Railroad since 1887, has been appointed general superintendent of motive power of the Pennsylvania Railroad, with headquarters at Altoona, Pa. Mr. Casanave served his apprenticeship in the Altoona shops, having begun there in 1862. He went through the usual course of instruction given to the Altoona apprentices. In 1876 he was promoted to be assistant master mechanic at Altoona. Five years later he was made master mechanic of the Fort Wayne shops. After holding that position five years he was made superintendent of motive power. We know of no man in the country who has such a good technical and mechanical training combined as Mr. Casanave. The successful establishing of the piece system of work on the Pennsylvania has been in a great measure due to his labors. He was offered by President McLeod the position of general superintendent of machinery of all the Reading lines a year ago, with a very high salary, and declined the place by the advice of the president of his road. He is chairman of the Arbitration Committee of the Master Car Builders' Association.

### How Could She, When She Couldn't?

Strange things happen when men make up their minds that they will happen, have got to happen and can't help happening.

It is now over twenty years since Superintendent Healy, of the Rhode Island Locomotive Works, built a passenger engine for the Old Colony; this engine had 17½ x 22-inch cylinders with a 5-foot wheel. The only innovation on the standard engines of the day was the trial of 2¼-inch tubes instead of 2-inch, there being about 160 of them.

Before the engine ever made a turn the general superintendent got onto the big flues and openly announced that the engine would never make the time with the Fall River boat train—for which she was built.

The master mechanic admitted that he didn't believe she would ever steam, and one by one the engineers shook their heads and allowed that she couldn't make it—because she couldn't. Then the firemen announced that no man could keep her hot and no one ought to expect they could.

The engine was doubted from the start. Everybody said she couldn't make the run—and she didn't.

She went on the road and was a failure from the start, and after eighteen months' service she was rebuilt. The general superintendent paid the Rhode Island Locomotive Works $1,000 extra for a new boiler (returning the old one) like the other except that it had 2-inch tubes.

He said he knew that the new boiler would steam and the engine make the time. The M. M. said he knew so, too, and the engineers and firemen agreed with them that now she was all right.

She was all right, steamed well and made the time—because everybody said she could and would.

Some months afterward John Thompson, general master mechanic of the Eastern Railway, wanted a 17-inch passenger engine, and wanted it as cheap as possible. He was induced to take the boiler discarded by the Old Colony (after being thoroughly repaired). None of the engineers knew the engine had an old boiler or flues larger than the ordinary. Mr. Thompson said she was a dandy and would just play with their fastest and heaviest express. The boys all counted on her as a good steamer—and a good steamer she was.

This engine never lacked for steam, did her work well, and as economically as the best engines on the road, and is in the service yet—running in sight of the scene of her former failure.

If a man at the bottom of a well made up his mind that he couldn't climb out, wouldn't climb out or wouldn't try to climb out, it is altogether likely he would stay there.

Many a device has been a success, and many a man won in the battle of life, because the inventor of the device or the man believed in his invention or himself; knew that if he had half a show he would "get there,"—and "got there."

Have faith in your ability to run your engine or fire it successfully. Make up your mind that it has got to *go*. Don't let any other man do what you failed to do, and because you failed have therefore decided couldn't be done.

### Power Required to Drive Wood-Working Machinery.

We have several times lately received inquiries about the amount of power required to drive wood-working machinery. On searching for information on the subject, we found that few people outside of those having the designing and placing of wood-working tools realize how much power is needed for these machines.

Some years ago Mr. William Lee Church, now of the firm of Westinghouse, Church, Kerr & Co., made some careful experiments to ascertain the power required to drive wood-working machinery, and the facts be made public are the most reliable data to be found on this important subject A somewhat curious feature of the test was that they demonstrated that more power is required to drive the tools than is needed for dressing the lumber. This of course is a characteristic of all machinery run at very high speed.

A 12-inch matcher running on 6-inch spruce called for about 15.25 horse-power. The same tool when running empty required 10 horse-power. It required 31.2 horse-power to start a 24-inch double surface planer, but after full speed had been attained the power required to keep up the velocity fell to 12.5 horse-power. A 14-inch rip saw cutting off 1-inch stuff called for 5½ horse-power, and almost the same power was required by a 24-inch circular resawing machine splitting 6-inch ... and it varies but a small fraction from the power required by a 60-inch circular resawing machine. Of course heavier ...ing would have greatly increased the resistance of the latter machine.

This information is a little limited, but it is good as far as it goes. If some enterprising superintendent in charge of a car shop would apply an indicator to his engine and take notes of the power required for the different machines, he would secure data that would be of much general interest.

A committee was appointed at the last meeting of the New York Railroad Club to put in form any suggestions regarding necessary changes on the Rules of Interchange of Cars. Mr A E Mitchell, superintendent of motive power of the Erie, is chairman of the committee. Anyone having suggestions of changes to propose should send particulars as soon as possible to Mr Mitchell.

The Southern & Southwestern Railway Club will meet at Atlanta on April 20th. The subjects to be brought forward for discussion are · Air Brake Practice ; Draft Rigging Appliances ; Soft Plugs for Crown Sheets of Fireboxes. Mr. George Morris, of the A French Spring Co., will read a paper bearing upon the second subject.

The Mt Vernon Car Mfg. Co. have just finished turning out 175 box cars, 75 coke cars and 10 caboose cars for the Monterey & Mexican Gulf R. R , Monterey, Mexico. They are now turning out 500 Illinois Central box cars, 1,000 Hicks stock cars, and have recently taken orders for 300 Louisville & Nashville box cars, 300 flat cars for the Monterey & Mexican Gulf R. R., Monterey, Mexico. This, with contracts on hand, will fill the company's capacity until August.

At the March meeting of the Western Railway Club Mr. F. C Cleaver, of the Terre Haute & Indianapolis, read a paper on a comparative test of simple engines and a compound built at the Pittsburgh Locomotive Works. The engines were of substantially the same size and the compound made a large saving of fuel over the others.

## Uneven Expansion of Long and Short Stay Bolts.

At a meeting of the New York Railroad Club, Mr. A. E. Mitchell made some remarks on the subject of Belpaire boilers, in which he enunciated a theory which may account for a well-known defeat of these boilers. He said Although we have none on our line, and I have never calculated the strains which come on them, I often wonder why the top row of stays should fail on Belpaire boilers, unless it is on account of the difference in the expansion of the top row of stay bolts and the lateral stays which run across the top of the firebox. In talking on this subject to one party some months ago, he gave this theory—that iron heated by steam will expand a certain amount—let us say for illustration one-thousandth of an inch to an inch in length. Now if the stay bolts are six inches long we get under the heat an elongation of .006. The top stay is running from side sheet to side sheet of the boiler—say 50 inches, is elongated the same distance per inch as the short stay, making a total 50 times greater than the other. This would naturally throw greater strain on those short side stay bolts, causing them to fail.

The Grant Locomotive Works of Chicago are full of orders but they are getting work done more slowly than they expected, the principal cause of delay being the want of good mechanics. The works are located in a district where houses are scarce, and which is not easily reached. Owing to this the men readily become discontented, and work is so plentiful in more convenient parts of the city that only fancy wages will keep them with the Grant Works.

The Hall signal system has been applied for the protection of trains on the Illinois Central Railroad, in the neighborhood of Chicago, and the trains for the World's Fair suburban business will be run under this system.

The Boston & Maine have given a large order to Pullman's people for passenger cars.

The next meeting of the New York Railroad Club, April 20th, will be a special car builders' meeting. The rules of interchange will be discussed and recommendations sent to the Master Car Builders' Association. There will be a short paper on practical car construction and a number of topical subjects on car repairs discussed. Everyone in the vicinity of New York who is interested in the building or maintenance of rolling stock ought to attend this meeting

## A Heavy Milling Machine.

The illustration on this page was made from a photograph of the largest milling machine we know anything about. This machine has been recently turned out by the Ingersoll Milling Machine Co., of Rockford, Ill.

The builders say they designed this tool especially for locomotive works and railroad shops, for such work as driving-boxes, cross-heads, shoes, wedges, connecting-rods, etc.

The machine looks more like a planer than a milling machine; the table is 36 inches wide and 8 feet long.

The feed motion is operated by friction, and the range of feed speeds is from 5 inches per minute down to $\frac{3}{16}$ of an inch per minute.

The spindle is 5¾ inches in diameter, bearings 25 inches long , it is back-geared 24 to 1, having a horizontal adjustment of 14 inches, and a vertical adjustment of 36 inches.

Cutters 15 inches in diameter and 30 inches long can be swung on this machine.

The cross-rail is graduated to read in thousandths, and can be raised by hand or power.

A piece 36 inches high can be milled in this machine, using a 6-inch cutter.

A pump is attached for throwing a stream of water on the tool while at work.

The machine weighs, complete, 22,000 pounds.

Using their special cutter, the makers of this machine state that they have milled cast-iron slabs 36 inches wide cutting $\frac{3}{16}$ inch deep, with a lineal feed of 3 inches per minute, removing by this operation 1,200 cubic inches of cast iron per hour. In other words, with one cut across the cast-iron slab, 36 inches square, they took off $\frac{3}{16}$ inch of the metal in twelve minutes.

We will be entirely out of February and March papers within a month ; no specimen copies of those months can be sent now. If you expect to make your file complete order back numbers now or you will be unable to get them ; we shall print no second editions.

The World's Fair business will promote many of the boys to pulling varnished cars. We hope they will all give satisfaction and be willing to go back to flats and gondolas in their turn.

We have just about 100 calendars left, if you want one drop us a postal card this month. Don't send after May 1st for we won't have one then

A report is current that Mr. A A. Robinson, who has resigned the position of second vice-president and general manager of the Atchison, Topeka & Santa Fe, is going to take a similar position in one of the Gould lines. It was generally expected, when President Manvel of the Santa Fe died, that Mr. A. A. Robinson would become president or at least first vice-president, for he has been a most successful manager. Mr. Robinson rose on the Santa Fe through the engineering department and looked after the construction of nearly 7,000 miles of railroads now forming that system. He has a surprisingly wide grasp of details and has the history of a great part of the vast properties forming the Santa Fe in his mind.

The Locomotive Educational Association, of Cedar Rapids, Ia., send us an invitation to attend their first annual ball and promise that we will have the opportunity to make good time around the hall without danger of collision. We are very grateful and should like much to witness the terpsichorean successes of old friends, but taking part in that species of train service is out of our line

Mr. J. W. Addis, who has been master mechanic of the Texas & Pacific at Gouldsboro, La., for several years, has been promoted to be superintendent of motive power of the same road. He succeeds Mr. A. S. Douglas, retired on account of bad health.

### EQUIPMENT NOTES.

The Delaware, Lackawanna & Western are asking bids for box-cars.

The Jersey Central are about to order a large number of freight cars.

The Huntington & Broad Top people are in the market for 500 cars.

The Florida Central & Peninsula people are in the market for locomotives.

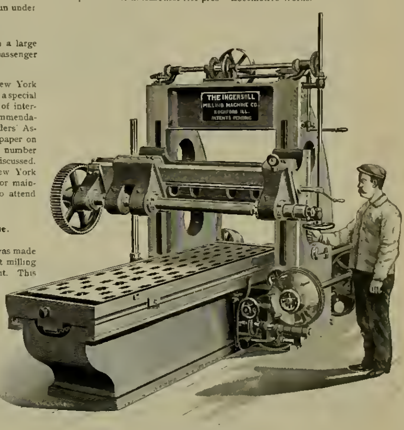
The Kansas City, Fort Scott & Gulf are in the market for new locomotives.

The Pittsburgh, Shenango & Lake Erie are about to order 300 freight cars.

The Noble Car Co., of Buffalo, have ordered 250 freight cars from the Lima Car Works.

The Louisville & Nashville people have placed an order with Rogers for some new engines

The Bangor & Aroostook have ordered seven locomotives from the Manchester Locomotive Works.




NEW HEAVY MILLING MACHINE

The Wilkesbarre & Eastern have ordered 13 engines from Rogers They are in the market for 18 coaches.

The Boston & Maine are getting thirteen new parlor cars built at Pullman They are badly needed on the road.

The Southern Pacific Co. have placed orders with Schenectady for eleven and with Cooke's for fourteen locomotives

The New York Central have specified the Fox pressed steel truck for 1,200 new freight cars contracted for within the last month.

Baldwin's people have lately received orders for eight moguls from the Ohio Southern, and a large order from the Missouri Pacific.

The New York, New Haven & Hartford are getting 14 new passenger cars built at Dayton. Part of them will be sleepers and part chair cars

The Safety Car Heating & Lighting Co., of New York, will have new gas plants in operation April 1 at Chattanooga, Portland, Ore., and North Chicago.

The Missouri Kansas & Texas soon expect to get into St Louis on their own line, and they are getting twenty-eight new passenger cars built to be ready for the increase of business

The New York, New Haven & Hartford are about to enlarge their shops at New Haven to give sufficient capacity to do all the repair work on cars and locomotives for the consolidated roads.

Pullman's people are reported to be turning out about three sleepers a day to meet the extra business of the World's Fair. Part of the sleepers are built so that they may readily be changed into day cars.

The Boston & Albany are about to build 6 combination cars and 100 flats in their own shops at Allston Mr. Adams has been getting out a sample box-car and it is now ready The company will order 500 cars of the same kind soon.

The Schenectady people are about to build some high-speed passenger engines for the New York Central with cylinders 19 x 26 inches, driving wheels 7 feet 3 inches in diameter A peculiarity about the engines is that they will have Buchanan's water table in a firebox set above the frame.

We understand that Mr E P. Watson, proprietor of the *Engineer*, has sold a half interest to Mr. Herbert W Harris, formerly business manager of the *Electrical World*. The *Engineer* is a remarkably bright paper and deserves the success that is likely to come to it by closer attention to the business side than Mr. Watson was able to give

The North Chicago Street Car Company are putting in a Pintsch gas plant which will be used for a novel purpose. Cars operated by small gas engines will be put on the lines to handle the business during the hours of light travel, when it does not pay to run the cables. Motors with gas engines will also be used on the feeder lines.

The Erie have ordered fifty new engines of Baldwins They will be their well-known "Class O" 10-wheeled passenger engines, with 20 x 24-inch cylinders and fire-box above the frame Those for the N Y, P. & O. will have a shorter firebox for soft coal and those for the Chicago & Erie will have a boiler four inches smaller in diameter. Part of them will be compounded.

Work is quite active in the Richmond Locomotive Works, and they are about to increase their capacity by the purchase of about $75,000 worth of new shop tools. They are still working on their large order for the Big Four, and have lately got an order for five switchers for the Chesapeake & Ohio They will exhibit at the World's Fair a passenger engine the same as the Chesapeake & Ohio standard.

## Improving the Reading System.

Mr. Theodore Voorhees appears to be making a decided success in reorganizing the operative departments of the Philadelphia & Reading. The organization has been somewhat similar to that of the Pennsylvania Railroad, but it was defective in many details, and these defects will be remedied by the changes introduced by the new first vice-president, who has a high reputation as an organizer. The intimate knowledge which Mr. Voorhees has of all practical details of railroad work promises to be of great value to the Reading system.

A striking weakness about the Reading, and on other railroads that have adopted the Pennsylvania system of management, is in the superintendents of divisions not being properly trained for the duties they have to perform They are in charge of rolling stock and of track, yet they have not received the proper training to be above mere meddlers with details they do not understand.

The system that makes the superintendent of a division responsible for everything on it, works admirably when the men in charge have been properly trained, but when men of limited experience are in charge it is expensive, confusing and dangerous.

## Wagon Top for Wootten Boilers.

"Thinking over the matter of steam room in boilers," said Mr. Charles Stryker, at the New York Railroad Club meeting, "has induced me to try to make an improvement on the Wootten boiler. The experience we have had on the Central of New Jersey has demonstrated that if we get dry steam the boilers are very economical. An ordinary Wootten boiler has very little steam room. I asked myself the question why a wagon top could not be put on this boiler to overcome the difficulty of having wet steam. Another point that I found on the Wootten boiler and in other straight boilers is, that for the sake of the construction the water space is sacrificed. The general construction of the Wootten boiler gives only 2¾ inches as the lowest water level above the crown sheet. When you come to consider that the Wootten boiler is 9 feet long and has a 3-foot combustion chamber it looks to me that the shallow water space is a source of danger, especially on a grade.

"I asked myself, cannot we put a wagon top on a Wootten boiler and raise the steam space from 16 to 22 inches? The boiler is not weakened by any means by putting this wagon top on it. It looks a considerable item to have 22 inches for steam space instead of 16. That, I think, will overcome the difficulty of having wet steam, besides, by doing it you can raise the main water level from 2¾ to 3¾ inches."

## Tempering Tools—Some Experience.

BY W. G LOTIFS.

I have tried to explain to the best of my ability how to heat and quench steel. It may seem strange, but it is true there are nearly as many tools spoiled in taking them out of the water at an improper heat as there is in putting them in at an improper heat. To convince yourself of this, take a reamer, such as shown in Fig 1, or a milling cutter as shown in Figs. 2 or 3, or a gripper jaw for lathe, as shown in Fig 4 After heating them to the proper refining heat, being careful that your water is clear, so that you can see at least 36 inches down from the surface, plunge your cutter down about 12 or 14 inches and you will see the teeth—just to where they are broken off as shown in Figs. 1, 2 and 3—cool very suddenly before the water can overcome the heat of the body. Now, the colder the water is the quicker it will overcome the heat of the body, and the better for the cutter.

But there is a large percentoge of our tool steel that won't stand to be left in until it is of the same temperature as the water, especially the cheaper grades, because the strain nearly all comes just to where the water couldn't overcome the heat of the body for a second or two, but it does not crack until it gets to about the same temperature as the water. The cause of this is that, when cooling, the cutting parts carry the hot body with them, because they cool so much quicker than the body, and the body being hot and soft it does not require a great deal of power for the cutting parts to draw it with them, but while the body is cooling it is going to have its natural shrinkage, and when it does, it must shrink away from the cutting parts, and this brings nearly all the strain just to that line where the water could not overcome the heat of the body. You will find that this is where your steel generally cracks in hardening.

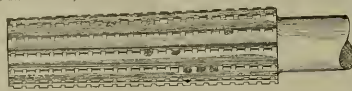


FIG. 1.

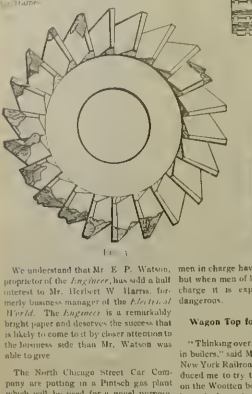


FIG. 3

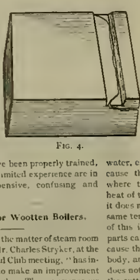


FIG. 4.

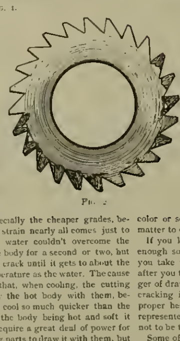


FIG. 2

Now, to prevent them from cracking, leave them in the water long enough so that they will be nearly hot enough to boil the water, which you can plainly see if your water is clear, then take piece out and drop it into lard oil, being careful not to lose time in getting it to the oil after taking it out of the water. If this is not done quickly you are liable to crack your cutter, because the cutting parts are very near the same temperature as the water, and when you take it out the water will stay on your cutting parts; yet there is heat enough in the body of it to dry it very suddenly, and it expands as quickly as it dries Now if your cutting parts are wet the heat will not run out into them quickly enough to expand them as fast as the body is expanding.

A great many toolsmiths hold their cutter over a keen fire after taking out of the water. I believe this practice is the greatest folly that has ever been practiced among toolsmiths, for this reason. If your cutters are of any size, you cannot prevent heating them more in one place than another, which causes unequal expansion, and very often the result is quite expensive. But you take your cutter out of the water as already explained; the body of your cutter will heat the oil and it will run out towards your cutting edges and heat them as quickly as the body heats the oil, and keep them the same temperature as the oil; and when you take it out the oil will form a coat on the outside of the steel that prevents the air from having the same effect it has on a cutter that was taken out of water.

Another bad habit, and one that is practiced a great deal, is taking hold of a fine edge cutter with warm hands after taking them out of the cold water. Fig 1 is a fair sample of such a case, it was quenched in water of a temperature of 34 degrees and left there until it was the same temperature as the water; there was not a crack in it when I took it out.

I took some waste and dried it, and then took hold of it with warm hands, and every tooth that was covered with my hand cracked—and they were the only ones that did.

Now the question may be asked, in what way does your warm hands affect a cutter of this kind enough to crack it? I am satisfied that it is the expansion that is caused by the heat of the hand, the steel being of a temperature of 34 degrees and the hands 100, and the steel being strained to about all it will stand, a very little unequal expansion will cause it to give away just at that line where nearly all the strain comes.

By heating slowly in drawing the temper, even if you don't heat it hot enough to color it any, you are doing away with a great deal of that strain. But I think the safest and quickest way is to take your cutter out of the oil with heat enough in it so it will not color or soften it any, which is an easy matter to overcome.

If you leave your cutter in the oil long enough so that it won't burn the oil when you take it out, or within a minute or so after you take it out, there will be no danger of drawing the temper and less of its cracking if it has been quenched at the proper heat and the steel is what it was represented to be, which I find very often not to be the case

Some of our salesmen make all sorts of claims for the steel they represent, and their knowledge of steel is very often limited, and the working of it more so.

*Madison, Wis.*

Spon & Chamberlain of this city have gotten out a neat little sketch book, for use in drawing offices, etc., with the pages accurately ruled in squares of one-eighth of an inch. Ruled sketching paper has been comparatively expensive, yet this firm are selling their handy book at 25 cents.

It is reported that the Ohio Southern have purchased 2,000 gondola cars of 60,000 pounds capacity of the Peninsula Car Co., of Detroit, also 500 gondolas and 1,500 box cars of the same capacity, and ten coaches and one mail car of the Ohio Falls Car Works, of Jeffersonville, Ind. They received two 18x24 switchers from Baldwins on March 1st, and have ordered eight 19x24 passenger engines to be delivered in May. The cause of this large order is the new 64-mile extension from Springfield to Lima, O, which they expect to open for business May 15th.

## Heat and Combustion.

BY ANGUS SINCLAIR.

The well-known phenomenon of combustion, or the burning of fuel, is due to the rapid union of the elements forming the fuel with the element oxygen, which is drawn from the atmospheric air. The composition and origin of the various fuels have already been discussed. It will now be in order to say something about the element oxygen, which performs extraordinarily important functions in the physical operations of the world.

### OXYGEN.

Oxygen is the most abundant substance in the globe Every atom of this element is like a dagger, always ready to pierce every other element in nature except one. This prevents it from being found in nature in a pure or isolated condition. But in combination with other elements it constitutes at least one-third part of the solid crust of the globe, eight-ninths by weight of all the water upon its surface, more than one-fifth of the atmosphere and eight-ninths of the vapor contained in the atmosphere. When separated from the other elements with which it is always mixed or combined, oxygen is a colorless, invisible gas possessing neither taste nor smell.

Any student of combustion can obtain a specimen of pure oxygen by placing a small quantity of red oxide of mercury in a test tube and heating it over a spirit lamp. When the compound gets hot enough, the oxygen which is combined with the mercury will rise in the gaseous form. If a glowing chip of wood be inserted in the test tube it will burst into flame, the pure oxygen inducing combustion more readily than the diluted oxygen in the air.

This experiment will teach two useful lessons. It will impress upon the beholder the active combustion-stimulating properties of pure oxygen and also show how loosely the gas may be bound into solid form along with another element for which it has affinity. Oxygen is bound very loosely into solid form with compounds of potassium and of manganese, and they are used for the distillation of this gas when large quantities are required. In silica, on the other hand, oxygen is bound up so tenaciously with the element silicon that the hottest furnace hardly suffices to separate them. In some of its solid combinations oxygen exists in greater relative proportion than it does in the air, but from the atmosphere alone can it be successfully drawn for respiratory and combustion purposes.

### THE ATMOSPHERE.

The atmosphere surrounding the earth from which the oxygen that supports combustion is derived is calculated to be about 45 miles in height. We hear a great deal in these days of rapid steam making about forced draught and artificial air pressure for urging combustion, but there are few amongst us who realize the unfailing storage of forced draught we have in the height of the atmosphere. The pressure at sea level caused by the height of the atmosphere is about 14.7 pounds per square inch. This pressure is always active to push the air gases into the furnace. The pressure of the atmosphere is calculated to balance 32 feet of water or 30 inches of mercury.

The atmospheric air is formed principally of the gases, oxygen and nitrogen. The composition is a mechanical mixture and not a chemical combination. Taken by volume there is 79 per cent. of nitrogen and 21 per cent. of oxygen in the air, or one cubic foot of oxygen to 3.76 cubic feet of nitrogen. By weight the proportion is 8 pounds of oxygen to 26.8 pounds of nitrogen, or one to 3.35 pounds.

Besides oxygen and nitrogen the atmosphere contains some aqueous vapor and from 3 to 1 volume of carbon dioxide in every thousand volumes. This carbon dioxide, although a very minute mixture in the atmosphere, is sufficient to perform highly important functions in the operations of nature. It supplies the principal element from which all vegetable and woody growth is built up.

### NITROGEN.

Nitrogen acts entirely as a dilutant to the oxygen with which it is associated, and in this performs admirably conservative functions.

Professor Faraday, writing about nitrogen, says: "It is remarkably curious. If I test it with a taper as I do oxygen or hydrogen, it does not burn like hydrogen and it does not make the taper burn like oxygen. It will not take fire, it will not let the taper burn, it puts out the combustion of everything. It has no smell, it is not sour, it does not dissolve in water, it is neither an acid nor an alkali. You might say, 'It is nothing.' What does it do in the air?

"Ah! then come our beautiful and fine results shown by an observant philosopher. Suppose, in place of having nitrogen or nitrogen and oxygen, we had pure oxygen as our atmosphere; what would become of us? You know very well that a piece of iron lit in a jar of oxygen goes on burning to the end. When you see a fire on an iron grate, imagine where the grate would go if the whole of the atmosphere were oxygen. The grate would burn up more powerfully than the coals; for the grate itself is even more combustible than the coals which we burn on it. A fire put into the middle of a locomotive would be a fire in a magazine of fuel, if the atmosphere were oxygen. The nitrogen lowers it down and makes it moderate and useful for us. It takes away the fumes produced by combustion and dispenses them throughout the whole atmosphere and performs a great and glorious purpose for man in the sustenance of vegetation."

With all its good qualities as a diluent, there are some drawbacks, so far as furnace combustion is concerned, to the large proportion of nitrogen in the atmosphere. It impedes the economical combustion of fuel in various ways. The large volume of this neutral gas accompanying the vital oxygen has to be heated to the highest furnace temperature, which represents considerable expenditure of fuel. Its presence obstructs the direct contact of the oxygen and carbon, and leads part of the gases to pass away uncombined. The increase of volume due to the presence of so much diluent requires also a much greater velocity of the gases than what would be necessary if the volume was smaller.

Having examined the elements, carbon, hydrogen, oxygen and nitrogen, which perform the principal functions in combustion, the next thing in order is to watch the lighting of a fire and note the scientific phrases of the events connected with this operation.

### IGNITING TEMPERATURE.

As has been several times mentioned, the phenomenon of burning is caused by the atoms of carbon or hydrogen entering into combination with each other, an act which is accompanied by the generation of heat and light. Carbon or hydrogen may be mixed or kept in contact for years at ordinary temperatures and no combination will ensue, but raise them to what is known as the igniting temperature and burning at once takes place. The temperature of ignition is the point at which the elements concerned open out sufficiently to come into intimate contact.

Everybody meets daily with illustrations of the fact that fuel will not burn till it has been raised to a certain heat. If you put a piece of wood or coal on the fire it remains unchanged for a time till the temperature at which it combines with oxygen is reached, when it begins to burn. Different kinds of fuel have different igniting points. Coal gas does not burn below a red heat of iron, and carbon has a still higher igniting point. If you take a piece of iron heated to a dim red and try to light an illuminating gas jet with it you will not succeed. Increase the heat till the iron approaches orange color and it will then light the gas. From this it will be learned that the igniting temperature of hydrocarbon gas is about the cherry heat of iron. As the igniting temperature of carbon is still higher, it will be understood that the coke or non-volatile part of the coal must be kept at a higher temperature still to make it burn.

### HOW A FIRE BURNS.

As a preliminary to lighting the fire we cover the grates of the furnace with a coating of wood. Then we strike a match and with its flame ignite some greasy cotton waste and scattering the burning material over the wood, start a fire. The phosphorus at the end of the match ignites at such a low temperature that the heat generated by the light friction of rubbing over a rough surface raises it to the burning point. The sulphur or other inflammable substance at the end of the match is ignited by the phosphorus, and the heat evolved is sufficient to set free the hydro-carbons in the wood, which combine with the oxygen taken from the air, making a bright flame. This keeps the carbon or solid part of the match at the high temperature necessary for combustion.

The flame of the match would not be sufficient to raise a large piece of firewood to the igniting temperature, because the extended surface would carry off the heat as fast as it was generated without raising any part to the temperature at which combustion is maintained. To overcame this, cotton waste saturated with oil, which consists of hydro-carbons, is employed. The waste being in a state of fine subdivision, permits the flame to communicate its heat to small particles which readily ignite and spread the fire through the mass. This being thrown on the wood in the furnace ignites the separate pieces, and raises the temperature to the point at which the elements forming the match burned.

### DISTILLING GASES FROM THE FUEL.

The fire being lighted, we will note the different phrases in the combustion of coal in a locomotive firebox. The principles that regulate the combustion of coal in fireboxes are little varied in their action when the fire is found in any other kind of furnace.

Suppose we have a bright fire burning on the grate and the fireman proceeds to throw in a charge of bituminous coal. The immediate effect of throwing in fresh coal is to reduce the temperature of the firebox, but the heat quickly raises the temperature of the fuel and drives out the volatile gas. If this gas is properly cared for, it is burned, producing intense heat that has about three times the steam-generating power of the solid part of the coal from which the gas was distilled. To burn the hydro-carbons a high furnace temperature is necessary, because the combustion of the volatile gases is performed on the space between the surface of the solid fuel and the mouth of the tubes. Between the heat-absorbing walls of the heating surface, which in this case might more aptly be called cooling surface, and the flow of air intended to provide the oxygen used in combustion, there is great danger of the hydro-carbons passing away uncombined.

### BURNING HYDROGEN COMPOUNDS.

When hydrogen belonging to the volatile gases meets with favorable conditions for combustion, 2 parts by weight combines with 16 parts by weight of oxygen (1 to 8), and the product is water. This process which Dame Nature has of making water generates intense heat. The water formed is not perceptible as it passes off in the form of vapor, but it is the only tangible product of this combustion. If it were condensed and collected, which can be done by special apparatus, the weight of the water formed would be found to equal the weight of the hydrogen and oxygen which entered into combination.

The presence of water as a product of combustion can be perceived when a lamp is newly lighted as the steam condenses on the cold chimney.

When a locomotive fire is first lighted, drops of water can be seen running out of the joints about the smoke-box. This is the steam made by the act of combustion of hydrogen condensing on the cold iron of the smoke-box and stack.

The favorable conditions required for the combustion of hydrogen are a high furnace temperature and the presence of oxygen. If the temperature is not sufficiently high or the supply of oxygen is limited, the whole or part of the hydrogen liberated from the coal passes away unconsumed. This loss is serious. In the first place, a large proportion of heat has been taken away from the coal fire to gasify the hydrogen. In the second place, the hydrogen in separating from the coal has the power of forming a gaseous compound which chemists call ethylene, similar to ordinary illuminating gas ($C_2H_4$), which contains 6 pounds of carbon to 1 of hydrogen. If this mixture is permitted to pass through the tubes unconsumed, it carries away valuable fuel.

In furnace combustion the hydrogen in the volatile gases may be said never to burn as pure hydrogen and oxygen. The engineer anxious to obtain the greatest amount of useful heat from the coal is interested merely in the combustion of carbon and hydrogen. Among the complex gases formed by these elements and oxygen are carburetted hydrogen, bi-carburetted hydrogen, carbon monoxide, and small quantities of other elements. With good firing and properly constructed furnaces the greater part of these gases are burned. When inferior firemen are employed and the furnaces are not properly adapted for the work to be done, the greater part of the hydro-carbons in the coal are wasted. When we hear it said that coke or anthracite coal can be used as economically as good bituminous coal we may be certain that the light gases of the latter coal are not converted into heat.

### BURNING THE SOLID CARBON.

When the volatile gases have been expelled from the fuel the solid part remaining is coke, whose principal constituent is pure carbon. There is very little difference in the composition of coke and anthracite coal.

When the carbon has been raised to the temperature of ignition and a plentiful supply of oxygen is present, 12 parts by weight or one atom of carbon unites with 32 parts by weight or two atoms of oxygen forming carbon-dioxide, commonly called carbonic acid. This is the most valuable combination of carbon and oxygen in combustion because it generates the greatest amount of heat possible by the union of these elements.

### EFFECT OF TOO LITTLE AIR.

In case that the supply of air is restricted in the furnace, one atom of carbon will unite with one atom of oxygen forming carbon-monoxide, a product whose heat is much lower than the heat of carbon-dioxide. The second atom of oxygen in carbon-dioxide appears to be in loose combination with the carbon atom, for should the carbon dioxide encounter any of the compounds of carbon on its way to the tubes, the second atom will leave its partner and form carbon-monoxide with some other atom of carbon. This converts both into the gas of low-heating property.

The atoms of carbon, on being raised to the necessary temperature, appear to start off in search of two oxygen wives, and their highest affinities cannot be satisfied short of this number. If the two atoms of oxygen are found in an atmosphere hot enough for combustion, the union takes place and much heat results. When the supply of oxygen is so restricted that only one atom can be obtained by the carbon atom, the dual union is made and the two march towards the tubes doing small work in the heating of water

Some of the carbon atoms have failed, like many mortals, to find a partner and are lingering about the furnace occupying space for no worthy purpose. A carbon dioxide molecule that has reached its highest destiny comes along with its two wives and one deserts it to embrace the stray carbon atom The result is a general chilliness. From this it will be understood that the oxygen wives ought to be liberally supplied if a hot fire is wanted The air supplies the oxygen

Furnaces and fireboxes have been designed with great ingenuity for the purposes of smoke prevention which systematically robbed the carbon dioxide of its second oxygen partner at a certain part of the journey towards the flues More particulars of this will be given when we are considering smoke preventers

During a recent visit to the Michigan Railway Supply Co.'s works at Detroit, we found them running a full force of men in the manufacture of their steel car-door and steel brake-beam The works are equipped with ingeniously designed special machinery for the construction of these articles and the work is done very expeditiously and with more exactness than by hand

"A Modern Boiler Plant" is the title of a very attractive illustrated circular issued by Westinghouse, Church, Kerr & Co., Boston. The pamphlet illustrates the outside and inside of an ideal boiler house and all the internal arrangements of boilers, bunkers and the plant necessary for running boilers to advantage. The publishers of the circular say that they have organized a department to design, build or remodel boiler plants and to furnish complete architect's drawings with dimensioned details for the construction of first-class boiler plants

The Emergency Train Signal Co., Liberty street, New York, have made arrangements to put in an equipment of their signalling plant upon the South Side Elevated Railroad of Chicago. The system comprises a block system for controlling the movement of trains and a tripping arrangement secured on the track for applying the air-brakes in case the engineer fails to stop when a signal is at danger

The Canadian Pacific Railway Company have sent to the World's Fair a vestibuled train of their well-known palace cars finished inside and out in solid mahogany. The cars look very fine when they are new, but they soon turn black outside. The train is, however, certain to attract much attention.

We have received from the Locomotive Superintendent of the New Zealand Railways a neat calendar for 1893 which has a double-ended suburban engine for a heading, and contains particulars about the expense of operating the motive-power and rolling-stock departments. From this we note that there are 1,869 miles of road in operation, and 1,370 employes in the locomotive department. There are 266 locomotives in service and 8,727 cars of all kinds. The coal consumed is 32.08 per mile; oil, 1.85 quarts per 100 miles; waste, 96 pounds per 100 miles. The total running expenses are 18.4 cents per mile. The car repairs per mile amount to 7.14 cents.

The Legislature of New York State have under consideration a bill making it a crime for newspaper publishers to misrepresent their circulation for the purposes of securing advertising. If this bill should pass it would be a little hard on some of the railroad papers whose subscription lists exist principally in the mendacity of the publishers.

A circular has been issued by Mr. C. A. Hammond, secretary of the American Society of Railroad Superintendents, giving particulars of the business to be transacted at a special meeting to be held at the Grand Pacific Hotel, Chicago, on April 10. An urgent appeal is made to the members to be present, as a large attendance is very much desired

The State of Maine has been exceedingly fortunate in having few serious railroad accidents There has not been a single person killed in a train wreck in that State since 1889.

The Chicago & Grand Trunk have equipped some of their locomotives with electric headlights.

Our Line Engravings are made by the wax process, a plan securing accuracy and distinct lines on original copper plates They are made by BRADLEY & POATES, 251 William Street, New York City.

## OUR ENGRAVINGS.

Of late we have had a great many inquiries as to who made the fine half-tone plates shown each month in LOCOMOTIVE ENGINEERING. Credit is due the expert anywhere and we are glad to recommend the engravers of our plates to those wanting good work at reasonable prices. All the half-tones and reproductions we use are made by the STAR ENGRAVING & PRINTING Co., 607 & 609 Sansom St., Philadelphia, Pa. SINCLAIR & HILL.

WE CAN FURNISH BINDERS FOR PRESERVING A YEAR'S FILE OF THIS PAPER at $1.00. Postage paid any address.

### Tests of Simple and Compound Locomotives.

At a meeting of the Western Railway Club, Mr William Forsyth read a paper on "Tests of Locomotives in Heavy Express Service," in which interesting data were given about the comparative economy of compound and simple locomotives in the pulling of heavy fast passenger trains. Five engines were employed: First, a Baldwin 4-cylinder compound ten-wheeler with cylinders equivalent to a 19 x 24-inch simple engine, 2.135 square feet of heating surface, grate area, 28.3 square feet; weight on drivers, 103,000 pounds; diameter of drivers, 72 inches. Second, a C. B. & Q. mogul compound, with cylinders 20 and 29 x 24 inches, 1,506 square feet of heating surface, 27 1 square feet grate and 94.500 pounds on drivers, the latter being 62 inches diameter. Third, a simple mogul in every respect the same as the compound except that the cylinders are 19 x 24 inches. Fourth, a simple mogul similar to the last except that the driving wheels are 68 inches diameter. Fifth, a simple eight-wheel engine, with cylinders 18 x 24 inches, 1,412 square feet of heating surface, 24 4 square feet grate and 66,000 pounds on drivers that are 68¾ inches diameter.

Tests were made on passenger trains of 11 cars, averaging close on 400 tons exclusive of engine and tender and run at an average speed of about 42 miles an hour.

The author says that the tests cannot be regarded as a measure of the comparative value of simple and compound locomotives, but rather as an indication of the value the Baldwin compound engine with the standard C B. & Q. locomotives for heavy and express passenger service.

The C. B. & Q. compound was built for fast freight service, and has never shown an improved economy over simple engines of the same class when used in passenger service.

The Baldwin compound would not steam freely when it first arrived on the road, and the grates and draft appliances were changed to suit Streator coal. Although the average boiler pressure was 177 pounds, the pressure was not at all regular, and the engine's performance must have suffered on this account.

With a train of twelve cars the simple moguls displayed power to force the train into speed superior to the compounds. With a train of eleven cars the Baldwin compound worked into speed more rapidly than the others.

The general conclusions of the tests given in the paper are as follows

1. The coal measurements show 22 per cent. more tons of cars hauled per pound of coal by the simple engines than by the Baldwin compound.

2 The average rate of evaporation was 5 per cent more with the simple engines than with the Baldwin compound.

3 The cylinder performance measured by the indicator cards taken at average running speed, 45 miles per hour, shows 18 per cent more foot-pounds of work done per heat unit in the steam used by the simple engine than by the Baldwin compound.

4 At 30 miles per hour the cards show the Baldwin engine to have the best economy, developing 14 per cent. more work per heat unit than the simple engine.

5. The poor showing made by the Baldwin compound was largely due to the heavy train and high speed. With a lighter train or the same train on a slower schedule it would have shown a much better economy. The cards taken at 30 miles an hour show this.

6. The Baldwin compound as operated on fast trains weighing 350 to 400 tons was not as economical in the use of fuel as the simple engine by about 25 per cent.

7. When working on heavy express service the Baldwin compound lost the principal advantages of compounding, viz. high initial pressure in the cylinders, increased number of expansions, softer blast on the fire.

As a result its boiler performance and cylinder performance were not as good as simple engines of proper capacity.

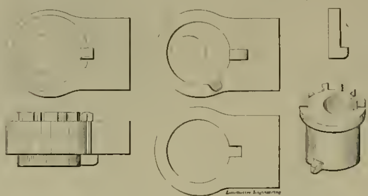
The record of tests shows that the smaller the amount of coal burned per square foot of grate per hour, the greater the evaporation, and at slower speeds the evaporation should increase. The average evaporation was 6.5, the same as that obtained from the same coal burned in a cylindrical tubular stationary boiler at a rate of 25 pounds per square foot of grate per hour. This shows that the locomotive boiler with properly proportioned grate and good draft appliances will burn five times as much coal per square foot of grate per hour with as good economy as the average stationary boiler.

The author of the paper does not say so, but it appears to us that the principal lesson of these tests is, that train service which requires high piston speed is not adapted for compound locomotives.

### A Draw-Bar Shortening Device.

The accompanying sketch shows a little device for shortening the draw-bar between engine and tender, the invention of Engineer H. W. Lounsberry, of the Fall Brook Railway.

Mr. W. A. Foster, superintendent of machinery, writes that they have a number of them in use giving no trouble at all, and that "it's a good thing."

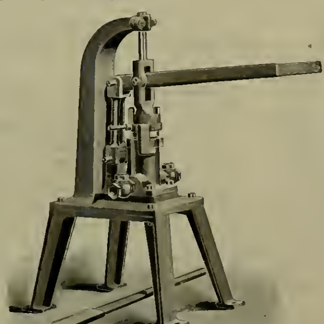


As can be seen, the eccentric block can be revolved enough to take up the slack and held from going back by a key.

A lug on the lower side of the bush goes through the keyway, and, when turned, prevents the bush from coming out of the bar.

### Portable Testing Pump.

This pump was designed for low-pressure work not exceeding 800 lbs per square inch, and is fitted with a double piston, the larger having a diameter of 3 inches, and a stroke of 4 inches, and is capable of giving a pressure of 200 lbs. to the square inch, while the smaller one (1¼ inches) can give the maximum pressure—800 lbs.



The pump is fitted for ordinary steam-pipe connections, 1 inch in diameter, and is mounted on a platform having four legs or wheels of good size as desired, making it convenient in moving and staple while pumping. The change from large to small piston is made by throwing a latching clutch.

It is made by Watson & Stillman, of this city.

### Arbitration Committee Decisions.

A case which ought not to require appeal to the Arbitration Committee of the Master Car Builders' Association, was decided again at last meeting of this committee. The D. L. & W. refused to accept one of its own cars from the Nickel Plate on the grounds that wrong material had been employed in repairing the car. The Nickel Plate protested that no repairs had been done on the car while on that road, and tried to push the responsibility upon the C C. C & St. L., which had delivered the car to the Nickel Plate. That road in turn was ready to place the responsibility back to the C. H. & D., over whose road the car had passed to the C. C. C & St. L. It is not clear how many roads might have been asked to take the responsibility of the wrong material, but the superintendent of machinery of the N. Y. C. & St. L. submits copies of telegrams sent by the P & W., asking for material to repair the car in dispute, and this is offered as proof that the P. & W. is the real delinquent The P. & W. refused to become responsible, and the case went to arbitration. The Arbitration Committee, of course, held the N. Y. C. & St L. road, that attempted to return the car to the owners, responsible, as has been done in numerous other analogous cases. There is no article in the rules of the interchange of cars more distinctly stated than that which holds a road delivering a car responsible for defects which cause the car to be refused. All attempts to trace back the road which caused the defects are futile. The proper time to throw back the responsibility is when the car is received. Then it may be refused, unless carded, which makes the delivering road responsible. It takes a long time to make all concerned understand this rule.

The next arbitration case is another with many previous decisions. The L. E & St L. delivered a Wabash car to a private siding, where it was burned, and the road that handled the car refused to be responsible because it was moved merely on a switching charge. Rule 30 plainly holds the road responsible, nevertheless, and a decision was rendered accordingly.

The Cold Blast Transportation Co. made a claim against the N. Y C. & St. L. for three broken center-plate bolts for which the road put on a defect cord when delivering the car to the West Shore. Two of the bolts were broken when the car was received from another road. The carding road held that the defects were broken by fair usage, and that railroad companies not being responsible for defects of this character on private cars, the charge was not just. The Arbitration Committee took the same view.

A rather novel case was raised by Nelson Morris & Co. against the New York Central. A car belonging to the former company came home with a wrong drawbar, the car being carded for this defect by the N. Y. C.; according to the rules of interchange the carding road was entitled to a credit of two cents per pound for the wrong drawbar, but this the owners of the car refused to grant on the grounds that they could not use a wrong drawbar to put on other cars, as is practiced by railroad companies, and that the drawbar was useful to them only as scrap iron. The Arbitration Committee decided that Nelson Morris & Co. were required to give the credit of two cents per pound according to the rules, but acknowledgement was made that the rule is unjust to private car owners and intimation was given that an effort will be made to change it.

A curious dispute arose between the Mobile & Ohio and C. B. & Q. The former road carded a C. B. & Q. car for one air hose and the owners sent in a bill of $2.55. The carding road held that the market price of an air-hose was $2 12½ and that t l rules specify this as the basis of charge. The C. B. & Q held that $2.45 was the actual cost of a hose applied in their shops and that there was no fixed market price. The Arbitration Committee decided that if the hose could be bought from the manufacturers at the lower price, that was a market price, and the charge made by the owners of the car was too high.

### A New Name.

We have received notice that the name of the Congdon Brake Shoe Company, of Chicago, has been changed to The Sargent Company. This is a proper change, for the company is doing a general business in iron and steel castings, and making brake-shoes is a small part of the work done. Mr. Geo. M. Sargent, president of the company, is so well and favorably known among railroad men that his name is much more potent than the name of any article which the company manufactures. The steel castings made by the company are said to be giving unusually good results.

# —Practical Letters— from Practical Men.

**Facts Wanted. There's a glut of Opinions.**

Write on one side of the paper, state your point plainly and briefly, and then quit. We supply the generalities. No letters noticed unless name and address accompany.

## Hard Times on the Chicago Elevated.

*Editors:*

The notice which you published some ... ago about the pay for engineers and ... men on the Alley Elevated Railroad of Chicago has made many engineers ambi... to find their names on the pay-roll of ... railroad. If any of your readers think ... going there, I would like to give the ... advice given by one of your ... story-tellers who said "Don't." That is enough. I have been through the mill and can talk from experience.

I went there on the invitation of the ... mechanic, whom I found a decent ... and left a good job, thinking to better ... It was the worst mistake I ever made. I began running extra, and soon found out that all the trainmen are suffering from the oppression of rules. They are constantly expected to do things that cannot be done, and when they are not done there are about ten men ready to report it and they never forget the reporting for they have nothing else to do.

The last work I did on the road was on a wild stormy night, with showers of snow flying. The time to be made is fast. It is all a man can do to make the time, and yet they compel you to stop at stations on a margin of 15 inches. If you go in too slow you lose time. If you have to give the engine steam again you are reported for jerking the train, and if you fail to stop within the 15 inches you are reported. If you apply emergency to make the stop you break a seal and get censured for violating an important rule. Just imagine a man working a train into a station with the snow blowing in his face, and perhaps steam blowing across his vision from the cars of a passing train, and see what chance he has to stop opposite a post that he cannot see until he is on it. If he fails there is certain to be a locomotive supervisor, inspector or road foreman of engines ready to make the report, which also goes in from train masters, conductors and platform men. Then he gets ten days.

If an engineer shows that he can run on that road without violating a rule at every turn he is taken in for examination. * * On railroads run by sensible railroad men, examinations are given to find out if the men know enough of their duties to do their work properly. The Alley Elevated management conduct the examinations for the purpose of puzzling men and tripping them up. A brother unfortunate of mine, on being asked some absurd question, answered that he would stop and ask the second man he found on the structure.

"Why would you do that?" asked the examiner.

"Because I would be sure that every second man I met would be an official."

Of course that closed his career on the road.

The management of that road has given infamous treatment to the enginemen and others who performed the hard work of getting the road into running order. The men did their work satisfactorily for months, and had become proficient in performing the hard duties put upon them. All at once they were ordered to attend the office for examination, and because they could not answer a long catechism of senseless questions they were discharged.

* * * * * * *

The truth hurts no man, and it is good for the engineers and firemen all over to understand just what kind of treatment they may expect if they go to the Chicago Elevated.

ENGINEER.

*Brooklyn, N. Y.*

## New Wheel Defect and Tire Gauge.

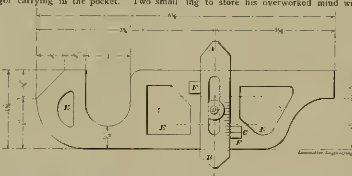
*Editors:*

The sketch below shows a combined wheel defect and tire gauge, which is more light, compact and handy than any other gauge that I have seen for the use of those having supervision over car and locomotive wheels.

A glance at the sketch will show that it covers all the points of the M. C. B. wheel-defect gauge, which need not be pointed out in detail.

The sliding scale *A B* is so made and graduated that the end *B* is used for measuring the wear of flange-tires and the end *A* for plain or "blind" tires, taking the reading in each case from the line *C*, but using different ends of the graduation on the scale.

The gauge and scale are both made of steel about 18 or 20 w. g., and the scale is fastened to the gauge by a stud *D* and small milled nut so that it can be revolved about the stud till it is parallel with the gauge. This makes it more compact, and it is cut out at *E E E* to make it lighter for carrying in the pocket. Two small



pieces of steel, *F F*, are riveted to the gauge so as to form guides for the scale and to keep it at right angles to the gauge when in use.

A gauge similar to this has been patented, but the idea was taken from this gauge when in an imperfect state, and it lacks many of the best points of the gauge here shown.

I have used one of these gauges for the past six years and find it the most useful tool I possess.

M. K. BARNUM,
Div. Foreman,
*No. Platte, Neb.* U. P. Ry.

## A Good Word for the Chain Gang System.

*Editors:*

I would like to get the views of your correspondents on the method of running engineers and firemen on the rounds.

On this road we do not have any regular engine or engineer—it is "first in, first out," and I think that it is a very good plan.

It affords no lost time for any one, and a fireman picks up a good deal from the different men he fires for. He can soon tell who is the best engineer, as there are hardly any two engines run alike.

A fireman can learn a good deal by keeping good watch of an engineer, and if he will ask once in a while something in regard to his work he will draw out things that he does not know.

It is not quite so pleasant as it is to have a good engineer steady, but in case you are mated with a cross one it is a thousand times better.

I will say for myself I have learned more in three years of running this way than in the previous three years, and since I have taken LOCOMOTIVE ENGINEERING I have been able to stick some good engineers on some of the problems given.

O. W. LA CREQUE.

*Elmira, N. Y.*

## For Examinations and Licenses of Locomotive Engineers.

*Editors:*

We hear every day, and as often as we turn our attention to practical questions, the remark, "We want better engineers, better conductors, and, in fact, better posted men in all departments of railroad life." Let us consider for a little while how we are to obtain better men in all the branches connected with running and operating railroads, and especially in the locomotive and train service. Are we at present on the highway to success or not? I say we are not. The future presents to our distant view a sadder state of affairs than the present, and why? The question is an easy one to answer. Seniority is the stumbling block over which we are to fall. The present and future present to every man of an imaginative turn of mind the fact that to make railroading a success we must keep abreast of the times. Under the present state of affairs it is not necessary for young men entering the various branches in railroading, especially in the locomotive and train service, to bother his weary brain with scientific questions or in reading books, papers, or in any way trying to store his overworked mind with things necessary to success. Seniority will overcome all these difficulties as the inevitable hand of time marks the years as they go by, until the time comes for him to be pushed upward and onward to a position of trust.

Seniority is a word that tickles the ears of a lazy man and at the same time it is the forerunner of three great evils in railroad life.

First, it creates discord among the rank and file of the men in the various callings of life on a railroad. Buried deep in the heart of almost every man is a hatred and an ill-will toward his fellow man, and as time rolls on he is longing for a misfortune to befall some one whereby he will be pushed onward one, two or three steps as the case may be.

Second, it is contrary to nature's laws, for it encourages sloth and idleness, because for a man to reach a responsible position it is not necessary for him to study or employ the leisure hours allotted to him in improving his store of knowledge. Seniority is helping him, and when his turn comes, whether he is competent or not, the company must give him an engine to run, or a train, as the case may be.

Third, we can look around us on every side and see the evil results of seniority in its present state of progress. We see men running engines and trains who are a burden to themselves, a detriment to the company and a danger to their fellow workmen and to the traveling public.

When a man's ambition reaches no farther than the pay car, it matters not what he is, whether a wiper, fireman, brakeman or train dispatcher, you soon set that man down as one who will never prove a success, and the time will come to his sorrow that he did not improve his knowledge when he had an opportunity to do so, instead of perhaps gambling or spending his time and money in saloons, or other places that lead to the ruin and destruction of many men.

There is only one way to overcome these evils, and that is to examine men who are in line of promotion at least once a year, and when the time comes for a fireman to take charge of a locomotive or a brakeman a train, subject him to a severe examination, and when he has passed it give him a license as an engineer or conductor. There is no reason why a locomotive engineer should not be required to hold a license as well as a marine engineer, both positions should be filled with trustworthy, competent and reliable men.

T. J. HENDERSON.

*San Bernardino, Cal.*

## Approves of De Sanno's Box—Large Exhaust Pipes.

*Editors:*

I want to say, "Bully for De Sanno." I have been at work about fifteen years trying to get rid of the wedge in connection with driving-boxes, and had gotten up an idea almost like his, they are so near alike that I would not change; I hope some road or locomotive works will try them.

I want to say my little say—just a few words about compound engines. I am sure that if a division of any road was equipped with an equal number of compounds and single-expansion engines, each to carry the same boiler pressure, all to be used in same class of service, run first in first out, the single-expansion to have exhaust pipes as large as is possible to get in the saddle, say 4 inches deep by 20 inches wide up to the nozzles—size of nozzle does not matter—that the single-expansion, after all had been rebuilt, would prove much the cheapest.

We have two engines on this (Rocky Mountain) division of the N. P., of same class, 17 x 24-inch cylinders, and one is at least 20 per cent. cheaper than the other, all owing to size of the exhaust pipes as cast in saddle. I believe that there never has yet been an engine built that was large enough in these pipes.

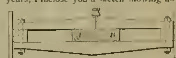
NORTHERN PACIFIC.

*Garrison, Mont.*

## Lining Guides.

*Editors:*

Having read with interest articles on lining guides and wear on same, by L. C. Hitchcock and C. F. Willson, I consider both articles ably written but lacking some proof that the cross-head wears the most on the bottom guide. Having to do with setting up guides for the past eighteen years, I inclose you a sketch showing how



I have found out how or where the cross-head wears the most, so that when guides need reducing I would be able to tell how to proceed so as to keep the cross-head central with piston at all times.

When engine is in shop, overhauled and cross-head planed, a circle should be described on cross-head at both ends, as shown in sketch at *A B*. When guides need reducing a compass should be used in center *A B*, which will indicate which way guides need lining, up or down.

When engine is running forward or backward, as in suburban work, this kink will show where the wear has been the most.

T. J. DAVIES,
*Colon, Colombia.* Panama Ry.

## Getting Dead Centers by Crossheads.

*Editors:*

Have read in the ENGINEERING about a number of ways to get centers and set valves quickly, but none of them use the cross-head for that purpose. Why not use the cross-heads, taking the one on half

stroke for center of the opposite side, etc., you only have to get two centers and pinch engine one turn of drivers, you also save the time pinching engine to take up last motion; you mark valve-stems in the usual way. Have done this work several ways, but think this the best, doing the work quicker and giving just as good results, if not better. G. E. B.

*Wilmington, N. C.*

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### Talk About Air-Hose—Some Records of Failures—How to Save Hose.

*Editors:*

As nearly all of the cars that are now being built at the various manufactories throughout the United States are being equipped with air-brakes, a person can easily see that it takes an enormous amount of air-hose to supply these new cars, also to keep up the repairs of those cars which are already equipped.

Now, I think that a discussion as to the relative merits of the various kinds of hose now on the market would be of general interest, as well as beneficial to all air-brake men, also to the railroad companies, as it is to their interest to buy the hose that will give the best service.

This company (A., T. & S. F. R. R.) are using quite a number of different brands of hose, and I cannot help but notice the difference in the construction of the hose and the period of time that elapses from the time of placing in service and taking out.

In giving a description of a hose which I have found to give the best satisfaction, I will say that the rubber should not be too hard, nor the duck too firm, as the hose will undoubtedly be expanded in inserting the fitting to such an extent that it will break the inner ply, thus making a weak place as the other ply are stretched so that the air will soon find its way through and form a bubble on the outside of the hose.

If the rubber be too hard, the hose will not be flexible enough to bend easily and place in the dummy hose-hook without breaking the hose.

By-the-way, I regard that same hook as being a very poor device for the use required of it, and think it plays a very important part in the ruination of a large number of air hose, for when a hose is the least bit hard, it is very liable to be broken or be cramped in such a position that it makes a weak place in it, generally just below the hose-nipple.

Another thing that I have found a great deal of trouble with is the inside seam or lap.

When filled with a pressure of air, this seam is held open and allows any oil or moisture that may be passing through to find lodgment therein; then the mischief is done, for we know that oil is an emeny to rubber, and the hose is soon eaten through.

I will say that I have come across one brand of hose that is made seamless in the manufacture of the inner tube before the duck is wound, and so far they have given entire satisfaction. They are The Boston Belting Co.'s "Imperial."

I would like to know why air-hose with the "patent-ends," or those that have a rubber covering over the ends, are superior to those that have not. I could never quite understand the philosophy of covering the ends if the right kind of duck be used and the hose properly clamped after the fitting has been inserted.

It has been a question in my mind for some time as to what is the average life of air-hose under favorable circumstances, but under the conditions now existing it is almost incalculable.

Perhaps a few statistics which I compiled recently (stating the cause of removal), after receiving a consignment of worn-out hose, will be of general interest.

Out of a total of 250 hose, I found that 88 or 35⅕% were removed for chafing against drawheads, bolts, straps, etc., 42 or 16⅘% were torn apart by breaking in two, switching, etc., and 25 or 10% bad been maliciously destroyed by cutting.

Thus you will see that only 155, or 38%, had seen a lifetime of actual service, and even a large portion of these were ruined by the injudicious use of oil and other causes.

In fitting up hose with machines the operator should be very careful and allow plenty of space for expansion of the hose, the full length of that portion of the fitting to be inserted, and should file off any unnecessary particle of metal that may be projecting from the fitting, as many hose are ruined by allowing these particles to tear the inside lining.

In order to be economical, they have a rule in vogue on this road requiring trainmen to save all worn out hose after removal and exchange them for new.

By this means they save an enormous number of fittings, thereby reducing the expenses in the air-brake department.

From the foregoing it is plainly seen that there are various ways by which we may get good service and a long life from air-hose if properly taken care of. In the first place, good hose should be selected by a person familiar with their construction and manufacture, and one who knows all the good and bad points of the principal brands now on the market.

The air-inspectors should be on the alert, "and with a little work with his wrench may save the life of a hose that may be chafing against some obstruction," or, if possible, remove the obstruction entirely.

The train crews should also be taught that it is considered "bad form" to pour a couple of gallons of car oil in the air-hose in order to oil the "triples," and if they take heed they will be doing their share toward saving expenses and diminishing delays caused by bad hose.

CHAS. S. SHALLENBERGER

*Ft. Madison, Ia.*

### Testing Air Before Starting—Engineers Held Responsible for Neglected Brakes.

*Editors:*

In the March number of your valuable paper I read a communication regarding train-pipe connection to brake-valve on second engine in double heading. Why will it not do to put brake-valve handle on lap to shut off all connection to main reservoir, and put a small stop-cock in port for the emission of air from train-pipe? Take the one off drip-cup on exhaust-pipe from pump; you can get to end of run by doing this, yet a brake-valve is not complete without a stop-cock on train-pipe, and engine should not be sent out on the road without one.

I also notice a communication from M., K. & T. as regards engineers using air-brakes only in case of emergency, on account of trains breaking in two. He says the management claims it to be the fault of air-brakes; the sooner the manipulators of the M., K. & T. R. R. learn that this is a grand mistake the better it will be for employees, motive power and rolling stock of that system. Why, we will take their claim as to trains parting. This accident is liable to occur at any time, and is as likely to occur to a train that has no cars equipped with air as to the one that has.

Not long ago I was running down a grade of 50 feet to the mile, with engine working steam, when all at once every brake I had in the train went on with a bang. The knuckle of an automatic coupler had unlatched, leaving one car of air with the train and five with engine.

You see no one was to blame for this break-in-two, neither could it be charged to air-cars.

In nearly every instance the cause of trains parting is defective links, pins or draw bars, and not owing to rough handling by engineers.

M., K. & T. says: "When we want to stop at a water crane we apply the emergency," and what is the consequence? Those quick-action fellows back of engine get in their work before that slow triple on engine, the automatic couplers and old style draw bars back of air are strained and cracked, and when engineer gets to division station reports lost motion taken up between engine and tank on account of those quick-action brakes doing their work before that slow triple on engine. There is nothing in the general usage of motive power and rolling-stock that will do as much damage as this emergency every time you stop, so I think the men that handle trains should be allowed to use their own judgment in handling air-brakes, and I have an argument to make for the engineer that sometimes fails to make a stop with a freight train that has, we will say, nine cars of air. The law compels railroad companies to equip freight cars with air-brakes, but does not compel them to keep air-brakes in good working condition.

Not long ago I was pulling a freight train in which were thirteen cars of air, these air-cars handled the train all right on the level, but when I went to head in down a sixty-four foot grade, "I got left." I went by three or four car lengths. When I got in on the side track I set air and went back and looked over these brakes myself, and I found that five out of thirteen brakes I could move with my foot against the brake shoe (the brakeman told me these brakes were all right after trying air at division), and as these air-cars were all empty and loads behind, the remaining brakes would not hold the train.

Sometimes we will get five or six cars of air that will handle a train anywhere, so we will say we will start out with enough brakes to handle a train and one-half of these brakes are not in good working condition, brakeman says every brake set, that is every piston went out, "you see the man that is handling them is the one that is responsible if anything happens."

Suppose Mr. M. K & T. was coupled onto twenty cars of air with a train of thirty loads behind him. After leaving division station the first station was a bad place to go into, and he had a good opportunity of trying air to see whether it would hold or not, and did not try it, and suppose he got by this station and was going down a fifty foot grade and "strikes a short flag," to use a railway phrase, and he goes after the emergency and finds that it will not work, for some one has turned the stop-cock behind the second car. I think Mr. M. K & T would rather have run the risk of breaking in two and tested that air a little at the first station.

*Creston, Iowa.* D. B. HUTCHINS.

### Unsatisfactory Experience with Hollow Stay-Bolts.

*Editors:*

I see in the March number that James Heron approves of the hollow stay-bolt. I have had quite an experience with them and cannot report so favorably.

The road on which I am employed use hollow bolts exclusively, and a short time since we put an entire set in a boiler. After the bolts were cut off and we commenced to head them down, we found some of them split on the end. Ten of them were taken out and found to be split from end to end.

When hydraulic pressure was applied, six more showed leaks at the center hole and were taken out, they too, were split.

We have taken out as high as seventy-five broken bolts in an engine in one month, we always increase the size when renewing—take out a ⅞-inch bolt and put in a 1⅛; we have used some as large as 1¼-inch, these also break. How large will we need to use to insure against breakage.

It is claimed that hollow bolts are more pliable or flexible than solid bolts. We have put solid bolts beside hollow ones and the hollow bolt broke first.

Now, don't say we can't tell a broken solid bolt—we can. I have an inspector that can not only tell when a bolt is broken but when *half* broken.

T. A. JAMESON.

*Knoxville, Tenn.*

[Perhaps the hollow bolts used are of the kind made by welding one piece of pipe inside another, or the "worse yet" kind consisting of two pieces of half-round iron, with a groove in the flat surface of each, welded up, and not the mandril roll bolt. We should like to publish the method of that boiler inspector—so far as we know, stay-bolt inspection is a very uncertain business.]

### Some Common Things You Ought to Know. Do You?

*Editors:*

1. Why is it that the quick-action freight triple has a threaded exhaust port on each side of triple-valve casing while that of passenger has only one?

2. Why is it that W. A. B. Co. forbid the use of freight triples in passenger service and *vice versa*, while at the same time freight train-pipe is larger than that of passenger; under such conditions, why is the freight train-pipe larger?

3. Why is it that, when making an emergency application with empty engine, or train of one or two cars, using the equalizing discharge-valve, that the black hand on the gauge will drop back until the handle spring passes the service notch and opens emergency port, when black hand will rise and indicate a pressure of from 45 to 50 pounds (from original pressure of 70 pounds) when train-pipe should be empty? W. T. HAMAR, R. F. E.

*Atlanta, Ga.*

### Some Remarks on the Care of Air Pumps, Swabs, Metallic Packing, Pounding, etc.

*Editors:*

There is one thing about the air cylinder of a pump that is seldom spoken of or taken into consideration, and that is the fact that they wear larger at the ends. This causes the packing rings to contract and expand at every stroke. When you find an air pump in this condition it requires more oil than one that has a good true cylinder. So I find air pumps are just like sick people. They require different kinds of medicine and methods, and also at the right time, for if an air-pump is not treated right it will get worse all the time.

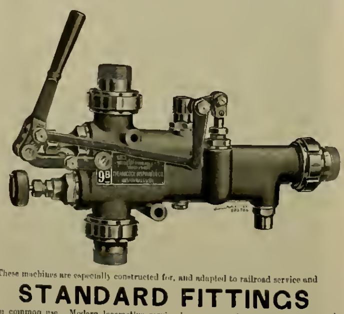
Now about swabs. Nearly all air-brakemen say to put a swab on the piston-rod, but the way most engineers put them on it does not touch the piston-rod but very little, and the swab just lies on the edge of the lower packing nut, and, of course, does the piston-rod very little good. But if instructors would caution air men to make it a close fit to the piston-rod, it would then do some good when it is oiled, and especially is this the case with air-pumps having metallic packing. I find metallic packing is one of the best things connected with air-pumps when properly taken care of; but it has one great disadvantage, and that is it makes a great many engineers very careless about their air-pumps, and they seem to think because a pump has metallic packing it does not need any care, and they will run it without oil until something gives way, which is an every-day occurrence on most roads.

Now about pump-pounding. Of course we all know there is different reasons for it, but there is one point that is very little said about and that is very badly constructed frames, or when the frame gets loose or the pump loose on the frame. This will cause an air-pump to pound in a great many cases, when by making everything fast it will run smoothly.

Another thing which some would-be smart men do, and that is putting in a common check-valve in the discharge-pipe. This is one of the worst things that can be done, and it should not be allowed on any road.

There seems to be a great deal of trouble





with the check-valve in the W. A. B. quick action triple on account of the seat getting very rusty, which is cast-iron. Why could it not be made of brass so as to avoid a great deal of this trouble?

Another thing, how would the air-brakemen expect engineers to handle the improved equalizing discharge-valve in the release position when it has the excess pressure valve attached. If it was left in full release all the time there would be a constant blow from exhaust port from the small detect hole in the rotary-valve. I mean men that do not know how to handle the brake-valve in running.

*Houston, Texas.* TEXAN.

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### Making Irish Mileage.

*Editors:*

An inspector had to speak to a driver of a shunting engine in one of the colonies about the mileage being too small on his daily report sheet, and that he would have to show more. "Faith, sor, I can't do that, for, begorra, every mile I travel goes down on the sheet."

*Inspector.*—"Well, if you can't show more mileage I will put some one on her that will, so let me have more mileage on your sheet to-morrow."

After the inspector departed, the driver of the shunting engine got to racking his brains how to do it. After thinking a long time, said, "Be jabers, mate, I have it. Whin we are done shunting for the traffic, you get down and oil the rails and I'll make plenty of mileage for that blankety blank inspector, sure." And he did make plenty of mileage that day; he showed so much that the superintendent had him up on the carpet before him and wanted to know how he had made 200 miles on a shunting engine in 8 hours. He told him how he made it.

"Well," says the superintendent, "you can now go and act as driver of a wheelbarrow at the ash-pits, and see what mileage you can get out of the barrow."

THOMAS HAYS.

*Wickham, Sydney, N. S. W.*

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### Government Inspection of Locomotive Boilers.

*Editors:*

Another one of those inevitable accidents has happened on the K. & G. road. Engineer Ben Wheeler's boiler is sailing up among the clouds, and his fireman has gone to the happy hunting grounds, the hostler is laid up in the hospital for repairs, while Mr. Wheeler is at his home in the care of the doctor, caused by the sudden demise of this particular engine boiler. I often wonder if all the M. M.'s realize how much responsibility rests on them, and them alone, in the eyes of the public.

And then again I wonder does the public realize how the M. M. is held down by his superior officers, and then I wonder how long our great and glorious country will allow things to be thus on railroads.

I just imagine I hear people, and especially our Congressmen, say, "What has the government to do with this question?" I say they have all to do with it, and I will explain how and why in my humble opinion this is so.

I need not go any further than the Marine laws, they are strong and will cover the management of railroads as well as they do steam vessels. A vessel can not run without a licensed crew and they must be licensed by the United States Government, so I say that on a railroad no train should be moved without a licensed crew and management.

I claim that the general government should appoint inspectors of the boiler and car and bridge and track departments for each State. Those inspectors should be paid out of the money that each State takes in from taxes—do not make the railroad companies pay this, as they have enough to pay running expenses and if they are forced to pay for motive power and car and track and bridge inspectors they will find some trouble to get a dividend.

I claim that each State should be forced to take care of the traveling public, even if it does cost them a little money, for what is money compared to life and limb. All these appointments should be made in the same manner as Marine Law appointments are made.

Do not understand me that I want the government to take charge of the roads, for I claim they have not the right to do that, but they have a right to see that they are properly managed, and that the rail road company uses the proper material and keeps the road in proper condition for the safety of the public.

The public includes everybody, not only the traveling public but people living close to a railroad are always in danger, also the people along the track and at the depots.

I think all this danger could be lessened at least one-half by good inspectors. The inspectors could cause the companies to keep their engines in good order also their cars, track and bridges, the same as vessels are kept. If I should live to see this made a law and enforced I think I could cross the dark river happily, but all our Legislatures and Congress think about concerning railroads is rates and a commission to enforce them, and life and limb seem to be an after consideration.

The government does not own the steamboats, but they do own the streams they run on, so they own the land the railroads run on, and thus they have a right to act in this matter as a great protection to the traveling public and the public in general.

As regards these blow-ups, do not understand me that there was anything wrong with the boiler, but I do say that the general government of the United States does not know any more about it than I do, but perhaps if they had inspectors it would not have happened—and yet it might. It is getting so of late years that it is about as much as a machinery officer's position is worth to condemn a boiler; it matters not how old it may be, he must patch it up and keep it going regardless of the danger.

I would bet you anything, if locomotive boilers were inspected as closely as steamboat boilers are by the government inspectors, one-third of the boilers would go out of service, one-tenth of them would not be received from the building works.

If this ever becomes a law, God help the sawmill man with his tram roads to haul logs. Nine-tenths of them would have to hunt up and feed their old oxen and haul logs as they used to do.

State laws are no good for this. It must be by the General Government, so that it will cover each State.

Furthermore, this would break up the blacklisting of employés. General managers, superintendents of transportation, superintendents of motive power and machinery, superintendents of cars, train dispatchers, engineers, conductors, brakemen, roadmasters, track bosses and superintendents of bridges should all be licensed.

Now, will somebody take this up and tell me why it should not be done, and show me where I am wrong, as I am open to conviction and will be pleased to have this discussion pro and con.

YE OLDE RAILROADER.

*Ft. Worth, Tex.*

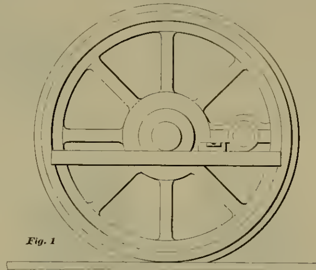

*Fig. 1*

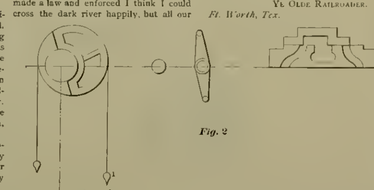

*Fig. 2*

### Another Plan for Locating Eccentrics Before Wheels are Under the Engine.

*Editors:*

I see inquiries made concerning the keying on of eccentric sheaves or cams before the wheels were placed under the engine.

I never worked in but one shop where that was done, and then only occasionally for the instruction of the apprentices.

After the wheels were on the axle and the pins in, they were placed on a pair of trestles that were perfectly level every way.

Then, with a pair of dividers, scribe a circle on each end of the axle the size of the shoulder collar of the corresponding pin

Now bring one of the pins to a nearly horizontal position with the axle and place a straight edge on the collar of the pin, and the edge of the circle on the axle (Fig 1) and then with a spirit level bring the straight edge level, which will bring the pin to the center on that side.

Now, be sure and clamp the wheel firmly in this position, and then put the eccentrics on the shaft

Then get a sheet of heavy wrapping paper or tin and tack it on the floor immediately under the eccentrics. Now, with a pair of plumb bobs, mark off the extreme travel of the eccentric (*a* and *b*, Fig. 2), and then with a pair of dividers find the center of the travel (*c*, Fig 2) on the side *next to the pin*.

Now set the dividers to the amount of lap that the valve has and the lead that you want and mark it out from the center (*c*).

Then bring the eccentric around until the forward plumb bob (No. 1, Fig. 2) comes to the last or lead mark and mark the eccentric ready to cut the key seats; the same operation will set any of the eccentrics with the exception that strict attention must be paid as to which side of the horizontal center the throw of the eccentric is.

I always set the pin so as to represent the forward center if the wheels were under the engine, and then the forward motion eccentric would be above the horizontal center and the back motion below it.

*Ft. Howard, Wis.* MECHANIC.

### Making Small Tools in Railroad Shops.

*Editors:*

I cannot see why it is that people who have a hobby cannot ride it without ridiculing or blackguarding other folks. Before this, as you know, I have felt called upon to censure writers in the LOCOMOTIVE ENGINEERING for their tendency in this direction I do not care to pose as the great and only champion of the machinists of the United States, but the writer of your first article in the March issue has aroused my ire by his superfluous and entirely unnecessary strictures on the tool-making machinists of the railway shops. Why "ostentatious inspection," and why assert that "then they are threaded with no particular degree of accuracy." Does your contract tool-maker think that his brother is a fool? It is useless to quote from this article. Every sentence almost is a slander on machinists who dare to make a tap, or die, instead of buying it ready made. Now while I am ready to admit that you may buy a ready-made article cheaper than you can make it, it by no means follows that it is better, or even as good. Some of the worst taps and reamers I ever saw were the product of a specialty concern, and I have seen some twist drills that might have been originally designed for taper reamers; and as a rule I believe railroad tool-rooms do not attempt to evolve the twist drill. But then I am charitable enough to allow that this sad state of affairs in the product of the specialists was due to the "stupidity of workmen," or something got wrong with the "most approved furnace," or mayhap the cheap man running four machines, making four small taps at one time, failed to thread them with the "proper degree of accuracy," or it might be the "reliever" had a jag on, and gave one too much relief, the other possibly not enough. Men are but human, whether they make tools for a manufacturing firm or a railroad company

There is another great drawback about buying your tools ready-made, and that is the purchasing agent. After this functionary has interpolated his fine Italian hand the master mechanic wishes he had stuck to his own "deliberate" tool-maker.

I remember a requisition I once sent in for a set of taps and dies, and, shade of Whitworth, I wish you could have feasted your optics on those tools when they came. The die plate was nicely wired to a nice board with rounded corners and covered with nice green paper (the board I mean), then the taps were wired to the board at one end, and the dies ditto at the other end. There wasn't a plug tap in the outfit. It was just the kind of a layout to make the heart of a country blacksmith burst with pride. But why a railroad should be

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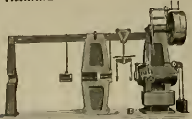

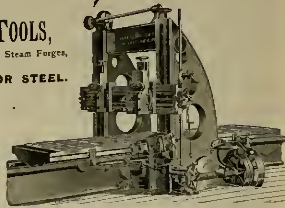

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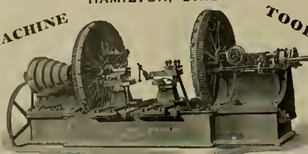

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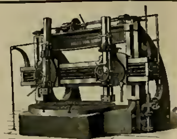

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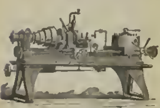

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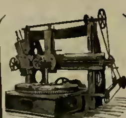

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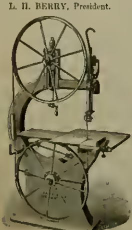

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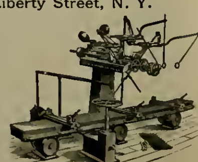

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called on to pay for that class of tools I am unable to say, except that the purchasing agent thought he was getting them cheaper than the incompetents employed by the railroad could make them.

Now I have no objection to the men who make tools to sell holding their business up in every legitimate way, but it is manifestly unjust and unfair, to charge that anybody outside of specialty shops cannot make a good tap or die.

*Nashville, Tenn.* W. H. Wesley.

[There is doubtless two sides to this question, and, on the machine shop side the interference of the purchasing agent is the largest and most important item to be dealt with. When the man in charge can get what he orders, in the way of small tools, we believe it better and cheaper to buy, and that by so doing more uniform work will be done. The specialist shop is much better fitted than the railroad shop for making taps, dies, etc., as the railroad shop is better fitted than the tool shop for repairing locomotives.]

### Curious Performance of a Cylinder Bushing.

*Editors:*

Some two years or more ago, when I was connected with the D. & R. G. road at Denver, Col., we had a peculiar thing happen to an engine that just came out of the shop.

The Rio Grande company have no foundry of their own, and when a cylinder gets worn too large we bushed them, as I find a great many other roads are doing.

The engine I have reference to is a narrow gauge consolidated with cylinders, when new, 15 x 20 inches; we let them run without bushing until they are worn out to 15⅝, then we bore them out to 15¾ and put in a bushing and bore that out to 14½, this makes the bush ⅝ thick when finished.

Before we put the bushings in we cut out the port holes and leave the bush ½ longer than the cylinder; this we face off when we bore out the bushing.

The bushings on this engine went in tight, and was what we called a first-class fit, it was bored out and counter-bored, and counter-bored for the cylinder heads, so that the heads had $\frac{3}{16}$ of an inch bearing on bushing and ⅛ on the cylinder. These joints were scraped and ground in.

The engine went out and was broken in all right, as far as we could see. She left our shop, however, and went down the road and made only one trip, I believe. The engineer that run her on this trip, when he returned he reported cylinder cocks on left hand side to be fixed; then he went to the roundhouse foreman and told him there was something wrong with that engine, and he wished he would come out and have a look at her. He said her valves were out terrible, and were getting worse all the time.

The foreman got on her and hossed her up and down the tracks a few times and sent for a machinist to come out and take off left-hand front cylinder-head. The foreman knew there was something wrong, for every other exhaust was very faint. When cylinder-head was taken off they found that the bushing had turned in the cylinder far enough to almost shut the ports off. Of course they sent the engine back to the shop, and we had a time to get that bushing out, we could not press it out with a common screw-jack, and had to break it in several pieces to get it out.

Now, what I want to know is, what was the cause of the bushing turning?

Some say, how could it turn with the cylinder-heads bolted against it with a $\frac{3}{16}$ bearing on each end? It is very easy to see why the heads will not hold it, for in screwing up the nuts on cylinder-head studs it is natural for a man to screw them just about as tight as they will stand, and this will throw your bearing all on the outside edge of joint, which is all wrong. With a good joint a man can pull it up plenty tight enough with a 12-inch monkey-wrench. After this happened we put a ½-inch plug in each end of cylinder and have had no trouble since. Fred. S. Hill.

*New York.*

### Tools for Blacksmith Work—Labor and Machines—Material and Its Uses.

*Editors:*

It requires experience and close observation to become acquainted as to what kind of iron or steel is best adapted to the condition of things, or the requirements of the work it has to perform.

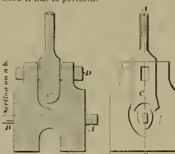


Fig 1 Fig. 2

Iron and steel is often subjected or under the influence of causes not always taken into account.

Now, there are times that the best experiments are those in actual performance in distinction from theory. Of course all mechanical writers, especially those of a scientific turn of mind, tell us that there is no opposition between theory and practice, which I take for granted.

Therefore, in selecting iron or steel for any specific purpose, there are considerations that should be taken into account as regards the relations that the different parts bear to each other, co-ordinate in a measure.

For example we will take the brake appliance of a passenger car, top rod, bottom rod, brake lever and fulcrum; now, the "lastingness" as well as the performance of the brake appliances, are dependent or subject to the support of the fulcrum, which must keep the top rod, and more particularly the bottom rod and brake-lever, from falling, as well as co-operating to secure a result as an auxiliary force.

As the brake appliance is subject to a force that is transmissive, communicating force from one part to another, and all depending or each individual piece, the question arises, What kind of iron is suitable for this particular case? In my opinion, iron that will bear a tensile strength of 45,000 pounds per square inch is sufficient for the top rod, brake-rod and brake-lever, on account of the force exerted being in a great measure direct, but would recommend that the material used in the fulcrum, on account of sudden variations, shocks, and its indirect operation, should be selected from the best grade of iron, iron that will bear a tensile strength of 76,000 pounds to the square inch. Swedish iron, I think, has an advantage over other iron in this particular case, on account of its possessing enough flexure to withstand any transverse stress it is liable to be subject to.

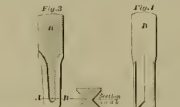
Now I expect some of my critics will ask why not increase the dimension of fulcrum or change the mode of construction. In one case it will impair the strength of a wooden brake-beam and in the other it may necessitate too much labor. I have in view a fulcrum that weighs six pounds and can be forged at one heat and will endure the application of the brakes in any way without breaking or yielding. I merely bring this subject under thought as an illustrative case. I might group a series of subjects more vital to the objects in view for there are many of them, and as I do not wish to invade the propriety rights of superiors, those that are "higher up," and as these are questions rather abstruse I will leave them to those possessed of a more refined mathematical or mechanical investigation.

Of course blacksmiths have no prescribed rules as a guide, consequently they must depend in a degree on experiments from which conclusions may be drawn. When rod brasses wear so as to change the proper distance from center to center of brass bore, it becomes necessary to insert liners in order to take up the lost motion and bring the rod back to its original length. Now, it is a very common practice to cut these liners regardless of the direction of the fiber or grain, which should lay in a cross direction, or in other words, the rod key should run in a direction across the grain or fiber of the liner.

By exercising precaution in this respect a great deal of trouble can be overcome in preventing the liner from dividing lengthwise or suffering disruption.

The same principle should be observed in the rod-strap in order to make it serve the highest good. In forging a rod-strap care should be taken to keep the fibers intact, the fibers should not be severed, but should run around the strap.

In forging a rod known as the solid-ended rod, the grain of iron should be so disposed to offer the most resistance to



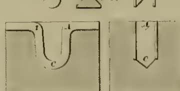


Fig 5 Fig 6

working strains. Although the methods employed in accomplishing these results occupy longer time than the "cutting-out" process, the advantage is well worth all the difference in cost, besides the confidence in knowing that the forging is every way satisfactory.

When we take into consideration the high rate of speed of locomotives on express trains, it behooves us to take into account the material and mode of forging.

Among many men there is a prejudice against labor-saving devices. Some imagine that the increasing use of labor-saving tools operates against the labor market by reducing the demand for hand-labor. How often the remark, "You are killing the business."

Now this is a natural but an erroneous opinion of the subject. Those nations which use the least tools are the most belated and less progressive. Those nations which employ the greatest variety are the most intelligent and progressive, have more of the comforts and good things of life, their hours of labor are shorter, wages are higher, thus signifying a superiority over their less progressive brothers. And so we find compensation wherever hand or manual labor has been supplanted by labor-saving inventions. Tools are evangelizers. "Commerce has done more for man than missionaries," not to undervalue missionaries. It is tools from the simple to the most complicated that makes social life first possible, then feasible and progressive.

The most careless observer cannot fail to note the new methods that are brought into use for the purpose of facilitating the mode of performing work. Even the grim-visaged and smutty-looking disciple of Vulcan is becoming imbued with the inventive spirit, at least so far as lessening the difficulty of his labor.

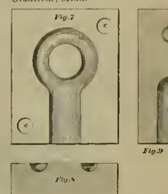
Figs. 1 and 2 represent a device for bending switch rope thimbles, rings, etc. The tool is made in parts in order to get the work off after it is bent or formed. The tool is held together by means of key bolt *a*, and key-bolt *a* is secured by key at *b*. The work is firmly held in place by clamp *C*, which is tightly drawn against the work by key *D*. To relieve the work from tool, drive out key at *B*, then drive out key-bolt *A* and key *D* which separates the tool, and the work can be taken out. Fig. 2 shows top of tool taken off.

Figs. 3 to 6 represents a tool for bending switch chain grab hooks and the like. After the hook is forged up to the bending point it is placed on tool at *A*, with the square on a diagonal vertical position, and the follower *B* is placed on the work in a perpendicular line from *C*, the hammer descending on the follower, thus bending the hook, preserving and keeping the corners intact.

Figs. 7, 8 and 9 represent the lower or bottom tool for forging the eye of a switch-rope hook, the upper or top tool being a counterpart provided with pins for guidance through holes *C C*. In making this tool it is well to provide for the work to be enveloped as much as possible in the bottom die, so as to prevent the work from clinging in both dies. The corners around the impression should be full and sharp with the surface of dies, and the bottom die should be at least ¼-inch deeper than the top, thus possessing two essential features, one is it will relieve the work more readily, and the other is that it will shear the fin by reversing the work. In preparing the work for the switch hook-eye tool, the work is drawn down rudely to the form and a hole punched for the eye under the steam hammer. The next operation is in a preparatory or roughing-out tool similar to Figs. 7, 8 and 9, after which it goes to tool as sketches 7, 8 and 9.

The bending operation of switch-hook is performed in a tool similar to Figs. 3, 4, 5 and 6. Geo F. Hinkens,

*Gladstone, Minn.*



### Excess Pressure and Gauge Tricks—Two Things that Relyea Wants to Know.

*Editors:*

A short time ago an engineer reported to me that he could get no excess pressure, and thought that the rotory valve or engineer's valve wanted facing, so I took out the valve, faced valve and seat, ground in the feed-valve and put the engineer's valve on again and tested it. I found that the rotary-valve was tight and put the handle in running notch to get the excess pressure, but didn't get it; then I thought perhaps the seat of the feed valve might be worn out of center. (To remedy such things I have a reamer with the shank the size of the feed valve, and in order to keep it central, I take a feed-valve cap with the hole drilled through, this I slip over the reamer, and screw it into the engineer's valve and ream the feed-valve seat out. This cap or sleeve fits the shank of the reamer close and keeps it central.) After I reamed the seat and ground in the valve, I could not get the desired excess pressure with handle in running notch, but when by accident I pulled the handle between running notch and lap, I noticed the red pointer kept moving up while the black pointer stood still. Now, I "began to

smell a mice," so I kept the handle in the position above mentioned, and after the red pointer had gained 25 pounds the black pointer began to move up. I stopped the pump and watched the gauge for several minutes, and it retained the 25 pounds all right. I repeated the operation several times with the same results. What was the trouble with this valve?

We can hardly call this a puzzle, it is so simple, but I thought if it bothered me it might bother others of less experience, so I thought it would be well to let the boys study on it for a while.

Here is a conundrum an engineer gave me the other day. He said when the reduced train pressure for a slow-up the black pointer would drop to zero, and then when handle was brought back to lap the pointer would go up very slow to within about 5 or 7 pounds of original pressure, or, in other words, the pressure would be reduced about enough to make an ordinary stop. The gauge was all right. Now, what caused the pointer to drop quick from about 70 pounds to zero, and then move up slow to about 65 pounds?

*Syracuse, N. Y.* W. F. RELYEA.

### Nuts for Machinists to Crack.

*Editors*:

I would like to know why it is that the cylinder next to the saddle under the steam-chest gasket is always worn so much more than the other three sides. Invariably this is the case with all locomotives which I have ever noticed.

Will the tram marks on valve-stem show the same after running engine all day as they did when valves were set previous to breaking-in? MARX.

*Frankfort, N. Y.*

### Who Knows the History of the Cork-Legged Pioneer?

*Editors*:

In 1848–9 there was an engine named the "Pioneer," the first one to run over the Vermont Central from White River to Montpelier. I think it was English built and a venerable looking old scrap—the boys called her the "cork leg." Do you know what she was and where she went?

*Turner, Ill.* JOHN WEST.

### Why Engineer's Valve Should be Kept in Running Position.—Air Brake Kinks.

*Editors*:

In reply to "Nypano's" question, "Is it dangerous to run without excess pressure or without handle in running position?"

With brake handle in release position air has direct passage from main reservoir through supply ports of brake-valve to train-pipe, and pressure in main reservoir and train-pipe will remain same, say 70 lbs. If a hose burst, the brakes are emergency applied by loss of train-pipe pressure, and without doubt, part, if not all, of main reservoir pressure will be lost. The brakes cannot be released without bleeding or enough air has been pumped up to knock them off, making a longer delay; and delays are dangerous to rear ends of trains now-a-days. In emergency application, say train-pipe pressure is used up, the brakes cannot be as readily released with the 70 lb. in main reservoir as if the excess, or 20 lbs. extra, had been added to it by carrying brake-handle in running position.

For ordinary stops, if user desires to make several applications for a stop he has more pressure to release the brake and recharge the pipe with than without.

What would be quickest way to release brake after a hose is burst, or anything occurs where train-pipe pressure with part or whole of main reservoir pressure is lost by having brake-handle in release position and the pump is the only means of releasing? In running position communication is stopped between main-reservoir and train-pipe through supply-port, but is opened through a very small port, called the feed-port, to feed valve held in place by feed-valve spring, having a resistance of about 20 lbs.; this keeps an excess pressure in main reservoir, and when valve opens, port gives communication to train-pipe, supplying what may leak off and equalizing pressure above and below piston 17 in brake-valve.

I see numerous mention of oiling air-pump (both cylinders) with different oils, to prevent their being gummed up and causing other injuries to valves. I do not see where any one has tried kerosene on a refractory pump. Don't mean to use it wholly, but occasionally worked into both cylinders, giving it a chance to go through brake and triple valve will help to keep the parts from being gummed up. Or would you be afraid it would catch fire, as one engineer said it would, when he was finding fault about his pump, and I told him to try that. One pump would not raise over 40 lbs. pressure, either working slow or fast, and would keep catching and jumping. I shut off steam, put perhaps three large spoonfuls of kerosene in top of air cylinder, emptied oil cup and put some in there, letting it into pump; started it lightly so as to give oil a chance to work around it good, then stopped it again. Filled oil cup about a third full of kerosene, balance with valve oil, and put about a teaspoonful of valve oil in top of air cylinder with some kerosene on top, started up pump carefully, and in a short time the pump was working good and had 75 lbs. pressure. When oil cup did not feed good a little kerosene has improved it as well as the rest of attachments, and I do not know of any harm in using it occasionally.

A good many engines here are equipped with Leach's sand-feeding apparatus that works good, but sometimes they work too much. The air to blow the sand is taken from main reservoir pipe inside of cab, before reaching the brake-valve. On some, when air is used to blow sand, the brakes are gently applied, making its use unsatisfactory. Can any light be given on it?

*Troy, N. Y.* INQUIRER.

[Air for the sand jet should be taken from the main reservoir pipe to engineer's valve, then no trouble is experienced.]

### An Association of Air-Brake Inspectors.

*Editors*:

I think that Relyea's proposition in the January number concerning air-brakemen forming an association is a move in the right direction and would receive my ablest support. I would like to hear through the columns of LOCOMOTIVE ENGINEERING what is an air-brake *expert* as referred to in Art. 3, Sec. 2 (c) of the constitution of the Traveling Engineers' Association. W. J. SHREVE.

*Ft. Howard, Wis.*

[The Traveling Engineers' Association consider men who have charge of air-brake equipment as *experts*—men who instruct the men or are in charge of the brakes on a road or for a brake company.]

### Foreman Blacksmiths' Association.

*Editors*:

I note with interest the editorial on traveling blacksmiths, and also the letter from Mr. Thornton, traveling blacksmith of the N. P. R. R.

It was somewhat of a surprise to me to hear that there was such a man employed on any of our railroads—which is certainly necessary, and has been for many years.

If a competent man is appointed he can save the company more than his salary will amount to in material alone.

And it will have a tendency to have our steel manufactors put a better grade of material on the market, which must be done in the near future; and an organization of foreman smiths ought to be a great help in getting a better grade of material in the market.

If the editor will give me room in the May number I will have a letter in on iron and steel, a subject to which I have devoted a good deal of my time for the past two years, and which is something that all smiths ought to devote more time to than what they are doing, and not allow something to come along that is composed of just three things—pants, shirt, collar and cheek—and make him believe that the steel or iron that he represents is the only kind made. W. G. LOTTES.

*Madison, Wis.*

### For the Foreman Blacksmiths' Association.

*Editors*:

Mr. J. J. Thornton, traveling blacksmith N. P. R. R., says: "What is the matter with an organization of the foreman blacksmiths of the different locomotive shops of this great country?" The suggestion is a feasible one.

Organization is in the air. Almost all branches of the railroad departments have an organization. Why should the blacksmith department stand to one side, while others are forging to the front?

Such an organization as Mr. Thornton suggests would be a school wherein members would get new ideas, learn all about new methods and improvements in blacksmithing, to say nothing of the literary part of the work, which would make them better writers and talkers.

I think an organization of blacksmith foremen would perfect the utility of the shop. No one shop excels in all things; each shop can give some useful lessons to all others, and by a mutual interchange of ideas we can gain valuable information.

I know there are some blacksmith foremen who have an idea that they are so far advanced in their calling that they need no lesson from any source. This is a mistake which will be corrected in an organization of this kind.

It is to be hoped that a great many of our wide-awake blacksmith foremen will give this matter their consideration.

I, like my brother craftsman, Mr. Thornton, would like to hear from some of the blacksmith foremen through the channels of LOCOMOTIVE ENGINEERING. I would suggest that some one outline a plan for organization. GEO. F. HINKENS.

*Gladstone, Minn.*

### Why Not Use Something Else than Key for Eccentrics?

*Editors*:

I watched with interest the answer given in March issue of LOCOMOTIVE ENGINEERING in regard to setting eccentrics before wheels were run under engine.

Unless the locomotive department on any road gave an imperative order to have their eccentrics keyed on shaft, it would almost seem like fooling away time to try to set them permanent, for seldom they would be found right when you come to run engine over, especially on repairs.

In shop where I served my apprenticeship and laid out work for new engines, we set our eccentrics on new work before engine was ready for the wheels, and very seldom had to move one afterward.

We got the extreme pitch of eccentrics by drawing line from center of bore to center of eccentric. We drew lines on shaft quartering each way from pin, set pitch line on eccentric ⅛ of an inch, measuring with dividers toward pin.

This would hold good where you have a 7½-inch shaft, 5½-inch throw of eccentric, ¾-inch outside lap of valve, 4-foot 10-inch radius of link, $\frac{3}{16}$-inch off, set to rocker-arm, and $\frac{5}{16}$-inch to link-saddle, and you would want from $\frac{1}{32}$-inch to $\frac{1}{16}$-inch lead.

It takes so little to throw motion out either on lead or cut-off, that I think it almost impossible to get a rule you could swear by, for there is such a wide difference in opinion in regard to motion-work, and any little kink in the motion might cause you to move eccentrics, and if keyed on, would be troublesome and expensive.

In holding eccentrics in place, why not use a feather or flated key, as they are called, if properly fitted up, an eccentric-strap will burn up and break before eccentric would slip. What more would one wish for? Besides they can be adjusted any time and save the expense of cutting key-ways in driving-shafts.

CORY S. CONCANNON.

*Hannibal, Mo.*

### Puzzling Brake Behavior—Two Questions.

*Editors*:

What causes quick action to take place when a service application is being made? I understand that a weak graduating spring, broken pin in graduating valve, defective slide-valve, or gummy piston (in engineers' valve) are causes of this trouble, but they were all examined and found to be in perfect working order. The trouble, therefore, lies somewhere else, and I trust you will give the readers of your paper an opportunity to solve this and the puzzle below.

While inspecting a train of five cars and engine and after signaling the engineer to apply brakes, 20 lbs. reduction, and seeing that everything was in good condition gave signal to release, at which time I was standing near the tender. I noticed that the brakes on the cars came off immediately, but tender brakes did not. It took about 10 lbs. to release them. What was the trouble with the brakes on that tender? The triple was examined and was found in good condition, in fact, it is a new one lately put on.

J. V. K. WALKER,
Air-Brake Inspector Seaboard & Roanoke
*Portsmouth, Va.*

### Why that Injector would not Work.

*Editors*:

Please insert the following in answer to injector problem. May refuse to work from one of the following causes

1st. By a small piece of dirt in combining tube.

2d. By supply-pipe being partly frozen, thereby reducing supply below that necessary to condense steam.

3d. By the pinch-clamp that encircles combining-tube having slipped, which is not easily detected. For the reason that the lever pulls the clamp at an angle to the tube, which has a tendency to bind it tight. But by tapping with the hand it manages to get far enough to prevent its working. R. BACHMAN.

*Beaver Meadow, Pa.*

*Editors*:

Replying to C. L. Dennis' Injector Problem, page 133, would like to know if his injectors worked after he examined tank to see if water-supply was sufficient

I have noticed this winter if many delays occured so that tank was not opened or refilled often, the injector would not begin to supply the boiler with water the same as it would on warmer days.

On one of the coldest days we had this winter, sidetracked to meet two trains, the result was, before we could get away, had three more to meet. Water-tank at end of siding we entered on, so tank was filled. Had to saw by these other trains, and when working the injector, it would sound as if strainer was stopped up or tank empty until the tank was refilled again. Before leaving, at 6 P. M., they operated all right for awhile About 8 o'clock refilled tank and made preparations to return, did not get started for nearly three hours (left injector, went on a strike), and then, after about a mile, the right one began to chuckle and finally broke, but started immediately and broke again.

After starting I pried up manhole cover, which was frozen down tight, and found over half tank of water.

The injector now began to work all right and did not bother any more that

trip, for refilled tank three times in fifty-two miles.

Same engine was cut out shortly after for failure of injector on a very cold day, claiming tank was dirty, filling strainers so with dirt they would not work after tank was about half empty. But it was not so, and I think it only by chance I did not have to drop her fire, for was seven miles from water.

Have often wondered at the cause, and last evening, while looking over some of back numbers of LOCOMOTIVE ENGINEERING, I found on page 3, July, 1888, the following, and what I think is a clear solution to the injector problem. "In extremely cold weather injector will often refuse to work, because the manhole cover on tank has frozen down solid and a vacuum is formed above the water in tank." Remedy given "Put on heater for a few minutes and break cover loose." INQUIRER.

*Troy, N. Y.*

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*Editors:*

In answer to Mr. C. L. Dennis' question regarding failure of injectors to work, would suggest, he found manhole of tank frozen up, making tank air-tight.

In absence of sufficient atmospheric pressure on water in tank, injector could not get water enough. M. M.

*Dennison, Tex.*

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THE ANSWER.

*Editors:*

The following is the answer to injector problem I sent you. The lid on tank froze making tank air-tight, therefore injectors could not get any water. Soon as tank lid was opened injectors worked O. K.

C. L. DENNIS.

*Houtzdale, Pa.*

### Why Those Air-Valves Break.

*Editors:*

In answer to the question why valves break, would say they may break from one of the following causes:

1st. By trying to induce pump to make as many revolutions or strokes as the engine while running at a 40-mile gait.

2d. By too much lift.

3d. By not being heavy enough in the wings to withstand the jars to which they are subjected.

4th. By the uneven movement of the pump, which increases the jars. That is, it makes the up-stroke more rapid than the return, and *vise versa*.

ROBERT BACHMAN.

*Beaver Meadow, Pa.*

### Emergency Application.

*Editors:*

In answer to J. S., Moncton, N. B., in February number, you say, "Something kept piston 17 from forcing its valve to a seat, probably gum or dirt." Air-brake men here say the valve is designed in such manner that volume of air discharged in making service application is not sufficient, nor is it intended to cause emergency application. How, then, can the failure of piston 17 to return to its seat cause emergency application? E. T. GRAY.

*Hopewell, Idaho.*

[It is not intended that the sticking up of valve 17 will cause an emergency application, yet it sometimes happens, especially with the first of the new equalizing and discharge valves turned out, more of this kind of trouble is caused trouble in one of the triples.]

### Do Our Side Rods Use Up 800 Horse Power of the Locomotive?

*Editors:*

The March number of *Engineering Magazine* has an article on "Increased Speed in Railway Travel," by Mr. W. Barnet Le Van, which contains many startling statements to say the least.

We have a small number of engineers among us who affect to see good design and merit in the British type of locomotive only, and to this class the writer of the article in question evidently belongs.

A comparison of speed between American and English practice which does not take into consideration all conditions is unfair to Americans. Given a perfect road-bed, double tracked between termini, with grades and curves inappreciable and an absence of grade-crossings, any railway company in this country would schedule quick time, and would make its schedule. If we go farther and have track so thoroughly patrolled that the headlight is dispensed with, we have ideal conditions for fast running. The British roads have these conditions, and in consequence make faster average time, perhaps, than is scheduled by American roads.

It is a mistake, however, to give them credit for the quickest long runs. The fastest trains in Great Britain (regular) run between London and Edinburgh, a distance somewhat less than from New York to Buffalo. Their time is an average of 52 miles per hour. The Empire State Express, between New York and Buffalo, on the New York Central, is 52½ miles per hour.

The writer recently rode from New York to Albany on the Empire State Express when remarkably fast time was made. For some reason there was delay in the block before Yonkers was reached; we passed the station at Yonkers at precisely 9 o'clock, and at 11 15 we were on the Albany bridge, giving a sustained speed of 56 miles per hour for a continuous run of two and one-fouth hours. During this run there were occasional "slows" in anticipation of signals.

So far as the motive power was concerned there seemed to be no reason why this run should not be made daily.

In England people pay for the luxury of fast riding. The Empire State Express, which is the fastest long-distance train in the world, is compelled by law to carry passengers at the rate of two cents per mile. If there were no demand on the N. Y. C. for other than quick travel, it is possible that these fast speeds might be profitable. But the local traffic must be handled, and these fast trains often entail an expense upon the whole system by the right of way.

Mr. Levan seems to think that we have only to adopt the English "single" locomotive to solve the question of speeds.

His reasoning in favor of single drivers will not bear analysis. For instance, he claims that English locomotives will haul an ordinary train at the rate of 53 miles per hour on a consumption of 25 lbs. of coal per train-mile. He places the fuel cost for hauling a similar American train, running 43 miles an hour, at 50 lbs. of coal. If we increase the speed of the American train to that of the English train, 53 miles per hour, it would bring the coal consumption up to about 65 lbs. per mile. The valve gear of American and English locomotives are practically the same, that is, both are operated by the Stephenson link. There is but little difference in the values of American and English coals. It is therefore fair to assume that a pound of coal fairly burned in one firebox will give off the same number of foot-pounds in energy as would be produced by the same combustion in the other firebox.

It will require about 500 horse power to run such trains as Mr. Le Van describes at a sustained speed of 53 miles per hour. In England he claims this is done with 25 pounds of coal per mile. It will require, per his reasoning, 65 pounds of coal to do the same train work in this country, with a coupled locomotive. If the coals are equal, the 65 pounds burned in the American firebox will deliver to the cylinders about 1,300 horse powers, 800 of which—in excess of requirements in the English "single"—get no farther than our side-rods and pins.

If our English friends will consider this question fairly, they will give us credit for a quality of workmanship and material in crank-pins and bearings unsurpassed in the world, even though they do not like our coupled locomotive.

Americans have the reputation of "blowing," but when it comes to the question of steam powers our English and Continental friends occasionally draw a full hand.

It is not long since the technical journals published accounts of M. Normand's torpedo boats, the engines of which furnished a horse power, with 60 lbs. boiler-pressure, at a coal consumption of 1¼ lbs. In this case the total horse power developed was about 120. We also remember the little Perkins steamer, "Anthracite," which came here with an English coal record of 1¼ lbs. of coal per horse power. This same steamer was thoroughly tested by a board of American naval engineers whose best possible result in coal was 2.74 lbs. per horse power.

There is, unquestionably, a loss due to friction in coupled engines. But it is extremely doubtful if that loss is not more than offset by the gains which come from using coupled engines on American roads. It is hardly fair to assume that American railway managers are not as fully alive to the best interests of their roads as outsiders; and as long as such managements as the P. and N. Y. C. continue to use such locomotives, is it not fair to assume they are best suited to their conditions?

*Rahway, N. J.* AMERICAN.

### Practical Questions for Engineers and Firemen.

The Lancashire & Yorkshire Railroad in England issue a small book with the above title for the use of their men. It is divided into chapters as follows: In the shed; on the road, shed day, and engine breakdowns. The book is in the form of questions and answers and is given free to their employés.

One question and answer that interested us is as follows:

Q. Some sorts of coal form a hard and close clinker on the firebox, can anything be done by the fireman to improve matters when working with this sort of coal?

A. Yes; a very good plan is to scatter some broken brick (old arch bricks) over the bars before making up the fire. The bricks should be broken up into pieces rather smaller than a man's fist. Broken limestone is also a good thing to use for this purpose, particularly with some sorts of coal.

Another question and answer reads:

Q. Describe how to set an engine so as to test the valves and pistons with steam to see if they are tight?

A. Set the engine so that the two little ends stand level with each other, either at the front end of the slide-bars or at the end next to the motion plate. When in this position, if the lever be put in middle gear the valves will cover all ports, so that if steam be put on it will test the valves.

Q. Is the same position of the engine right for testing pistons?

A. Yes; then if the lever be put in full forward gear, the steam will be on one piston only, and if put into full back gear, the steam will be on the other piston only.

Q. In the case of a right-crank engine, if the little ends are set level at the motion plate end of the bars, and steam be put on, which piston will it test in forward gear?

A. It will test the right piston from the back. If put into back gear it will test the left piston from the back. If the engine is then shifted a half-turn, so as to bring the two little ends level with each other at the front end of bars, then the right piston will be tested from the front in forward gear, and the left piston from the front in back gear.

Here is a question that would stick most of our boys:

Q. What is the difference between a plug trimming and a tail trimming?

A. A plug trimming is one that only feeds when the engine is running, and is used for those parts that have sufficient motion to shake the oil over the end of syphon pipe, such as big ends and outside rods, etc. A tail trimming is always feeding (so long as there is oil in the cup), and is used for those parts of the engine which are steady, such as slide-bar oil cups, etc. A plug trimming is made by wrapping worsted over a piece of twisted wire in the usual way, and when in use the top of it should be a little below the top of syphon pipe. A tail trimming is made in the same way, but a few strands of worsted are left at the top end, and these turn over and hang in the oil. All trimmings require to be looked at occasionally, as they become clogged by the impurities in the oil.

### An Awful Jump.

The railways on the Island of Jamaica are not exempt from some of the dangers so well known to those who are engaged in train service on this continent. An engineer in Kingston, Jamaica, in a letter sending in some subscriptions to LOCOMOTIVE ENGINEERING, says:

Mr. J. F. Sargent begs to be excused for sending in his subscription so late. The cause is nothing uncommon to railroad men. During the latter part of the month of November, his train of twelve cars and engine entered the Gibraltar tunnel at his usual speed, a white flag having been shown by the tunnelman, but before he made daylight he had to decide between life and death, for thirty feet from the mouth of the tunnel was a huge land slip, and the river Rio Cobre roaring and jumping seventy feet below. He did all he could for the company he served, and waited for the mouth of the tunnel to take his chance. He remembered jumping to clear the coming wreck. How long he laid he could not tell, but he found himself under the body of a freight car, when he crept out he saw his frightened conductor looking down in the river at his engine and two cars on top of her; his fireman went over with the engine and was killed. Since then he has been in the hospital, but I am glad to state he is now out to work again.

### Wash-Room or Tannery?

"I had a green fireman once," said the New England engineer, "and he worked two straight months without having his overclothes washed. I kicked finally and told him if he'd wash 'em I'd furnish the soapine. He put 'em in a pail of water, climbed on the back of the tank and got a can of powder I had there and dumped in a pint or so, and turned steam into the pail through injector-overflow. They didn't 'suds' worth a cent and he dumped in more powder. About here I saw that he had my can of soapstone (for hot boxes) instead of the soapine. After he got all the stuff in and was rubbing, I turned the gang loose on him and went home. Them overclothes looked like a dirty oil-skin 'slicker' or the flesh side of a half-tanned hoss hide—but he wore 'em."

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A reader of LOCOMOTIVE ENGINEERING, writing from Retalhuleu, Guatamala, says that an American firm has built 41 miles of a new railroad there which is doing an excellent business. They have four Baldwin engines. Engineers are paid $180 and firemen $75 a month. Machinists are paid $6 a day. Board costs from $30 to $60 a month. The writer speaks enthusiastically about the delightful climate and pleasant country.

# Car Shops and Car Builders.

## Lining Freight Cars.

A practice of lining box cars from the floor to the top plate, which was introduced by a leading western railroad a year or two ago, is becoming highly popular and promises to be widely followed. The original purpose of this design was to prevent freight which holds moisture from accumulating between the lining and sheathing. This soon rots the wood and shortens the life of the car.

When cars lined to the roof were put in service, it was found that they were much stronger than those built in the usual way, and the practice is now followed because it greatly increases the durability of the car at little first cost. The heavy loads now carried and the shocks due to long trains pulled by powerful locomotives tear cars to pieces very rapidly. Any inexpensive method of increasing the strength of a car is likely, under these circumstances, to receive attention.

## Bird's Metallic Car.

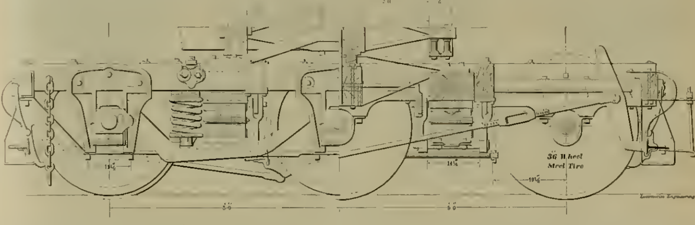
A metallic car for railroads has been patented by G. M. Bird, of Boston, Mass. It consists of sheets of iron or steel forming an outside and inside shell with a space between which may be filled with some heat non-conducting material, such as mineral wool or asbestos. The frame is a semi-circular trough, with the round part resting on the trucks and the rims secured to the body. It is a rather sensible form of construction, and appears to have been designed by a man with sound mechanical ideas.

The objects of the invention are said to be to provide a car of great strength to resist blows, and protect the passengers from injury by fire, or by steam from the heating pipes; second, to connect and hold the car platforms so they cannot telescope or drop to the ground, or be thrown apart away from the road-bed in case of collision or from other causes; third, to secure the trucks to the car frame so they will not be detached by derailment or other causes, and that their weight may add great resistance in checking a train when derailed and prevent the cars from rolling over. Passenger cars are usually made of wood, having the frame and sills under and level with the car floor; to this frame the cross frame and center castings are bolted that the truck is secured to. The platforms are a continuation of the car frame.

I have noticed, says the inventor, in accidents caused by broken wheels, axles, rails and by collision, the bolts that go into the wood-work split it in pieces; the trucks are broken away from the body of the car, the platforms are crushed, the cars fall to the ground and are often forced away from the road-bed, sometimes fire adds terror to the disaster. The weakness of wooden cars is the particular cause of the fatalities attending accidents on railroads. The principal object of the metallic car is to reduce the loss of life and property following accidents on railroads.

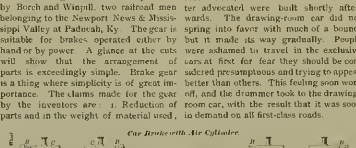
## Southern Pacific Six-Wheel Truck.

The annexed engravings show a very well designed six-wheel truck in use under the passenger cars of the Southern Pacific Co. A feature about the truck which will attract attention is the method of transmitting the power of the brakes to the three pairs of wheels. As six-wheel trucks are on the increase it would be well for those interested to examine the simple way in which the brakes are applied in the Southern Pacific truck. The only criticism we would make is on the turnbuckle used for adjusting the length of tension rod. The turnbuckle has been tried a good deal for this purpose and nearly always fails by running back, moved by the vibration.




## Improved Brake Gear.

The annexed engraving illustrates a form of brake gear that has been patented by Borch and Winpill, two railroad men belonging to the Newport News & Mississippi Valley at Paducah, Ky. The gear is suitable for brakes operated either by hand or by power. A glance at the cuts will show that the arrangement of parts is exceedingly simple. Brake gear is a thing where simplicity is of great importance. The claims made for the gear by the inventors are: 1. Reduction of parts and in the weight of material used, 2. Equalization of power to the several shoes; 3. A direct pull from the air piston and the brake always adjusted.




Brake gear of this kind has been applied to cars on the Newport News & Mississippi Valley, and it is reported to work very satisfactorily.

## Origin of the Drawing-Room Car.

The drawing-room car, which is now regarded as a necessity for the comfort of our luxurious travel, did not come into use till after the war. About 1865 the Old Colony Railroad imported a first-class passenger car, very fancifully upholstered, from England, and it was considered a wonder of comfort, although with the growth of taste for luxuries of travel it would now be considered a very inferior car. The anglomaniac was abroad amongst us even at this early date, and the exclusiveness of the car, which was of the compartment type, commended it to people who disliked to ride in company with mixed classes.

At this time there was a director on the New York Central named Russell who was of highly aristocratic tastes. During a visit to Newport he saw the Old Colony compartment car, and he came back to New York determined to have cars of the same character built for the Central. He was so persistent that Messrs. E. D. Worcester and J. Tillinghast were sent as a deputation to Boston for the purpose of examining the car and making a report. Mr. Worcester made a report advocating the use of a modification of the English car to a design similar to what was afterwards known as the Mann car, with separate compartments reached by an aisle at the side. Mr. Tillinghast recommended the use of an open car, with seats arranged with a special view to comfort, and the putting in of other conveniences then not thought of for day coaches. His views found favor, and some cars of the character advocated were built shortly afterwards. The drawing-room car did not spring into favor with much of a bound, but it made its way gradually. People were ashamed to travel in the exclusive cars at first for fear they should be considered presumptuous and trying to appear better than others. This feeling soon wore off, and the drummer took to the drawing-room car, with the result that it was soon in demand on all first-class roads.

## French Imitation of Wood.

French artisans excel in imitating mahogany, ebony and satin wood. So nearly do they contrive to render any species of wood of close grain like mahogany in texture, density of hue and polish that many expert judges will often mistake the imitation for the natural wood. The following is the mode. The surface having been planed and rendered perfectly smooth, the wood is rubbed with diluted nitrous acid, which prepares it for the materials subsequently applied. Afterward, to a filtered mixture of $1\frac{1}{2}$ ounces of dragon's blood, dissolved in a pint of spirits of wine, is added one-third that quantity of carbonate of soda. The whole constituting a very thin liquid, is brushed with a soft brush over the wood. The process is repeated with very little alteration, and in a short interval of time the wood assumes the external appearance of mahogany. If the composition has been properly made the surface will resemble an artificial mirror, and should this brilliancy ever decline it may be restored by rubbing the surface with a little cold drawn linseed oil.

## Effect of Turpentine Gathering on Longleaf Pine.

We have received from Mr. B. E. Fernow, of the United State Forestry division in Washington a circular saying that longleaf pine is in no way affected by the tapping of turpentine. The circular says

To determine whether any changes in the chemical composition take place, a series of chemical analyses of bled and unbled timber has been made, which indicates that the resinous contents of the heartwood are in no wise affected by the bleeding, the oleoresins of the heartwood being non-fluid, the whole turpentine flow is confined to the sapwood.

Among other interesting facts regarding the distribution of resinous contents through the tree which will be published in a separate bulletin, it appears that trees standing side by side and to all appearances in similar conditions show very varying quantities of resinous contents.

To make sure that experience did not, if sifted down, contradict the results of these investigations, a competent agent, Mr F. Roth, visited turpentine orchards and sawmills in the Longleaf Pine region. He reports that nobody was found—although it was claimed by some—able to discern any difference in the appearance of the bled and unbled timber; that in spite of consumers' specifications for unbled timber, they are almost invariably served with a mixture without finding it out, that experience in the districts where bled timber is cut and used has not sustained the claim of inferiority.

## Chemical Extinguisher for Car-Lamps.

The accompanying illustration shows the details of a fire extinguisher for cars, the invention of W. H. Durant, of Concord, N. H.

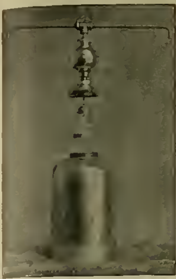
The lower can-like body is a tank containing about one quart of a powerful extinguishing fluid. Attached to the under portion of the cap, which screws on the tank, is a metal loop which carries a hoop on trunions, this hoop holds a small acid bottle; this bottle has a metallic stopper attached to an adjustable chain, and this serves to keep the bottle vertical in the tank. The trunions are always in line with the length of the car to prevent displacement of the stopper from shocks.

The tank is located near the lamps on a bracket fast to the ceiling of the car, and from the cap small pipes lead through the smoke-shades to the tops of the chimneys.

Above the screw-cap is a globe containing an automatic valve that insures the contents of the tank from evaporation and will allow the fluid under pressure to flow out.

The inclination of the car to a certain degree will withdraw the stopper of the

acid bottle, the chemicals mix and a pressure of 45 pounds to the square inch results;



Lamp Extinguisher for Cars.

this sends a jet of extinguishing fluid to every lamp in the car and instantly puts them all out.

## Notes on the Railroads of Northern Italy.

BY WALTER LODIA

During a recent visit to Italy, the writer's third, I took occasion to look up some information about Italian roads. There is a chance for pretty rigid criticism for any of the roads in the land of the Dago.

On one of the principal lines, they have in service 1,280 locomotives, and I found that in one year over 500 of these met with accidents requiring immediate repair, there being 350 accidents to goods trains alone, and 200 accidents happened to their mountain and special engines—of which they use a great many.

There is an engine accident to every 25,000 kilometers; besides this, they had over forty break-downs of air and vacuum brakes—they use the Westinghouse and the Smith-Hardy.

Very careful statistics are kept, and from them I find that the locomotive engineer of Italy has rather an undesirable berth. His average life is 42½ years—just the same as given for an locomotive, by the way—and 18 years, including his time as fireman, the average time spent on a locomotive. This is not a remarkable showing for a man employed in the open air in a climate noted for its salubrity.

Many inquiries were made into the treatment and living of Italian engine-drivers. It was ascertained that locomotive engineers on the chief peninsula road were divided into seven classes. Each class has a fixed salary. They receive a stated sum for their work, and whatever they make by economizing the coal, oil, picking up lost time, etc., is so much extra. About these items, more later on.

As to the established wages for drivers. There are stated to be on the S. F. M. 764 such men under all heads. They are classed according to the number of years they have been in service. There are 26 of the 1st class, receiving 2,400 liri annually, 83 2d class, with 2,100 liri, 79 of the 3d class, having 1,950 liri, 124 of the 4th class, getting 1,800 liri; 87 of class 5, with 1,650 liri, 102 of the 6th class, with 1,500 liri, and 263 of the 7th, obtaining but 1,350 liri. Now, as the liri are equal to so many of the more commonly known francs, and it takes 5 liri to make a dollar, or 25 to the British 20-shilling piece, it can easily be figured out what these amounts represent in American or English money. Thus it transpires that the 1st class passenger express driver only gets $480 per year assured. That is the substance. For the shadow he has to look to uncertain and varying economies.

And even the shadow has been going down as the calendar of years has been going up. The poor engineers, after all their labors at economizing, have been rewarded by the company cutting down the reserve of supplies allotted them. The administration has said to them "Well, you have shown that you can cover so much ground with so much coal, so we propose in future to only allow you that quantity of fuel. If you can realize any on *that* you will get the ordinary percentage." Or words to that effect.

This is something like putting men on piece work to find out what they can do, and then expecting them to do the same amount of work when on time.

What is the percentage earned by the runners on the saving of coal? It is asserted to be (by the shareholders' officers) 7 liri per ton (of 1,000 kilograms). Whether they get this, and whether there is much to be made over economizing nowadays, is another question. Then, as to the profits on oil-saving. They are put down at 12 centesimi per liter (1¾ pints). It is doubtful whether the actual extra remuneration here is any great "shakes" (to use a pat expression among some drivers).

There is a little book of nearly 170 pages issued to the central administration in Milano, entitled, "Raccolta di Disposizioni concernenti il servizio delle locomotive," which is full of matter affecting drivers. Particulars are given therein of premiums accorded drivers for reducing time between stations without exceeding maximum speed of engines; it is usually 3 to 5 centesimi (the centesimi is the hundredth part of a lire) for each minute saved, according to type of locomotive and number of kilometers run. For time made up, under certain conditions, when a train is in retard, 15 centesimi per minute is paid for passenger and 10 centesimi for goods trains, which amounts are reduced respectively to 10 and 5 centesimi for distances of over 150 kilometers.

Drivers are paid overtime at the following percentage in excess of their earnings. If absent with their engine from the depôt for over 15 hours and up to 18 hours, 50 per cent. extra, for from 18 to 24 hours, 100 per cent., 24 to 36 hours, 150 per cent., 36 to 48 hours, 200 per cent. Then there are, of course, a number of other ways in which the driver has an uncertain chance of increasing his small stipend.

Italian railroad reports are interesting, with an effort. The public reports are all figures, with little or no text. The private reports are lithographed. The former, with their network of small and cramped figures, are thus tabulated and statistized to meet the requirements of the national bureau of statistics at Rome. They are all very well for the requirements of that office, but all readers are not statisticians. Then, as to the private reports (for circulation among shareholders). While their contents are reduced and put in more interesting form, their printing is worse than the public memorias, so far as immediate distinctness is concerned. Every line is in lithographed handwriting. At least, this is the case with the Strade Ferrate Mediterraneo publication. Now this report will be intelligent enough to Italians, but even they will admit how much clearer, preciser, better and cheaper would be typographic printing.

Several new types of carriages have been added in recent periods to Italia's chief system. It was time! They are of the three classes—1st, 2d, 3rd. The third-class cars do not seem to have received much attention. And then some of those on the Mediterraneo system, there are perhaps no worse cattle-trucks in Europe. They are cooped-up boxes with no side windows, and only small apertures in the doors. There is no roof ventilation, so that the interior becomes like an oven under the sun's rays.

For fuel, briquettes are used on Italian lines, as on most other continental roads. They give off a fearful amount of grit, as the coal is not dampened.

The total kilometrage of the Strade Ferrate Mediterranean network is some 4,300 kilometres of double and single track. The head offices are in Milano. There the administration has a vast edifice, but are building near by a still larger. The fully subscribed capital is 260 millions of liri (liri is plural of lire, the unit and standard of reckoning.) The other great company in Italia is the Adriatica, with headquarters in Firenze (or, as the name is more commonly and improperly corrupted by foreigners—Florence). They tap all the Adriatic side of the country. Principal of the smaller companies is the Ferrovia Nord-Milano, with headquarters in that capital of Lombardy. Their capital (all paid up) is 13,000,000 of liri. They are fortunate in having the most direct route to the incomparable Italian lake district from the northern metropolis of Italy—to the Lac de Como as well as the Lac Maggiore—and, as scenery is everything to tourists, the road is here again fortunate, for the line between the two lakes climbs up and continues for a long distance among the mountain ridges, from where the views are most extensive, and charmed with all the poetry of distant prospects and vast horizons.

It is this latter and lesser-important company which has been the first to introduce electric lighting into their carriages. The road is supplied by means of accumulators from the principal station in Milano of the local Società di Ellectricità of which the chief engineer is an American, J. Liet, late of New York.

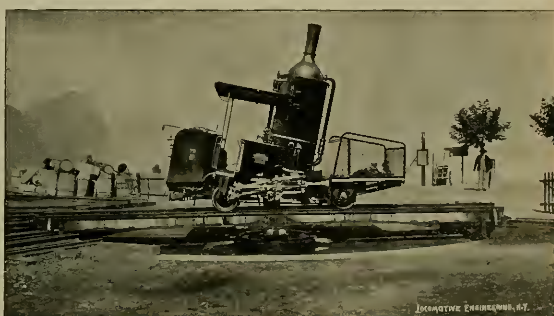
### The Boss.

We all know him and speak of him by this name, yet it is not yet fully recognized as a word legally belonging to the English language. Philologists, the people who interest themselves particularly in the origin of words, are a little divided about the origin of the word boss. Those with Celtic learning trace the word to the Gaelic word *bos*, the hand. The word is, however, doubtless the Dutch word *baas*, meaning master. The pronunciation is almost unchanged. Master, in all the early Dutch settlements, was baas, and boss it became with the English-speaking races, who hated and repudiated the word master, but were willing to endure it under a foreign name. There are many kinds of bitter pills that have their obnoxious taste entirely obliterated by a thin coating of sugar. How many there are who respect bosses and hate masters!

The Butler sand dryer, which was illustrated in the March issue of Locomotive Engineering, has been put on the market and is handled by Mr. G. P. Wilson, 435 North Broad street, Philadelphia. Several railroad companies have already adopted the device, which will dry more sand per pound of coal than any device ever tried for this purpose.

The exhibit for the World's Fair sent by the London & Northwestern Railway formed a special train which went West on the New York Central on March 14. The exhibit consists of one of F. W. Webb's famous compound locomotives, two passenger cars, and a great variety of historical curiosities used on the Liverpool & Manchester Railway when railroading was in its infancy. This exhibit will be highly attractive to railroad men who are interested in the development of railroad machinery.

A new and finely illustrated catalogue has been prepared by the Newton Machine Tool Works of Philadelphia showing their cold saw-cutting machines. Those interested in this class of machinery would do well to send for the catalogue.




An Engine of the Righi Mountain Road—Lake Lucerne in the Background.

## Train Running Under the Confederacy.

BY CARTER S. ANDERSON.

Excuse my delay in fulfilling my promise to tell your readers more about how we managed to so rapidly move the armies of northern Virginia with our very limited motive power and rolling-stock during the campaign of 1862. My apology is that I am at present a supply storekeeper. Between two fires, the trainmen and agents firing their wants at me in front, and our vigilant officers firing back at me, "Decrease expenses," I have been so busy defending my position that it has been out of my power to write sooner.

Allow me space to tell you the golden rule of economy given me as storekeeper by my superintendent, Mr. C. E. Doyle, and then for my part of the story "Issue what is needed, not what is wanted."

While General Lee was keeping one eye on General McClellan on the Bay, and the other on General Pope in Piedmont, we Virginia Central Railroad men were busy rigging our troop trains; bluff old Master Mechanic Wildman was all business—"No time now for foolishness," was his oft-repeated injunction.

Right in the midst of all this the shop struck, and nobody could blame them. Up to this time wages had run on pretty much as they had before the war, while notwithstanding our victories, every kind of living had gone up, so that our men could not support their families, so they determined to take chances of going into the army or of getting more pay. They all came down to the general office, at Seventeenth and Broad streets, two abreast. It was a sad sight, but very soon they broke rank and cheerily went back to the shops, their petition for more pay having been granted by Superintendent H. D. Whitcomb and President Edmund Fontaine.

An illustration of how our wages compared with the cost of living—we had a jolly passenger conductor named Wm. D. Gilkeson, who one pay day, about that time, bet our ticket agent, Wm. F. Adcock, that he could go to a restaurant and eat up at one meal Adcock's month's salary. A big crowd gathered near the old market restaurant, and Gilkeson fairly won the bet, coolly requesting Adcock to send him fifty cents more for a common cigar. Granted.

We soon had ready eighteen trains of about fifteen cars. There were freight cars of all descriptions, with one passenger car at the rear of each train for officers, the conductor riding there also, and acting as rear brakeman generally. I give below a list of engineers and engines, which may remind some of your readers of men and machines that took part in the story of our country, and in adversity played well their part

"Staunton," Martin R Alley; "Albemarle," John M Kraft, "J. H Timberlake," John Harton; "John Timberlake," Robert Murray; "Westward Ho," John Davidson; "E. H. Gill," Geo. W Pelter, "Chas. Ellett," John Dunn, "Greenbrier," Raymond T. Dunn, "Millboro," Seth Mack; "Monticello," Fendall W. Ragland; "Jeff Kinney," Tunis Swatz, "Beauregard," James McCandlish, "Stuart," Wm. Keaton; "W. M. Baldwin," Simon Ailstock; "C. G. Coleman," L. S Alley, "E. Fontaine," R. J. Goodwin, "C R. Mason," Westley P. Huntley.

Some of the army had already been hauled to Gordonsville, and skirmishing had brought the line of battle, with General Pope, near Cedar Mountain. Then it was that General Lee's main army leaned forward in that direction.

It was generally very short notice we would get of army movements. Hearing the drums and seeing the mass of men and muskets moving to the depot was the first positive information we would generally get as to any military move. So it was in this case. Standing at Seventeenth street depot and looking toward the west, as far out in Broad street as the eye could see, we watched the mass of Confederate soldiers bearing down upon us, until, as they got near to the depot, the crowd grew so dense, and it was so hot, that it was almost impossible to keep them in order. However, when we would get the wrong soldiers off a train, and the brigadier-general would call for certain regiments to be loaded on certain trains, they would settle down on it as bees upon a hive, and once down nobody was silly enough to give a soldier any advice as to finding better accommodations here or there. They were "there to stay" We gathered them in for ten miles along the road from Richmond, in the direction of Gordonsville. All trains loaded, we would pull out with about ten minutes' space between trains.

Getting to Gordonsville, the first train would pull up and unload, and pull by until all the trains came in; then we would turn the engines around and start out to Richmond for another load. So we kept going for about ten days, during which time we never undressed, nor saw a bed. We slept some, while waiting for other trains to load or unload—engineers on their boxes, we on the cars. I wish now that I had counted how many soldiers would pile into one train. How tenaciously they would stick! On top of a slanting wood-top car or wherever they could find room enough just to hold on, they would stick. To illustrate: We loaded all the trains one evening and started from Richmond to Gordonsville, just about dark. Going out from Richmond we always had a tough tug to get over a summit about four miles from the city. That night was no exception to the rule. We all got in sight of each other, while going up this grade; but after turning the grade and getting on what our "Uncle" Jimmie McCandlish called "our side of the hill" (down-grade), we endeavored to get our ten minutes' space as soon as it was practicable to do so. We had rolled along down toward the Chickahominy for about two miles, when entering the very heavy curve around Strawberry Hill our engineer called sharply for brakes three times, and reversed his engine. After running back to give the following trains the signal, I ran up to the engine to see what was the cause of his signal. I found our engine, "Albemarle," so near the rear of the preceding train that her head-light cast a ring of light about the size of a hogshead on the rear of the coach ahead.

I saw the men under a freight car. The draw-head had pulled out, dropping one end—the end that was fast prying up the floor of a luggage car that was literally packed with soldiers. The officers were all asleep, and those soldiers were so worn out, and so sound asleep, that we could do nothing with them. We tried to show them the danger they were in, and how narrowly they had escaped being crushed. We begged them to transfer to the other cars, so that we could throw out of the train this broken car and put it into the little side-track near Chickahominy, which the bridge carpenter built there to put the pile-driver on when at work on the trestling. It held about two cars. The few soldiers who did wake sufficiently to make any reply only ridiculed us. I never before heard such nonsense talked as I did that night. They heard us say something about the draw-head.

"Draw-head," one soldier bawled out, "Draw your heads out o' here, or we will draw them for you."

The hole in the floor which had been caused by the draw-head bursting through, they called, "Ventilator," "Head-rest," "Elevator," "Jess let her set," "Jess let her go like she is." "Let her roll," etc. I asked them to move so that I could get room to stand in order to nail down the floor which was torn up. Looking at my brogan shoe, one of them remarked to me

"Stranger, ain't you mighty unhealthy?"

It was very trying to me just at that time, bothered as we were with a dozen trains waiting, but being in his power, I answered politely

"Not particularly so, sir; why do you ask me that?"

"Nothing, Captain, more than I see that most of your body lies on the ground, and I always heard 'twas so unhealthy to lie on the ground. Well, boys, let's move and let the Captain have enough room for one foot"

John Davidson, the engineer of the damaged train, proposed that we quietly put the broken car, soldiers and all, into the little pile-driver track, and leave them there—a very wise solution of the difficult question. We very soon carefully placed them in, cut loose and coupled up to the rear cars and pulled out for Gordonsville. What became of those soldiers, whether or not they went back to Richmond or got on some other soldier train the next day, or deserted, this deponent knoweth not. We were never questioned about it, either by our railroad officials or by army officers. The crowd of soldiers at Gordonsville the next morning was so large and mixed that the car we cut out did not check short. It was "railroad bliss," as the soldiers called it, and they passed by as unnoticed some little irregularities in our management.

On my next trip out from Richmond the regular engineer of the engine "Albemarle," which had been pulling my train, was unable to run her out, and in his place was detailed from the shops a machinist named "Dock" Galloway. I am not afraid to say that a machinist is not necessarily an engine-runner. During that night, with "Dock" Galloway as engineer, we became surrounded by circumstances peculiar and thrilling, and it was by mere chance or good fortune, if you choose to call it, that we escaped a fearful accident, before relating the details of which, it is necessary to show your readers the relationship existing at that time between our military and our railroads, and how it came to be so.

While the Confederate government itself was always very respectful to our railroad officers, and very seldom interfered with their management, our Southern officers would sometimes, especially during the first year or so of the war, attempt to assume command of our trains. To illustrate: It was in 1861, a train load of Southern soldiers came to Charlottesville, from Lynchburg, over the Orange & Alexandria Railroad. It was noticed that two soldiers rode in the cab of the O. & A engine, and it seemed had the engineer under arrest, or rather under their charge. Our Virginia Central Railroad, of course, took charge of the train at Charlottesville. Our engineer, Ragland, running 'Monticello,' asked the engineer of the Orange & Alexandria what those two soldiers were doing in his engine. He replied that the Colonel had put them on at Lynchburg. "And," said he, to Ragland, "they will take charge of you before you leave here."

Ragland replied that he might be arrested, but he swore he would run no engine under arrest. Sure enough, when his engine hooked on to the soldier train, and while Ragland was greasing her up, etc., the soldiers entered the cab and took their position as they had on the Orange & Alexandria engine. Ragland climbed up on his engine and said

"Gentlemen, it is contrary to rules for any one to ride on the engine. You must go back into the train."

They answered him that their Colonel had commanded them to ride there and to take charge of the engineer until he landed them safe at their destination. Mr. Ragland went straight to the telegraph office and got the operator to telegraph Superintendent Whitcomb that he was under arrest and that he positively refused to run an engine under such circumstances. Very soon came orders to the Colonel not to interfere, but to leave the transportation to the railroad officials. The soldiers got off and Ragland got on and pulled out.

One more illustration: It was early in the spring of '62, just before or about the time of the battle of Seven Pines, that there suddenly arose urgent necessity in the Peninsula for some soldiers that were yet in some part of Virginia north of Gordonsville. At any rate, there pulled up at Gordonsville, bound for Richmond, at 8 P. M., a double-headed train full of soldiers, with some refugees among them—women and children. It had been arranged for this O. & A. train to go right through, with O. & A engines and men. We had a train also to come in as a section, either in front or rear of this train. A dispute arose between Fred. A. Kuper, our conductor, and Mr. Jonah Fisher, Assistant-Superintendent of the O. & A. road, as to which train should take precedence. It ended in a fight and every one got into a bad humor, and, of course, while squabbling where there was plenty to drink, they soon got to drinking. Mr. Fisher's O. & A. train took the lead, however, with the engines "Jeff Davis," run by Amos Woodward, and the "Nelson," run by one of the O. & A. engineers

The "Jeff. Davis" was captured from the Loudon & Hampshire in 1861, with two others similar to her in build—the "Beauregard" on our road and the "Johnson" on the R., F & P. road. They were three as nice and as smart engines as I ever knew. The engines were returned to the Loudon & Hampshire road after the war, and may yet live Surely it would be interesting to know what fate befell these noble refugees.

To return to my narrative. The orders received by the conductor of the leading O. & A train were "Come to Richmond—moments are hours." A Louisiana colonel was on the engine. He was about half drunk, and told Amos not to stop anywhere but for wood and water, and to "let her roll." Amos wanted nothing more glorious than such orders from the railroad officials and the military man telling him to go ahead and stop for nothing.

After sending these orders to this train at Gordonsville, necessity arose to start a train out from Richmond to Gordonsville, which left Richmond about 11 P. M., with orders to go to Hanover Junction and report. The train dispatcher considered this perfectly safe, thinking that he, of course, could intersect the fast east-coming train certainly at Beaver Dam, and knowing that all trains were ordered to stop at Hanover Junction—that was a standing order and very strict rule for both roads.

The fast-flying east-bound train came on by the Beaver Dam signal without even slacking up. The operator immediately informed the Richmond officer, whereupon the operator at the Junction was urged to stop the train at all hazards. Anxiously did our faithful train-dispatcher pace the floor waiting to hear the Junction operator call and tell him he had stopped the train. He did soon call, but alas! to tell the sad news that the fast Richmond-bound train had passed and not even slackened, but had crossed the old R., F. & P. R R. as fast as the engineer could run. The dispatcher's heart sank within him, and he calculated where the trains would meet. He predicted that it would be in the curve at "Little River." So it happened. Five minutes after passing Hanover Junction, the "Jeff. Davis," with her ten passenger coaches literally crammed with soldiers with some refugees, amongst whom were some ladies and children, locked horns with old "Millboro" engine, a ten-wheel heavy freight engine run by the oldest engine-runner now living in the United States, Seth Mack. John H. Richardson was the conductor.

Seth was at a great disadvantage, being in a cut, and with a heavy left-hand curve. But he caught a glimpse of "Jeff. Davis'" headlight in time to shut her off, and to roll off into the sand. He knew better than to be found about that time, and he and Conductor Richardson ran off quietly into the pines, made their way to Hanover Junction and reported the accident to Richmond.

This was the worst collision that ever

happened on our road. How any mortal being could come out alive from some of these coaches was the wonder of all who saw the splintered wreck. Coaches were telescoped in every conceivable way, parts of them hanging over the Little River bridge. There were many killed, among them a little child killed in its mother's arms, while the mother was not hurt at all. The "Jeff. Davis" rebounded when she struck the "Millboro," and stood with her front truck off in the ditch and her boiler front all smashed. She looked like some wild beast which had been demolished by old "Millboro," and then dashed aside. The old "Millboro" was standing on the track but stripped back to her cab

It was soon after this that the circulars were issued by the Government forbidding any military officer to interfere with the railroad management unless he had positive instructions from the General commanding the armies. These circulars were posted in every station, engine cab and caboose, and prevented what, as I will try to show you soon, would have been serious accidents.

## Bursting Up a Railroad.

BY DYCE CONVETH.

The boys were sitting around in the club-room one mighty cold night in December. A regular winter storm was raging outside. Occasional gusts, laden with sand-like snow, struck the building and shook it to the ground. A good deal of gust came inside, inviting more than the usual attention to the stove. Each man present had served some time at that job, and as every one fancied himself made for building a fire, the emulation might have caused trouble, but for an interruption. Right in the middle of a gust a thundering knock was heard at the door and in a few minutes a stranger was admitted.

The stranger wanted to see the secretary, but on our statement that that functionary was not present, he allowed that he would remain for a little, anyway.

"The fact is," he said, with easy *bonhomie*, and every syllable and accent betrayed his English education, "I am in town on business, and was told that I could pass an hour or two listening to the interesting and instructive experiences of the members of this club." He was an engineer, himself, he said, and in pursuit of his calling had seen many parts of the globe Was in America as agent for English-made firebricks, and was doing fairly good business. He wouldn't mind, he said, retailing some of his own little experiences, as he didn't believe in entertainment of that kind being all on one side. But of course he did not court the *role* of *raconteur*, not at all, he merely desired to contribute his share of the entertaining.

We thanked him for his visit, and said he was welcome, a remark to which the boys nodded or expressed their assent. We regretted that no amusing anecdotes or experiences would probably be heard that night. Considering the weather, we did not feel in a mood for romancing, and most of us had forgot the way to do anything else Under the circumstances we considered that we were speaking the sentiments of the boys when we suggested that the stranger might favor us with some incident of what must have been an interesting career. This course recommended itself to the boys strongly, and they expressed their agreement loudly. Well, the stranger seemed at first taken aback at his offer being so quickly accepted, but, pulling himself together, he told us the following story

About twenty years ago I was engineer on a road running out of London. I had good wages, a good journey, and should have been contented, but I wasn't. Most men incline to see the world at some part of their lives, and at that period the inclination to rove was strong in me. I watched the advertising columns of the daily papers closely, and when I saw an advertisement for two engine-drivers and two firemen for a railroad in the East, I applied, and after some parleying got one of the places. I got the job with less difficulty than I expected, mainly, I believe, because I had served an apprenticeship as a mechanical engineer, which few engine-drivers in Britain do, and because I was young. Anyway, I got the job, and in three weeks I was at sea on board of the steamer *Ling-Chang* bound for the Flowery Land—for China was our destination.

I learned afterwards that a British-Chinese company, whose headquarters are in Shanghai, had used sufficient influence with the Imperial Wanchow to obtain a charter for the construction of a short railroad on the bank of the Canton river. The road was to be 200 li, or about 72 miles in length, between the towns of Ching-Siang and Ning-Lo. It was expected to be finished by the time we got to Canton, and would be opened for traffic as quickly as possible

I don't know what influenced the Imperial pagan to grant the charter for that particular province, unless he wanted the innovation to be as far distant as possible from the capitol. It is certain that if it had survived on the banks of the Chukiang, it would survive anywhere in the Empire, for a more intolerant race of heathens I haven't met on earth, except the gentle natives of the Corea, who certainly excel the world in antipathy to strangers.

However, to come back to my story. There were four of us on board, engine-drivers, and the same number of firemen, double the number mentioned in the advertisement.

We had a pleasant time enough on the voyage, and arrived all right at Canton.

We were delayed three weeks in Canton for proper transport for our engines, which had come out in the *Ling-Chang* along with us, and were to be conveyed up river in junks. We enjoyed the time like a holiday, and were rather sorry when the word was given to start up-river. The attractions of Canton to an unsophisticated European are many and powerful, especially to anyone with a faculty for the picturesque and ludicrous. Don't imagine, however, that I am going to inflict a description of the sights of that city on you. My story is about the brief history of the Ching-Siang and Ning-Lo railroad, or rather railway, to give it its British name.

We arrived in the junk at Ching-Siang all right after what we considered many hair-breadth escapes. The river swarms with native craft of every kind, and why we were not run down, or why we didn't run into some other junk twenty times in a day, is in my mind an everlasting mystery. Anyway, we got there, and then our troubles began.

Our engines were in the junks, and the railroad was on the land, but no provisions had been made for lifting the engines ashore. It was assumed that being practical engineers we would be able to get over this initial difficulty with ease. We did fairly well under the circumstances.

We rigged up temporary sheer-legs, and by means of some tackle belonging to the junk, got the six engines upon the rails without mishap, except dropping one of the tenders when the tackle broke, but no one was hurt, so it didn't matter much.

We got things into fairly good order during the month which elapsed before the opening of the railroad, and then business was begun with great *eclat*, as the French say.

A gorgeous ceremony inaugurated proceedings. A number of mandarins of high rank—who I heard afterwards had been handsomely subsidized by the company—graced the occasion by their presence. A feast for pretty nearly all comers was provided, and at night Chinese lanterns and fireworks rendered the gim-crack railroad erection at Ching-Siang resplendent.

The heathens did not seem to take kindly to us, however. We ran mixed trains—freight next the engine, passenger cars behind; blamed little there was to fill either kind of cars, however.

It used to afford us no little amusement, at first, to observe, when the road and railroad were running close together, the merchandise being carried swung on bamboos on the shoulders of laborers, or mandarins being carried in palanquins at the rate of six miles an hour, rather than ride with the "foreign devils," as they were pleased to comprehensively describe both us and our engines.

But after a time we got tired of the sight, and from amusement we veered round to annoyance. Our annoyance was, however, of as little importance as our amusement to the placid Celestials. They jogged on their equable gait equally indifferent, apparently, to our presence, and to the facilities which we offered. Rumors were certainly current about the hatred which the people generally bore us; but these we treated with contempt.

We had, however, strict orders to cause no unnecessary alarm in the minds of the superstitious and credulous heathens. Our work was to be performed with as little noise and disturbance as was consistent with carrying out our daily programme.

Well, the work went on for about six months with somewhat increasing results, but the passenger traffic was mighty poor, and the freight portion did not increase much. The company held on, however, but the work must have been carried on at a big loss.

At the end of six months the concern burst up, and some of the Europeans had no little difficulty in escaping with their lives. It came about in this way.

About thirty miles from Ching-Siang the railroad struck inland from the river and upward about ten miles, then level and parallel with the river the rest of the distance to Ning-Lo. At Ning-Lo water was extremely scarce in summer, although in winter it was as plentiful as humanity, of which there was no stint. Our company under these circumstances made arrangements to get a supply of water at an arrack-mill about ten miles the down side of Ning-Lo. Arrack is a sort of whisky made from rice, and the casks in which our water was brought were usually saturated with the spirit. The casks were brought to a platform put up for the purpose, same height as the tender, rolled into position, the bungs taken out, the water then running into the tank.

Well, one dark night in winter we left Ning-Lo with more than the usual number of passengers, mostly Europeans, and a good deal of freight, mostly tea. Jim Lawson, a Yorkshire man, careful and attentive, was the fireman. The engine was of a type now seldom seen. The four-coupled driving-wheels were 40 inches in diameter, inside cranks and low cylinders. A pair of trailing wheels, 36 inches in diameter, behind the firebox. The cylinders cocks could only be opened or closed by moving handles immediately over them, so that in the event of their being open when we started, one had to walk along the foot-plate, closing one on that side, pass in front of the boiler, close that on the other side, then back into the cab. All the outside was yellow painted, beautifully enameled, and on the side of the boiler the name of the engine, "Ning-Chow." in Latin letters, with the Chinese equivalents beneath, were painted in gilt. Jim Lawson was never tired of admiring the glossy aspect of our paint, and whenever opportunity offered he was at work with a handful of oily waste giving a rub-down here, or an extra burnish-up in another place; whenever we stopped, if only for a minute, he had the cylinder-cocks open to prevent any of the condensed water being thrown over the paint on the boiler.

Well, on this particular night we stopped at the arrack-mill as usual to take in water. The casks were waiting, and the attendant heathens had them quickly aboard and empty. They smelt mighty strongly of arrack, we thought, but concluded that our sense of smell must be for some reason exceptionally keen.

The water was pretty low before we filled up the tank, so Jim started the injector at once to keep down steam.

After a bit I noticed a flash of blue-colored flame, amidst the black smoke coming from the smokestack; but as my attention was occupied looking for a signal ahead, the incident did not at first convey any impression to my mind.

After a time, however, I was startled to see that the colored flame was coming continuously, and amidst the black smoke it had certainly a peculiar effect. Well, I was puzzled. While I quite admitted the properties and powers of Chinese coal to raise Cain generally, when it came to steam-raising I'll be hanged (only he didn't say "hanged") if I could see how they could burn blue and black at once. My ideas on combustion were certainly getting into a chaotic state when the cylinder-cocks began spouting fire also. I am not naturally superstitious, but this sight sent the chills down my spine. Fevered with horror and alarm, I jumped up on the tank and drew a dipper full of water to cool my parched lips and throat. I swallowed the contents and found when it was down that I had drunk about a pint of arrack.

It was arrack, as sure as I am a living man. There we were with a boiler chuck-full of whisky, and losing some of it every yard we ran. What could we do? It wouldn't be any good stopping, because we had no casks to hold it. And if we had casks for the arrack we had no water. There was nothing for it, therefore, but to do our best to get to Ching-Siang with the least possible consumption of the liquor.

I was never very partial to arrack. Its effects are too sudden for my taste. I prefer a good comfortable liquor like old malt whisky, which you can drink in reasonable quantities a whole evening without getting much drunker than you will on a couple of rice arrack drinks.

This liquor is as potent as Spanish aquaardiente, but when it comes to racing for a man's upper works the rice article can give the other a long start, and then win each time with ease.

When I returned to the cab, Jim was staring at the smokestack like a blooming imbecile, wondering where on earth all the flame was coming from and where it got its cerulean complexion. By this time the fire had cleared, and instead of the usual clouds of steam, masses of flame were spouting from the chimney. The spirit as it left the cylinder was met by the flame from the tubes, hence the blaze.

I didn't attempt to explain the matter to Jim. The less he knew of the waste going on just then the better for his peace of mind. This thought, however, brought it forcibly to my mind that more arrack was going to waste than the circumstances of the case required. The dose I had swallowed made me think that a little more would clear my mind, so I climbed over the coals and took another pull at the dipper. Coming back over the coals I felt the engine give a kind of a shiver, as if a cold draught had given her a chill; then she seemed to bound forward, landing me in an awkward sitting posture amongst the coals. Recovering an erect position, I was just in time to be violently impelled forward by a sudden slowing of speed on her part.

Grasping the reversing lever in one hand and the throttle handle in the other, I prepared to do all that mere human effort could accomplish to bring to a satisfactory issue what I felt to be a unique task in locomotive engineering.

It had struck me like a blow that the engine was as drunk as Bacchus and only a cool head and steady hand—both of which I rather flattered myself I possessed—would succeed in bringing that train safely into Ching-Siang terminus.

She seemed to go all right for a time, but by-and-by she heeled over and ran along a

but on one set of wheels like a skater doing what is called the outside edge. I should say, as far as I can recollect, that the wheels on the right would at one time all be at least a foot clear of the rails, but of course it would be no good pretending to know to an inch or two, because such a thing would be impossible. I shut off steam whenever she began to heel over, reversed, and turned on steam again.

That brought her to her bearings, I tell you. Then I set her going again, but, Lord! what an awful time I had.

First she would give a jerk forward, as if she intended to boom the coupling-making industry, and no sooner had I turned off steam to steady her than she wanted to stop and rest a bit. Then I would turn on steam and off she went ahead again with a rush. How the couplings stood it has been a mystery to me ever since.

Then Jim Lawson, the blamed fool, thought that I wasn't doing all that was humanly possible, and he wanted to have a hand. But when I proposed to argue the question, with the assistance of the coal-hammer—on my side—he climbed over the coals and left. I didn't see him again for three days.

When we got on the level I fired up a bit to get more steam, and then we seemed to be making it at a frightful rate. Before long that engine was a terror. The flame was pouring from the stack in a stream; the cylinder-cocks were blazing away; the safety-valve began to blow off, and then it took fire. When I blew the whistle for a signal to be hauled down, the handle wouldn't go back, and there we were tearing through the dark night like a flaming, screaming fiend, terrifying the superstitious natives and sending the women and children into fits with fear.

All the time we were making steam at an enormous rate, but I quite recognized my responsibilities, and opened the throttle as wide as it would reach.

As we drew near to Ching-Siang it entered my hazy brain that, as the rails terminated at that place, some difficulty would be experienced in continuing the race. It did not occur to me to close the damper, or draw the fire, or turn off steam, or anything of that sort.

All that was present in my mind was the fact that the steam was being produced, and that it must be used up, or something would burst. But the difficulty of getting beyond Ching-Siang did puzzle me, and to give some stimulus to a wearied brain I took another pull at the dipper. That settled all doubts. I knew that the difficulty would overcome itself in a few minutes, so I lay down among the coals to await events, and have a rest.

I was mentally cursing the sharp corner of a lump of coal which had settled itself in uncomfortable proximity to my left kidney, when I noticed from the lights that we must have reached Ching-Siang. We had.

* * * * * * * * *

Three days afterwards I recovered consciousness on board of the good junk *Fat-Shan*, bound for Canton. Jim Lawson was sitting cross-legged beside the mat on which I was lying. He told me that as we approached Ching-Siang he had succeeded in uncoupling the engine from the train, and the engine alone dashed into a mud-bank, while I was thrown down an embankment without receiving any serious injury. The engine was wrecked, and next day a native horde, thousands strong, came and wrecked the railway buildings. The European officials would also have been immolated in satisfaction of their wrath, but, getting wind of the riot, all hands made for the junks, to which I was carried. Three weeks afterwards I parted from Jim Lawson. He shipped as stoker on board a steamer bound for Europe. I got a job as second engineer on board of an opium smuggler whose headquarters were at Hong Kong.

The Ching-Siang and Ning-Lo Railroad is now a weed-covered monument of the blighting influences of arrack—when used for producing steam.

### Merits of Diamond Stacks and Extension Fronts.

The Union Pacific people have abandoned the extension smoke-box and all the modern forms of spark arresters and returned to the use of the diamond stack. The diamond stack possesses some of the worst features to be found in spark arresters, but most people think it reduces spark throwing just as effectually as any extension front arrangement. To this, however, there are many exceptions. Not a few men think differently. The pros and cons were very fairly stated by Mr. W. Montgomery, of the Central Railroad of New Jersey, at a New York Railroad Club meeting. He said:

As to which is the better spark arrester, the diamond stack or the extension front with a netting, I would say that the extension front, properly constructed, and with a bituminous coal burning engine, with a brick arch, is superior as a spark arrester, and even without the brick arch. With the old diamond stack and a netting with a proper mesh, and cone properly made, we had a fairly good spark arrester when it was in good order. But after a time the sparks began to wear the netting and the engine began to throw fire. This improved her steaming qualities, because the openings were enlarged, and the engineers were careful not to say much about it. When we would get out to look at the netting we would find several of the wires cut. Sometimes they would cut holes through the cone. With that stack we had a great deal of trouble from burning the lagging, and frequently the men's overclothes would get on fire, and it often burned clear back on the cars so that the brakeman could not sit there. The force of the exhaust drove the sparks up and they ground against the netting and the cone until they wore through both.

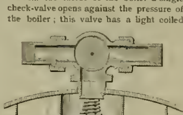
Several years ago we received an order to put on extension fronts. I did not like the idea very well, as I thought the diamond stack was good. But after we had put on the extension front and tried it with bituminous and anthracite coal, there was no question but that, as a spark arrester and as an improvement to the engine, it was a success over the old diamond stack. The tendency of the sparks to stop up the netting was not so great as in the case of the diamond stack, for the reason that the sparks were simply drawn up by the exhaust, whereas, in the other case, they are oftentimes driven in.

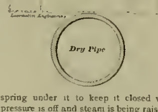
Of course there are disadvantages in connection with the extended front. One of the worst is the tendency of the exhaust pipe to stop up. When we used the diamond stack and had a low pipe with a petticoat pipe or a lifting pipe, we had very little trouble with the exhaust pipes or nozzles choking up. But with the pipe extended on up to the netting line, or in line with the top row of flues, there is a tendency for the pipe to stop up more, and very often the engines are running choked up. A strong back pressure is created by the closing of the exhaust pipe and the engine of course labors very hard. But with the proper construction of front ends and attachments and the nozzles kept clean, I think that the engine with the extension front does not burn any more coal than it did with the old stack. I think the cost of maintaining the extension front is less. Mr. Forney said at the last meeting that on the Baltimore & Ohio they burn 196 pounds of coal per square foot of grate surface per hour. In order to burn that much coal we have got to have a great velocity of draught to produce that rapid combustion, and it seems to me that with an engine running under that pressure of steam and with that force of draught, it would be impossible to prevent sparks from going into the front end—and good-sized sparks, too.

### Foster's Feed-Water Delivery.

The outline cut shown herewith explains the details of a feed-water delivery now in use on the Fall Brook Railroad. The branch pipes from both injectors lead to a T located on top of boiler just ahead of the dome.

From the inside of the boiler a single check-valve opens against the pressure of the boiler; this valve has a light coiled

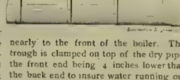





spring under it to keep it closed when pressure is off and steam is being raised.

This plan makes the feed-pipes very short, and gets rid of the dangerous side-checks, the inside valve closing up in case the T is broken off.

Instead of a pipe from the check to front of boiler, Mr. Foster uses a thin steel trough about 16 inches wide and running



nearly to the front of the boiler. This trough is clamped on top of the dry pipe, the front end being 4 inches lower than the back end to insure water running out freely.

Experiments show that the water is delivered at the front of the boiler at about 300° Fahr. There are no pipes to clog up or break off, and all the scale deposited in the trough makes no difference with its efficiency. This device is giving the best of satisfaction on the road.

### Cylinder Proportions of Compound Engines.

Although the engineering fraternity of this country has learned a great deal in the last few years about compound locomotives, there is still considerable diversity of opinion concerning the proper proportions of high and low pressure cylinders. In this connection some remarks made by Mr. F. W. Dean, at the Master Mechanics' Convention, are highly edifying. Mr. Dean said:

"In designing a locomotive, it is desirable to have the cylinder surface as small as possible. The condensation in the cylinders is proportionate, roughly, to the amount of cylinder surface. Therefore, speaking in a general way, the engine which has the least amount of cylinder surface will have the least cylinder condensation, and will be the most economical engine.

"Now, it is perfectly easy in designing a compound engine to so design it that the expansion through the two cylinders will be continuous, and it can be shown mathematically that if the cut-off in the low-pressure cylinder is at that point which is determined by the cylinder ratio, the expansion will be continuous through the tube, that is to say, the low-pressure cylinder will begin its expansion at the pressure at which the high pressure leaves off, and therefore the objection to the two-cylinder type of engine, that you cannot expand your steam continuously, disappears." * * * * * * *

Speaking of a Lehigh Valley compound, which he designed with cylinders 20 and 30 x 24 inches, Mr. Dean said: "It was put to service which I did not expect. It never occurred to me that that engine was to push coal trains up a 96-foot grade at 12 miles an hour. I fancied she was going to be used in a general run on a more level division. The cylinder ratio is 2¼ to 1. I wish it were 2 to 1. Then, although she might have the same total expansion, it would be divided between two cylinders. In pushing thirty coal cars up a hill they cut off at 17 inches, and of course that is too late. She ought to be compelled to do the work with a cut-off not later than 12 inches, and the only way to accomplish anything of that sort when you are limited as to the size of your low-pressure cylinder, is to make your high-pressure cylinder larger. You will then get the total expansion that you expect to get anyway well-divided between the two cylinders, and that gives the minimum condensation with the best results. * * * * * * *

"If any compound engine has a high-pressure cylinder so small that you are obliged to run three-quarters to full stroke in order to get sufficient steam through the engine to make it do the work, the engine is no longer a compound; that is to say, the high-pressure cylinder becomes a sort of steam feeder. It measures off every time so much steam to be expanded in the low-pressure cylinder. Such an engine as that cannot give the best results, and the only way to overcome the trouble is to make the high-pressure cylinder sufficiently large to cut off early.

### New Facts About Train Resistance.

About a year ago tests were made by Mr. Angus Sinclair of the locomotive pulling the Empire State Express, which appeared to indicate that the train resistance was not more than half what the text-books treating on this subject make it out to be. Mr. A. M. Wellington, of the *Engineering News*, took the data found in the run referred to, and comparing it with other reputedly accurate records, plotted out a diagram of train resistances, which makes the resistance at 40 miles an hour 12 pounds per ton, and at 60 miles per hour 16 pounds per ton. This is not more than half the resistance given in the text-books. The correctness of Mr. Wellington's figures appears to be substantiated in a paper read by Mr. William Forsyth, on tests of locomotives. The following is condensed from a paragraph on train resistance, which appears in the paper:

"The dynamometer records show the amount and variation of passenger car resistance for the whole of the trips. The paper traveled one foot per mile. On these diagrams points have been selected where the track was comparatively level and the speed uniform. The average resistance per ton of cars at speeds 39 to 46 miles per hour is 13.5 pounds. At speeds 45 to 52 miles per hour the resistance shows 9.77 pounds per ton. The reason for this being less is doubtless because at the lower speeds, although the speed was apparently uniform, yet the train was being accelerated to higher speed. At 48 to 52 miles an hour the train had attained a velocity where it almost drifted along, and the demand on the engine was very light. This illustrates the difficulty in getting exact figures for train resistance where there is such constant fluctuations in speed and pull. At average speed of 54.6 miles an hour the resistance is 12.2, and at 61 miles an hour the record shows 10.8 pounds pull with 10 to 12 cars."

These figures represent only the resistance of the cars.

The small resistance shown at 61 miles an hour was probably caused by the engine putting less work on the draw-bar than was necessary to maintain the speed.

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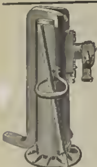

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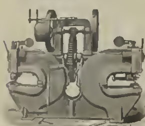

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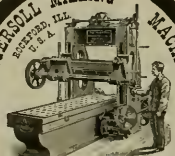

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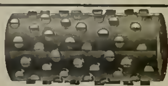

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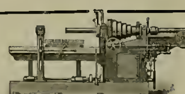

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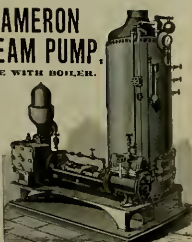

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## ? A. What You Want to Know. ? A.

Don't ask questions that simply require a little figuring to determine; make each question separate. No notice taken of anonymous questions.

(35) J. L., Albany, N. Y., asks

Is there any reason why a locomotive engine should develop a pound in boxes on one side more than other? *A.*—No.

(36) King, Tulare, Cal., asks

Does all the steam used in an injector condense to water in passing through the injector? *A.* Almost all of it condenses, but it raises the temperature of the water in doing so.

(37) J. D. B., Santa Fé, N. Mex., asks

Why will an eight-wheeler slip easier than a ten-wheeler, both same size cylinders? *A.* The ten-wheeler probably has more weight on the drivers and has some more friction, in its extra parts, to overcome.

(38) J. D. R., Wolfboro, N. H., writes

Where does the most strain come on a locomotive boiler under steam? *A.*—At the mud-ring. 2. In a train of twenty cars, which pin does the most strain come on when pulling up hill? *A.*—On the front pin.

(39) L. K., Turo, N. S., asks

What is to be done in case main driver of a mogul should break all to pieces? *A.*—You could probably run in slowly by blocking up the end of shaft, using the opposite cylinder, taking down all side-rods.

(40) F. C. C., Cedar Rapids, Ia., writes:

Please give the number of revolutions a disk 12 inches diameter should be run for cutting off flues, gas pipes, etc.? *A.*—Disks used for cutting rails and bar-iron are run with a peripheral speed of nearly two miles per minute. We think about 5,000 feet per minute would do for cutting off flues.

(41) L. G., Cleveland, O., asks

Will you kindly inform me what is the matter with air pump governor. It will stop the pump at 30 pounds in spite of how much it is screwed down; governor and pipes are perfectly free from dirt or gum and look O. K. every other way? *A.*—We don't know. This is an individual case, the cause probably being local.

(42) G. P., Findlay, O., writes

Will you give me a rule for finding horse-power of boilers and engines, and horse-power to do certain work? *A.*—Depends on the type of boiler and engine; 15 square feet of heating surface is usually allowed to a horse-power, where natural draft is employed. With artificial draft a horse-power is represented by much less heating surface. To find the horse-power of an engine look up any book on the steam engine indicator. The other question is too indefinite.

(43) W. G. B., Ashland, Ky., writes:

We use Ohio river water and Bellfield and Monitor injectors. Why when weather gets warm does water waste through overflow while injector is working a great annoyance? And no one have I found who can remedy or tell me the cause. *A.* When the water gets too warm it does not condense all the steam, which generally causes the injector to break. A heavy fall in steam pressure will cause injector to waste at overflow. Try shutting off part of the water supply on giving the instrument more steam.

(44) W. H., Barring Cross, Ark., asks

Will it make any difference in the weight on the drivers of an engine to raise or lower the front of engine on truck? If it would make any difference, about what amount would it make on a ten-wheel Baldwin engine to raise or lower front end on engine-truck one inch? *A.*—The principal difference would be that raising the front end would throw the water back, take some from the front and put it at the back end of boiler, making some difference with the weight on drivers. The amount for a given engine would have to be determined by actual experiment.

(45) E. E., West Shore writes:

The articles on valve-setting have got up quite an argument here in the shop among valve-setters, some claiming that in running over the cut-off and finding it necessary to change the valve for one motion that both forward and back blade of eccentrics should be changed an equal amount or moved the same distance. Which is the proper method? *A.*—You certainly would not move both eccentric blades to rectify an error in one motion. It often happens that the easiest way to equalize cut-off is to throw the back-up gear "out" a little to help the forward gear. Each are treated separately in valve-setting.

(46) S., Frankfort, N. Y., asks

Suppose we bore the cylinders of a locomotive and leave one ⅛-in. larger than the other, will the power against the piston be more than the power against the piston in the smaller cylinder, both valves being set alike? If so, why so? *A.*—Certainly, the piston in the large cylinder will present the most area to the pressure of steam, and as a result give more power. It is a plain problem in simple arithmetic. A cylinder 18 inches in diameter has an area of exactly 254.47 square inches, while a cylinder 18⅜ inches in diameter has an area of 265.18 inches, a difference of 10.71 square inches. Assuming the pressure to be 100 pounds, there would be over 1,000 pounds more pressure on one piston than on the other. Yet in practical working it would be hard to detect a difference.

(47) E. D. C., Roodhouse, Ill., writes:

I understand the angularity of main-rod, but do not see how the distortion caused by this is overcome by setting link saddle-pin back of center of link. In what way does it affect the travel of valve? *A.*—The angularity of the main-rod causes the piston to travel farther for one-half the revolution of the wheel than for the other half. The placing of the saddle-pin back of the center of link causes the link to swing on the hanger farther back than it does ahead of the perpendicular; this causes the link to slip on the block more for one half of the stroke than for the other half, and this distortion is used to open the valve at nearer the proper point in the travel of the piston. The distortion of the motion offsets the distortion caused by the angularity of the main-rod.

(48) Fireman, Argentine, Kan., asks

1. Is an Allen valve supposed to take steam through supplementory port before valve has opened steam port? 2. Are such valves intended to be set blind or with lead opening? 3. What effect will it have on a freight engine with 58-inch wheel to change side-rods, substituting for old ones a pair lighter by 50 lbs. each? *A.*—1. M. C. Hammett, Troy, N.Y., manufacturer of the Allen-Richardson balanced slide valves, states that the valve-seat for Allen valves should be of such length that the supplemental port will admit steam simultaneously with the opening of steam-port by steam-edge of valve. 2. Allen valves should not have more than ½ the customary lead at steam-edge, as you are having the same amount of lead at supplemental port as at steam-edge. 3. It will change the conditions, and require a lightening of the counter-balance weights.

(49) A. P., Winslow, Ara., writes

I am running an engine that is square when on track curving to the right, but when on opposite is quite lame. She is a ten-wheeler with double-rocker boxes. What is the probable cause of this? *A.*—We don't know—some local cause. 2. When this engine is working full throttle, it is almost impossible to hold reverse lever when taken out of notch in quadrant. Valves, rocker-boxes and eccentrics have been examined, but the trouble has not been located. *A.*—The friction of the eccentric straps on the sheaves causes most of its "pull," and the angle of the links intensifies it at certain points of the revolution. Some engines built with two rockers or with motion-bars are often almost unmanageable from this cause. We should like the experience of some one who has found the cause of the disease—and cured it.

(50) D. O'B., Mancelona, Mich., asks

1. What is to prevent a Nathan light-feed lubricator from cross-feeding? *A.*—The condensing chamber is separate from its cup, and there are two balancing tubes, one for each side; there being no passage for the oil from one sight-feed glass across to the opposite oil pipe. 2. About what candle-power is an ordinary headlight? *A.*—The flame is about 24 candle-power, the reflector intensifies and directs all the light in one direction, making the light many times stronger. 3. How can the steam in an injector overcome the friction in the pipes and still feed water against the same steam pressure? *A.*—This is a question of dynamics; the steam itself could not re-enter the boiler, but it has picked up water, which has weight, and forced it against the pressure within the boiler; it is somewhat in the nature of a blow. 4. About what would be the cost of a 28-ton narrow-gauge mogul locomotive of the common build? *A.*—From $3,500 to $4,000.

(51). G. B. Ashland, Ky., asks

1. Please tell me how to locate knocks or pounds sitting upon the seat-box while engine is running; that is, how shall I know the difference between wedge knock or pound and knock in consequence of loose brasses? 2. How shall I tell whether front-end brass or back brass of main-rod need filing? 3. How can I tell which side is lame without measuring valve-stem? 4. How to know whether it is valve blow or packing in cylinder down and to locate which side blow is on. *A.* 1. There are altogether too many men who want to take care of their engines and inspect them "while sitting on the seat-box." There is a trite old saying, "Naething is got wi'out pains, except dirt and lang nails." Take pains to inspect and examine your engine. The easiest way to find whether a box is pounding on account of a loose wedge or on account of a loose brass, is to block each side of the wheel and let some one give the engine a little steam and throw the reverse lever back and forth while you watch the box. 2. Notice this while testing box, the front end makes a very sharp and distinct pound while passing centers, and once started will wear very fast. 3. All depends on what causes the lameness; you can generally tell if a valve is admitting steam evenly at each end of the stroke by moving very slowly and noting steam at cylinder cocks. 4. If you put your reverse lever in the center and the pin on the suspected side on the quarter (cross-head in center of guides) the valve will cover both ports, leave the cylinder cocks open and admit steam, if any appears at cylinder cocks the valve leaks. If it don't blow test the piston by blocking engine in same position and putting reverse lever in forward corner, this will admit steam to the front side of the piston. If steam appears at the back cylinder cock the packing is down. A valve blows quite steadily, while packing down causes a roaring blow while steam is on; an experienced man can usually tell one blow from the other from the cab, especially if it is bad.

### Compressed Air for Transmitting Power.

At the last meeting of the Northwestern Railway Club, Mr. Wm. McIntosh, master mechanic of the Chicago & Northwestern, read a paper on the "Use of Compressed Air in Railroad Shops." He saw wonderful possibilities in the use of compressed air for cities from places where water power can be obtained. This method of transmitting power is peculiarly suitable for railroads. We have now pneumatic brakes, signals, gates and other apparatus indispensable to the proper running of trains. The time is at hand when an air compressor will be as necessary to a well-conducted shop as the steam engine, and most of the drudgery in and about such an establishment will be performed by this agency. The rapid development of the use of compressed air in railroad shops is astonishing. There is scarcely a shop in this country that does not use it in some form or another, and this speedy evolution is largely due to the technical press publishing each new growth which in turn leads to new applications. In one issue we find illustrations of an apparatus produced in Kansas for cutting off stay-bolts which does more work in one hour than could be performed by hand in twenty hours. From Nebraska comes a description of a pneumatic crane, a grate-shaking device, and an apparatus for opening the furnace door. Then there are numerous air motors, large and small. The portable motor can be attached almost direct to boring bar or flexible shaft, dispensing with complicated counter-shafting, belting and rope-toggles, while the smaller type is used as a breast drill when desirable, or slung up in any convenient manner to reach a desired position.

There are devices for sanding the rails for locomotives, delivering sand in desired quantities directly where wanted, thus saving many a crank-pin and strap from destruction and assisting many a train over a hill that would otherwise stall for want of sand or by reason of a too liberal supply, as often occurs when regulating its delivery by the lever and valves in common use.

There are air bell-ringer motors, neat little devices that are put in operation by a touch from the engineer. Then there are numerous snow flangers and dumping and drop-bottom cars handled by pneumatic cylinders. Drop-pit cylinders are supplied with compressed air, and the heaviest pair of driving wheels or an engine truck can be balanced on the piston as buoyantly as a cork will float on water. There are air-lifts for handling steel rails as easily as fence boards, and innumerable hoists in and about shops, some suspended from cranes, some fixed in a stationary position, and others sunk below floors for lifting driving wheels and other heavy weights. Outside of shops this power is utilized for raising cars and trucks in repair yards and for elevating sand and coal and various other purposes.

The latest application coming under my notice was for tripping and returning the ram of a hydraulic press, giving the operator absolute control of the ram even to $\frac{1}{32}$ of an inch. I might go on specifying indefinitely where this power is already employed and where it can be introduced to advantage. There is practically no limit to its usefulness, which is principally due to the ease and directness with which it can be conveyed to any locality, and the entire absence of complicated machines—all that is necessary is the cylinder with its piston and rod, a common plug-cock, and suitable hose connections for a portable lift and ordinary pipe connections for stationary ones.

The North Adams branch of the Boston & Albany road has been designated as Division No. 4, and the mechanical department has been put under the supervision of Thos. B. Purves, Jr., of the Western Division.

### "Windy" Jackson—Chairman Stove Committee.

"When you're talking about fast running," said "Windy" Jackson to a group of men who sat along the side-rod of the new decapod, "you poor, common railroad liars always spin out some cussed yarn that is so d——d incompatible with scientific principles, and the molecular action of your brains don't reach far enough to discover the incongruities of your statements."

Tom Smith was just telling how Dad Jones pounded the 136 on the back down Maren Hill, and had taken out a plug of tobacco with which to refresh himself, when "Windy" came in—after the manner of a cyclone—and delivered himself of the above opinion. The plug found its way quickly back to its owner's pocket, for the boys all knew "Windy's" predelection for U. P. tobacco, and the size of his mouth assured the rapid disappearance of a neighbor's plug if once he got his fingers on it.

Everybody kept still when "Windy" began to talk; they were all past being insulted by anything he might say of them, and they also knew that he would end his harangue by telling them something from his own store of experience. Standing before them, with his arms revolving like the arms of a Dutch windmill—though without their regularity—he told them this story:

"We were on No. 6, out of Denver, one night, three hours late. Old Sam Burns was on the right side and 222 was as bright and trim as a new dollar. No. 6 is a hummer on the new card, but we kept cutting down that three hours at a pretty steady gait. You know that ten miles of straight track out on the west end? Well, sir, when we struck that, old Sam said he was going to see what the 'Three Deuces' could do. So he pulled her wide open and hooked her in six inches, and say, mister! how that engine did run! I was kept pretty busy attending to the chemical reaction that was taking place in the fire-box, while the old girl kept going faster and faster.

"Allow me, gentlemen, to remark right here, that old Sam's ability to run an engine can only be exceeded by your humble servant's ability to keep one hot.

"We were flying that night, and don't you never doubt it; and I could not refrain from saying, just to myself, that we were a full house—three deuces and a pair of birds. It is not often that I get leary on an engine, but when the drivers commenced to purr like a buzz-saw I began to wonder why Sam didn't ease her off a little. When I looked up at old Sam my heart just naturally dropped into my boots There he sat, spellbound, his eyes fairly leaping from his head and his left hand grasping the throttle. I, too, looked out the gangway at the drivers, and blamed if you could see anything but a circle of fire with a white center, and how they did purr!—they almost put me to sleep. I was feeling a little nervous myself just about that time, so I went over to shake old Sam up a bit; but when I put my hand on his shoulder, dogged if he wasn't as stiff as a piece of statuary.

"I came to the conclusion just then that I'd take a hand in the running and shut her off; but, do you know, I couldn't make him let go nor could I move him. Then I thought I'd dump my fire and stop her in that way, but when I went to do it the fire was out. I have heard a great deal about wind-splitting and wind-splitters, but say, gentlemen, we were the first to practically demonstrate that phenomenon.

"For a few seconds there wasn't enough oxygen on that train to keep a canary bird alive My nose began to bleed and so did Sam's, and my head felt as if it would burst. I heard a noise as of distant thunder, and I thought I'd die for want of breath before we could get stopped. But we were already slowing up, and as we struck that little hill coming into Littmore the train stopped.

"There is usually some sacrifice connected with the demonstration of scientific truths, and this was no exception to the rule. There was a poor consumptive back in the sleeper, who had been out to Denver for the light air, but was compelled to return home because he could not stand the rarified atmosphere of the mountains. The poor man died that night on No. 6, and I've got the papers to prove all I've told you."

Here "Windy" drew a newspaper slip from his vest pocket and read:

"We, the coroner's jury, being duly sworn, and hearing all the testimony in regard to the death of John Kidd, lying here dead, do solemnly affirm that said John Kidd came to his death in the sleeper Patmos, attached to train No. 6 on the X. & Y. R. R., by the rarification of the atmosphere from intensely accelerated velocity."

### Too Complex for Coupling Cars.

He was impressively modest and knocked at our office door. When the boy invited him to enter he dragged in a grip shining of the waterproof canvas variety It appeared to be heavy, but he held a tight hold while he asked for the editor.

On being shown inside the sanctum, he remarked that his friend, Alonzo Dolbeer, had told him that we were fond of examining inventions of a mechanical nature, and that he had come all the way from Central New Jersey to see us.

We were inclined to exclaim superciliously that we were tired looking at car-couplers, but the pathetic look on the old man's face and his simple but earnest manner softened our heart.

He proceeded to relate the history of his invention. Went with elaborate details into certain family reminiscenses to prove that he had inherited inventive faculties of a superior order. The fates had thrown their dice wrongly when they put him down a market gardener instead of a mechanic; but he had done his best to overcome the defects of his training and to rise above circumstances and surroundings adverse to the cultivation of inventive inspirations

"Do you know anything about railroad rolling-stock and the rough service and terrific shocks draw-bar attachments are subjected to?" we inquired.

"Yes," he replied, "I was a brakeman on the Erie for ten days thirty-five years ago," and he proceeded to wind off some reminiscences of railroading as seen in his youth.

On receiving the hint, "This is our busy day," he proceeded to open the grip, and from its depths he drew out an apparatus formed of wood and iron, rough in form but complex in design.

We examined the thing critically, trying to think how it could be secured to the end of a car in a way that it would embrace a similar apparatus on another car We gazed at it for five minutes and imagined it set in all sorts of positions without succeeding in making an intelligible connection.

"Friend," said we at last, "you have made a success in one respect—you have got out the most extraordinary car-coupler we have ever seen!"

"Car-coupler!" he exclaimed, "who said anything about a car-coupler? This invention of mine is a potato-digger."

We bowed down our head and wept for a brief period, then we turned with supreme dignity to the inventor and explained that we knew about car-couplers, grain-doors, compound-engines, and valve-motions just enough to get along, but as to the merits of potato-diggers, we understood as little as the cow of his native state that makes milk-generation a specialty.

One favor we implored that he would grant us. We had seen a shot-gun in a second-hand store to be sold for three dollars. Would he have the kindness to tell his friend Dolbeer that we intended next pay-day to buy that gun and use it on people who send inventors of agricultural machinery to us for consultation.

The old inventor expressed regret at having troubled us, and offered us an interest in the invention on advantageous terms. This we declined with thanks. Two hours afterwards, when we went out to lunch, we happened to see him down the street asking for the office of the *Scientific American Engineer*.

### Misplaced Confidence.

That reminds me, remarked the Northwestern member, of a little story I heard about Mr. Smith. You all know Mr. Smith?

We did not understand what had been the reminder, since profound silence had reigned in the club-room for ten minutes, slightly varied by the creak, creak of the rocking-chair which was aiding McKelvey's meditations. But we all knew Smith, and said so, glad to have the silence broken.

The Smith I mean, continued the N W. M., is William, who is now superintendent of motive power of the Chicago & Northwestern. William is a Scotch country boy, brought up among rural surroundings, and naturally he was innocent and unsophisticated in his youth.

He was for some years an engineer on one of the Cunard steamers, and had not grown hardened by the wiles of wicked men when he came to Chicago to begin making his fortune under the Stars and Stripes.

William made up his mind to stand and fall with the United States, and he took a lively interest in making himself familiar with our political system. As a part of his political education he made up his mind to attend political meetings Hearing from a fellow workman that there was to be a party meeting in a certain hall, one evening Mr. Smith went there.

It was a big meeting called for the purpose of electing delegates for something. William sat down in the body of the hall and he had no sooner found a seat than a small easy-talking chap entered into conversation with him. Mr. Smith explained that he had never been at a political meeting before and wanted information about what was to be done.

"Now," said his new made acquaintance, "you are a big man and could easily make your influence felt."

"How is that, in what way?" asked Smith.

"Well, this way. In a little while they will be naming candidates and you stand up and shout with all your might, 'I propose Charlie Royal of the Tenth Ward.' Don't let them bluff you down. He is the best man in this city."

Mr Smith was good natured and anxious to do his political duty. When the proper time came round he got up and shouted for Charlie Royal. A man who stands six feet and a half and has good lungs is influential in a stormy meeting. Smith's man was duly nominated.

When quiet was restored his new made friend whispered to Smith, shout, "let us hear from Royal" He did so and the call was taken up. At this point Smith's acquaintance left him and went to the platform.

"Well, well, well, shiver my timbers," exclaimed Smith, "if that little cuss who asked me to shout for Charlie Royal isn't Charlie Royal himself."

No one has seen Mr. Smith nominating candidates in a political meeting since that time.

### One Hundred Years in the Steel Business.

The well-known firm of William Jessop & Sons, of Sheffield and New York, makers of the famous "Jessop's steel," celebrate their centennial this year. In 1793 this business was established in a modest way by William Jessop at Sheffield, Yorkshire, England

After the death of the founder the business was continued by the sons, Thomas, Sydney and Henry, who, through careful and judicious management and a thorough acquaintance with the practical part of the steel-making business, amassed great wealth and placed the firm of William Jessop & Sons at the head of all similar concerns in the world, and the management has continued in the hands of the family since its establishment.

About sixty years ago the agency in the United States was established, the firm being represented by one of the sons of the original founder, Henry Jessop, who died in 1849. The present headquarters at 91 John street, New York City, were purchased by the company and have been occupied by them for the past fifty years.

William Jessop & Sons are well represented in the United States and Canada, by a number of agencies controlled by first-class concerns in the principal cities, all under the supervision of Mr. William F. Wagner, who is the general manager of the American agencies. They carry a large stock of cast-steel in bars and sheets and circular plates of all salable sizes. They have acquired a world-wide reputation for making crucible steel for tools, dies, etc Their works at Sheffield are situated on the banks of the river Don and cover no less than thirty acres of ground They have also supplementary works in two other sections of the city in the exact localities where the firm originally started in business.

Several years ago the firm introduced a new branch into their business, that of steel castings. They have now one of the largest plants in existence for this purpose, and have produced the heavy marine castings for many of the largest steamships afloat. The premises are of the most complete character, their equipment including extensive converting and melting furnaces, forges, rolling mills, steel foundry, gas works, engineering shops, and all the necessary appliances for the successful manufacture of steel in its various forms, from the heaviest forgings and castings to the smallest bars, and from the largest plates to the thinnest sheets. The rolling of sheet steel is carried on to great perfection, the company supplying large quantities for the manufacture of circular and other saws, for which the Jessop steel has been found especially valuable Another important branch of the business is the manufacture of sheet steel for making steel pens, for which William Jessop & Sons have almost a monopoly.

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Queen & Co., of Philadelphia, the instrument makers, have taken hold of the Bachelder indicator. This indicator is a new departure from all other forms, the important feature being the flat adjustable spring by which the change can be made from one scale to another by a simple adjustment of the fulcrum, thus avoiding the extra expense and necessity of carrying a series of spiral springs. This house has also this year put on the market a line of steam and pressure gauges of their own make for which they claim great accuracy.

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Novelties in the way of car couplers are becoming rare, the ingenuity of many inventors having almost exhausted the possibilities in this direction. Under the circumstances we raise our hat to Frank Bender, Armourdale, Kansas, who has patented a car coupler which he might conscioasly swear is novel and original. It consists of a block which is slotted to take in two links set side by side on edge. Mr. Bender ought to exhibit his coupler at the World's Fair.

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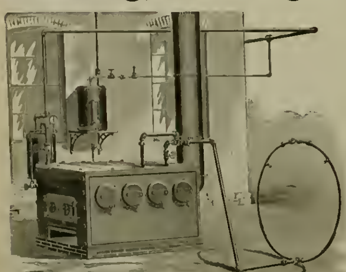
An improved form of smoke-burning boiler has been patented by Mr. J B Barnes, superintendent of motive power, Wabash Railway, who had already secured several patents for smoke-preventing devices. The principal feature about the latest patent is a chamber placed at the back of the firebox outside, which is used in connection with openings through the firebox and steam jets for inducing a supply of air.





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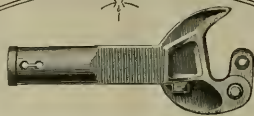

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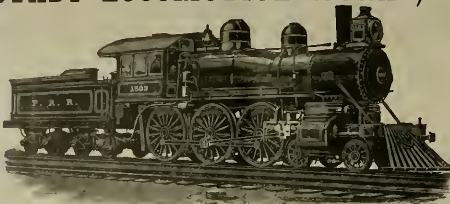


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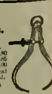

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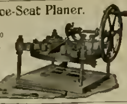
Quickly Attached.
Easily Operated.
Does Accurate Work.

## Valve-Seat Planer.

Over 300 in use.



## —DAVIS— Valve Port Milling Machine.

This machine will mill out ports in valve faces of steam cylinders, duplicating work exactly and in the shortest possible time.
It is operated by a rope belt similar to that used for driving drills, etc.
It is much lighter than the cylinder and can be readily placed in position using the stud-holes to attach to for that purpose.

## PATENT PORTABLE Locomotive Cylinder Boring Machine.

Will bore out Locomotive Cylinders **in their places** by removing one or both heads, as desired, and piston. **The end thrust is always in exact line with bar.** It is fed with constant feed of ou' gears.

PEDRICK & AYER, MANUFACTURERS
Special Railway Tools
1001 Hamilton St.
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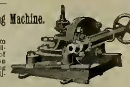
## —LEED'S— Horizontal & Radial Drilling Machine.

Designed to work on or from a Drill Press. Is useful in drilling ends and diagonal parts of frames. Can also be mounted on the work and driven by a sliding shaft and universal joints. Drilling in all directions can be done.



## —LEED'S— LINK MILLER & SLOTTER.

For rapidly and accurately Milling out Links to any desired radius. Can be used on Drill Press or as an attachment to our Heavy Universal Milling Machine.

*A link 20 inches long can be finished in four hours.*

## Greenwood's Universal Planer Chuck.

FOR STRAIGHT, CURVED (CONCAVE OR CONVEX) OR ANGLE WORK.

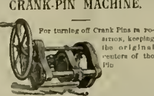
Used on any planer with cross feeds for links, keys, wedges, etc.

*Indispensable for Locomotive Builders and Master Mechanics.*

## —JOINTER— FOR Facing Locomotive Brasses.

Will hold any size brass same as held by strap when in use.
No more time required to place brass than screw up an ordinary vise.
Any desired thickness of cut can be taken, jointing the faces perfectly true.
No files required.

## CRANK-PIN MACHINE.



For turning off Crank Pins in position, keeping the original centers of the Pin.

## PORTABLE DRILLING MACHINE.

**For Fitting New or Old Cylinders to Locomotive Boilers.**

It will drill all the holes in smoke boxes and cylinder flanges necessary to hang one pair of cylinders at one setting of the machine.

Quickly set and operated.
Driven by hand or belt power.

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## STEEL OPEN HEARTH CASTINGS

STANDARD STEEL CASTING CO.
THURLOW, PA.

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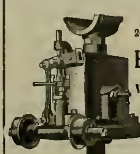

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OPEN HEARTH AND EUREKA **STEEL CASTINGS**

Railroad and Machine Work. Locomotive Cross-Heads a Specialty. Guaranteed Knuckles for M. C. B. Couplers. Address, Eureka Cast Steel Co., Chester, Pa.



## Ross Regulator Valve FOR CAR HEATING.

Low in price and always reliable. No complicated parts. Easily understood. Durable. Has no equal.

ROSS VALVE CO.,
TROY, N. Y.

## RICHARDSON & ALLEN-RICHARDSON,

BALANCED SLIDE VALVES.

New Patent, April, 1891.
6,000 Locomotives Equipped. In Use on 175 Railroads.
Manufactured only by
M. C. HAMMETT,
Successor to Estate of F. W. RICHARDSON, Troy, N. Y.

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## HOPKINS & ATKINS, PATENT LAWYERS.

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Members of the Bar of the Supreme Court of the United States.
REFERENCES: SAFETY CAR HEATING & LIGHTING CO., 160 Broadway New York. SHEFFIELD VELOCIPEDE CAR CO., Three Rivers, Mich.
Marcus S. Hopkins, formerly Principal Examiner, Examiner of Interferences and Examiner in Chief in the U. S. Patent Office.
Joseph L. Atkins, formerly of the Pennsylvania R. R.

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Nothing but best Steam Metal used in the manufacture.
Keyed Stuffing Box and Disc Removing Lock Nut.
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LOCOMOTIVE ENGINEERING
A PRACTICAL JOURNAL of RAILWAY MOTIVE POWER AND ROLLING STOCK.

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## The Heaviest Piece of Freight Ever Transported on a Railroad, and the Car that Carried It.

The two large engravings on the first and second pages will be interesting to our readers. One represents the great Krupp gun being lifted from the hold of the gun suspended, and on the ground to the right can be seen a rack of railroad rails weighing 130 tons, used to test the lifting tackle before the precious 127 tons of rifle was intrusted to it.

This crane consists of two immense legs or shears, made of steel tubes ¾ inch thick, 4 feet in diameter in the center and 3 feet capable of standing over 2,000 pounds to the inch.

When this back leg is at the front and top of its travel, the top of the shears are some 30 feet over the edge of the dock, which will admit of lifting a great weight from any vessel. When the back leg is carried in the weight is brought over the ings being steel castings. It consists, as may be seen by referring to the engraving, of a major bridge, two minor bridges and four eight-wheel cars. The gun rests in the major bridge on two supports, designed to closely fit its perimeter. In addition to these two supports, to avoid any vibration while in transport, the muzzle is

THE HEAVIEST PIECE OF FREIGHT EVER CARRIED ON A RAILROAD, AND THE CAR THAT CARRIED IT.—LIFTING THE GREAT KRUPP GUN FROM THE HOLD OF THE SHIP.

steamer Longueil at Sparrow Point, Md., by the immense crane built for the purpose by the Maryland Steel Co.

This gun weighs 270,000 pounds. This is an immense load when put into the shape of a single cannon.

Krupp's built a car at Essen to carry the gun to the seashore, and the Pennsylvania Company built one on the same general lines to carry it to Chicago, where it arrived safely.

The picture on the first page shows the at each end and 116 feet long, the bottom points being 45 feet apart and joined at the top. The lower ends rest in cast-iron cup-shaped castings.

The tops of these legs are joined to a third leg of the lattice-girder, the lower end of which is 126 feet long, the lower end running on rollers over a curved base or track made immensely heavy. This is moved over the curved track by great hydraulic cylinders carrying a pressure of 1,700 pounds to the square inch and dock, where a railroad track extends along the edge.

The big gun was safely lifted by this arrangement.

The car that carried this load is the largest and strongest ever built. The following description of it was furnished by Mr. Theo. N. Ely, chief of motive power of the Pennsylvania Railroad

The large gun car has a capacity of 285,000 pounds, and is built entirely of boiler steel, the center plates and center bear- secured by wedge-shaped oak blocks set in cast-iron shoes, and drawn up to the muzzle by means of right and left hand screws. The major bridge is 50 feet from center to center of supports, and rests directly on the side bearings, while on the other hand the minor bridges are supported by their respective center plates

The cars have been designed so as to combine strength with flexibility, and are equipped with Janney couplers and draught rigging specially constructed for strength

The journals are 4½ x 9 inches, 37½-inch wheels with wrought-iron centers and steel tires are used

Each car has a Westinghouse air-brake cylinder, with brake on all wheels, and National hollow brake beams with Christie brake heads and shoes.

The load on cars is thoroughly equalized by 32 elliptic springs of 36-inch span each spring having eighteen leaves, 3½ inches wide and ⅜ inch thick

The extreme length of car is 90 feet 9 inches extreme width, 9 feet 10 inches, extreme height to top of bridge, 9 feet 9⅜ inches

| | Lbs |
|---|---|
| Weight of long bridge | 47,000 |
| " short bridge, each. | 14,400 |
| " 8-wheel car .. .. | 24,800 |
| Total weight of car .. | 175,000 |
| Weight of gun.. .. ... .. | 270,000 |
| " car loaded. . | 445,000 |
| " per foot of wheel base . | 5,545 |

The Car that Carried the Krupp Gun to Chicago. Weight of Car and Load, 445,000 Pounds.

### Old Men and Old Machines.

"The modern method of running locomotives takes away all the romance that attached to the business in olden times," remarked an old engineer who was inclined to look upon old machines and old ways with pleasing regret. "A man can no longer talk about 'my engine,' or think that he has got any more interest in a particular machine than dozens of other men The consequence is that he has no special interest in trying to make an engine do better work than she will perform under common treatment

"I have seen many cases of locomotives being kept successfully at work long after they were worn out. This was done by the personal efforts of old engineers who would not see their old favorites sent to the scrap heap as long as care and hard work would keep them on the road. The most striking case of this kind I remember was on the Delaware, Lackawanna & Western. There was an old Winans camel-back that had a famous reputation for pulling trains. Nothing would stall her. This engine in her old age fell into the hands of old Ralph Max. He was proud of her past record, and did his best to keep it green to the last. The master mechanic talked for years of sending the engine to the scrap pile, but Ralph pleaded for delay and kept the engine in repair by his own exertions

"A generation of men came upon the road who knew nothing about camel-back engines, and Ralph's mill was a mystery to them. When he was sick or wanted to lay off for a day the engine remained in the house, for no man would venture to take her out There were very few who would attempt to put her upon the table, after the end of the engine house had been knocked out by men trying to handle the old camel who did not know how to stop her. When any other man than Ralph had her out the old engine was always dropping something or breaking a part that did not seem to have any rational connection with the vitals of the machine, but kept her from working nevertheless Men who were ashamed to have such a thing happen to them would bring the engine in dead, because they did not know how to fix her up to work on one side

"Ralph never had to bring her in on one side. He was always doing something to the 'old girl,' as he called her, not much, either, but she never broke down in his hands. There appeared to be a strong band of union between man and engine and they acted in perfect harmony.

"One day Ralph did not answer the caller and another man and engine had to go out. Other mornings passed and Ralph still remained in bed and the old camel stood cold in the engine house. Both had made their last active trip. One day the engines on the division appeared with white and black bands on their hand rails, and in the afternoon many a sorrowing heart followed Ralph to his final resting-place Some of the boys draped the camel and a week later she was placed upon the bone-yard track."

Quick Way of Loading Consolidation Locomotive on a Flat Car of Steel. Not Recommended.

### Fireboxes that Burn Hard or Soft Coal.

President Blackall, of the New York Railroad Club, having asked Mr Mitchell, of the Erie, if it was true that they were burning anthracite and bituminous coal in the same engine, the following facts were given

We have ten-wheel engines with the fire box entirely above the frames. The engines were originally built for hard coal. We found it necessary to send some of them to western divisions where there was nothing but soft coal. We began using soft coal with them and had no trouble whatever in burning it We afterwards made a series of experiments, and found that we could burn at pleasure either hard or soft coal in the engine without changing the draft or the grates. In fact, it is nothing unusual for these engines to go west burning hard coal and return burning soft coal. Shaking grates are used.

### Motive Power from Explosives.

Daily papers have had a great deal to say during the last few weeks about a wonderful engine which is going to revolutionize ocean travel and dispense with the use of boilers and steam. It is said that the coming engine will use chlorate of potash and sugar to generate a force which will be much more powerful than steam. The inventor has been boasting about what his engine will do, and he expects to drive a 5,000-ton vessel at the rate of 35 miles an hour. This indicates that the man does not belong to the modest class of visionaries. The cylinders of the engine that is to drive the 5,000-ton ship 35 miles an hour are said to be no larger than two flour barrels. That is a little indefinite, but it is near enough to form a basis for something to wonder at.

The mixture of chlorate of potash and sugar forms an explosive. The parties who have been turning the heads of stock-brokers and reporters about what they expect to do with this as motive power force evidently are not aware that explosives have been used a great deal for driving engines and that the engineering world is perfectly familiar with a variety of engines driven by the explosion of gas. The men who are going to drive a big ship with an engine having cylinders about the size of a flour barrel will learn something about the difficulty of controlling explosive forces when they change from the promising to the performing stage. They talk of using cylinder pressures that reach into thousands of pounds to the square inch. It is a pure case of "fools rushing in where angels fear to tread." Machinery has never been made that will control pressures of that kind and keep it going as a working motor

### The D., L. & W. Road's New Ten-Wheeler for Milk Train Service.

Master Mechanic David Brown, of the Scranton shops of the D., L. & W., has recently turned out the handsome ten-wheeler shown herewith.

This road, like the Lehigh Valley, has always been original in designing engines, often departing from the beaten path in detail while still keeping pace with general improvement.

This engine has an immense firebox set above the wheels but without combustion chamber, this gives a grate area of over 83 square feet and an immense heating surface, 2,082 square feet.

The throttle arrangement is, to our way of thinking, the simplest and best that could be devised. Some of the traps recently designed in order to get the throttle stem into the boiler head are as unnecessary as they are trappy.

The arrangement of both injectors on one side of the engine will commend itself.

The extension front is lagged over and covered with a jacket.

This engine has a flange on all her driving-wheels and uses a swing bolster truck. She is said to curve perfectly.

The designers have departed from the rest a little in the design of cylinder-saddles. The steam and exhaust ports are separated by an air space, and the exhaust passages are very large—10 x 5 in., the nozzle is double, each 3½ in. in diameter.

We are glad to note the keeping of the valve travel down to a reasonable distance, and the tendency to using a larger cylinder with a moderately high pressure rather than an excessively high boiler pressure and a small cylinder, although 160 lbs. per square inch is by no means low pressure.

The following general dimensions are given:

Gauge of track, 4 ft. 8 in.
Rigid wheel-base, 11 ft. 8 in.
Total " " 24 ft. 10 in.
Driving journals, 7½ x 9½ in.
Cylinders, 20 x 24 in.
" steam-ports, 1½ x 17¼ in.
" exhaust-ports, 3 x 17¼ in.
" bridges, 1⅛ in.
Slide-valves, Allen-Richardson balance.
" travel, 5¼ in.
" outside lap, ¾ in.
" inside lap, none.
Boiler, diameter of front course, inside, 64 in.
Boiler, 288 flues, 12 ft. 10 in. long.
" heating surface of flues, 1,935 sq. ft.
" center to rail, 8 ft. 7 in.
Firebox, 8 ft. 4 in. wide, 10 ft. long.
" grate area, 83⅓ sq. ft.
Firebox, heating surface, 147 sq. ft.
" fuel, fine anthracite coal.
Total heating surface of boiler, 2,082 sq. ft.
Weight of engine on drivers, 110,000 lbs.
" " truck, 27,000 lbs.
" " total, 137,000 lbs.
Tank, water capacity, 3,700 gals.
" coal capacity, 7 tons.

HEAVY TEN-WHEELER FOR MILK TRAIN SERVICE, D., L. & W. BUILT BY DAVID BROWN, M. M., AT THE COMPANY'S SHOPS, SCRANTON, PA.

### New York to Chicago in Twenty Hours.

About the time this paper appears, a train will begin running between New York and Chicago which passes over the entire distance of 980 miles in twenty hours. The route traversed is the New York Central to Buffalo, thence by the Lake Shore & Michigan Southern to Chicago. The speed is forty-nine miles an hour from starting point to terminus. The route traversed is exceptionally good for the maintenance of high uniform speed, for there are no grades that will reduce the speed of the locomotive, few curves and comparatively few road crossings.

The mechanical difficulties in the way of safely and certainly maintaining a running speed of fifty-five miles an hour have long been overcome. The most difficult part of the problem is to keep the line clear so that the projectile train shall find no obstruction in the way. The Empire State Express, which has been running now for about a year on the New York Central, has been handled with much success, and there is no reason to doubt that the twenty hour train to Chicago will be managed just as well throughout the longer journey. There will be no difficulty whatever experienced in making the time if the right of way is kept clear for the train.

There is some likelihood that the running of this train will supply some interesting data respecting the type of locomotive best adapted for exceptionally high speed. The experience of the New York Central with the Empire State Express has been that a powerful engine with very large driving wheels is necessary to make the time regularly. When the train was first put on engines with driving wheels 5 feet 9 inches in diameter were the best available. They made the running speed with difficulty, the high piston speed militating against them when a velocity above sixty miles an hour was attained. Some engines with drivers 6 feet 6 inches diameter were then tried and they did the work in a manner that was much more satisfactory. Still later an engine was equipped with drivers a little over 7 feet in diameter, and it is said to handle the train with greater ease than the others. All the engines that have been used on this train have cylinders 19 x 24 inches and a boiler capable of supplying them with all the steam required.

Mr. John Newell, president of the Lake Shore, is a civil engineer and takes great pride in having an exceptionally fine track. A tender feeling towards the permanent way prejudices him against heavy locomotives and particularly against locomotives that have excessive weight on any pair of wheels. This influence has led to the stocking of the road with light passenger locomotives, the policy being to employ very high boiler pressure and small cylinders. It will be interesting to note how the small engines will compare with the big ones in pulling the fastest train in the world.

### Making Discord Among Trainmen by Rules.

In the course of a letter on train matters one of our correspondents touches on a delicate point in railroading which nearly all engineers and conductors have suffered from. There is a rule on the road that the head and rear brakemen must be on the tops of the cars when approaching a station or any point where braking is likely to be called for. These men must be out even when the train has enough air-brakes to control the train, and the engineer is held responsible for seeing that the head brakeman attends to his duties, while the conductor has to look after the rear man. If a train passes a station and an official or other person reports that the brakemen were not at their posts, the conductor and engineer get punished. This places these men between the horns of a very annoying dilemma. When a train is equipped with air-brakes it is next to impossible to drive a brakeman to the top of the cars, and the fellow-trainman who does his duty by reporting the delinquent is likely to be very much abused. We do not think that any railroad company acts fairly by making a rule requiring a conductor or engineer subject to punishment for the neglect of duty of a brakeman. The punishment is harder on the man who does the reporting than it is on the man who violates the rules. Officials who have ever been trainmen themselves would not make rules of this character.

### Mr. Leeds Defends the Belpaire Boiler.

The Louisville & Nashville have a great many locomotives in use with Belpaire boilers, and Mr. P. Leeds, superintendent of motive power, is a warm advocate of that type. He writes us:

"I take exception to an article in the March number of LOCOMOTIVE ENGINEERING containing estimates by Mr. Mitchell in regard to Belpaire boilers. He states it as a fact that there is an excessive number of stay-bolts found broken in Belpaire boilers. This is not in accordance with my experience of boilers with the same length of firebox, and their conditions being the same as regards pressures, etc. But what I take particular exceptions to is his explanation why they broke. As I read it, he thinks the long rods extending from side to side of boiler expand to a certain extent, and being so much longer than the stay-bolts, they become loose; or, at least, in lengthening they throw the strain on to the short stays between the firebox and side-sheet. It occurs to me that he has overlooked a very important feature in this case, and that is that the distance from side-sheet to side-sheet, that the outside shell is no longer where the long rods come than it is where the stay-bolts come, and the conditions are such that if any strain is thrown on to the stay-bolts on account of expansion it must be that of compression.

"For instance, we will say that his boiler is 62 inches in diameter, and his longitudinal stays, from side-sheet to side-sheet, the same length. Now the length of his top stay-bolts is the difference between his crown-sheet and these side-sheets, and his crown-sheet makes up the difference as between their length and the long braces. Now, as the crown-sheet is exposed to a greater heat than these long stays, it would look to me as though the expansion would be greater in the combined distance, made up of two short stay-bolts and about 52 inches of crown-sheet, than it would in 62 inches of rod passing through steam or water space; consequently, if expansion has anything to do with it, the tendency would be to press the side-sheets out at the top row of stay-bolts, and that the first row of longitudinal stays would have to resist the difference in expansion between themselves and the crown-sheet, while my understanding of his theory is the reverse.

"I do not write this for the sake of criticising his opinion, nor to air my own, but if there is anything in this statement, I do not understand it and would like to have it explained."

All subscriptions from this on must commence with April or a later date. We are out of papers for January, February and March, though we had lots, but railroad men wanted 'em worse than we did. We don't propose to carry a lot of back numbers.

## An American Express Train.

Nowhere but in America can there be found provision for

people *living on wheels*. All the European railroad does is to transport the body, very few pay any attention to heating their cars, dining cars are curiosities, sleeping cars are very scarce, very uncomfortable, and the rates very high, water-closets are luxuries to be found only in rare cases, and the modern American coach with its closet for each sex, its wash basin and towel rack, its steam heat, careful ventilation and comfortable seat is the peer of many a monarch's private car; while to tell many people in Europe of the bath rooms, barber shops, telegraph offices, etc., to be found on our limited trains is to be put down for a gilted liar.

While this country has but a few Pennsylvania limiteds and Royal Blue Congressionals, and Empire State expresses are not universal, we want to show the comfortable way in which the average American citizen can and does "live on wheels while covering from one to two thousand miles of distance with far less discomfort than an Englishman must endure in going as many hundred miles in his own country.

Our large inset shows a sample American express train. Every trunk line in this country runs trains similar to this.

On this train a traveler can enjoy himself as at a hotel, he has every attention, an electric button at each seat calls an attendant night and day, he dines in a sumptuous car, receiving a five-course meal three times a day, he can smoke at will, every personal comfort is at his command, he can go from one end of the vestibule train to the other bareheaded, without danger of draft, rain or cinders, he can read, write, sleep, or tell stories in the smoking-room.

When night arrives he undresses and goes to bed like a Christian, and all the time a magnificent locomotive is whirling him to his destination. That's solid American comfort. It is unknown except in North America. Every citizen ought to be proud of our passenger service, yet we complain when there's the least bit of a lapse of perfection.

Our inset was made direct from a photograph of the Michigan Central's Pacific Express as the train stopped at Falls View, overlooking the king of waterfalls, Niagara.

The magnificent ten-wheeler looms up grandly, she is one of Schenectady's best, and behind her come eight splendid cars, each over 70 feet long, vestibuled throughout, five of them sleepers.

This is not the Michigan Central's best train by any means. Her North Shore Limited is a marvel of luxury, running between Chicago and New York, 979 miles, in twenty-four hours.

The Pacific Express is one of the regular every-day expresses, stops at all the larger cities on the way, furnishes lots of accommodation—in fact is a fair sample of how the average American can take comfort as he goes.

## Coal Tar as Fuel.

The use of Pintsch gas for the lighting of railroad cars is extending so rapidly that within a few years no other light will be tolerated. In connection with the gas-making plants there is a waste product in the form of coal tar, which some companies find difficulty in disposing of to advantage. Those interested may gain a point by learning how Mr James Holden, locomotive superintendent of the Great Eastern Railway, of England, disposed of this tar.

Not being able to dispose of the tar he tried it as fuel under a Cornish boiler and found that it could be used successfully in steam making. Then he applied the system of tar burning to three stationary locomotive boilers, and the comparative results of a week's working with coal only, and with coal and liquid fuel together, were as follows Staveley coal, 156 cwt. for 63½ hours' steaming, or 275.1 lb per hour, including coal for lighting up. With the coal and oil there was a consumption for 60½ hours' work of 55 cwt. of Staveley coal and 546 gallons of green oil, or an average of 101.8 lb. of coal and 99.3 lb of oil (9 gallons per hour). With coal only the evaporative duty was after the rate of 7.16 lb. of water per pound of fuel, while with the coal and oil it was 8.91 lb. per pound of the combined fuels. Subsequently the system was adapted to a furnace in the steam-hammer shop, to a rivet-furnace in the boiler shop, to a Cornish boiler in the printing department, and to two locomotives. Various descriptions of liquid fuel have been tried. *Engineering* reports a trial run of a locomotive burning a mixture of one-third of green oil with two-thirds of tar, which was completely burnt without smoke or trouble. Roughly speaking, the consumption of fuel in this engine was 1 gallon of liquid and 14 lb. of coal per mile. In Mr. Holden's system the liquid is injected into the furnace (which is not altered in any way) by a steam jet. The steam is supplied to the central jet of the injector, the liquid fuel surrounds it, and an air supply is disposed concentrically outside the whole. A thin coal fire is kept on the grate; and to assist in keeping the grate properly covered with the very thin fire, lumps of chalk are placed on the bars when starting for the day. The locomotives fired in this way with tar valued at 2¼ cents per gallon of 11 lb., show a slight saving as compared with coal.

## American Railway Association.

In the course of a pamphlet on safety appliances, Col. Haynes made a remarkably vigorous defense of the American Railway Association, of which he is president, in reply to disparaging remarks about it in Congress. As this association will perform important duties connected with the enforcement of the new law on safety appliances, information about the organization is seasonable. Col. Haynes said:

"It was stated that the American Railway Association was not a corporation, that it owed no obligation to the public, that no duty could be imposed upon it, and that to recognize its existence would be to recognize a phantom, yet in this very debate it appeared that this association represented more than 122,000 out of the 165,000 miles of railroad in this country. Here is an association whose members are railroad corporations, represented by their managing officials, its reason for existence is avowedly 'the development and solution of problems connected with railroad management in the mutual interest of the railroad companies of America.' It has been in existence for seven years; in that period it has established a uniform standard of time, which enables travelers to pass from the Pacific to the Atlantic slope and across to Europe, and yet follow the schedule of every train without setting their watches; it has promulgated a code of uniform train rules that, once learned by an employé, facilitates his employment on any railroad, and, not to speak of other matters, it has solved this problem of safety couplers, if not prevented by Congressional interference. Surely this is no phantom; it does recognize the duty which it owes to the public and to railroad employés.

"It is not a corporation, but a voluntary association of railroad companies, and its decisions have no binding obligation upon them. Yet within its sphere it expresses the consensus of opinion among those who are looked upon as authority in questions of railroad operations, and its voice is heeded accordingly. Let its work be recognized in the same way by legislators and they can leave to it the solution of these problems relating to railway appliances, not in the interest of any clique nor of any class interest, but dispassionately and intelligently, as representing the impossible management of the whole railway system of this country in a national and not in a corporative sense."

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While passing through a roundhouse not long since, I stopped to watch a boiler washer, and I learned something. He was removing plugs from a boiler not yet cold. He had with him a little can of cold water, which he slowly poured on the wash-out plug, thus cooling and contracting it. Then a quick, sharp tap on the wrench loosened it, and the plug was easily removed. Since then the ordinary method of pounding a hot plug with a hammer, getting two or three men on the wrench and breaking the wrench or the head of the plug, has seemed to me like making a mountain out of a molehill.

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The discontented and ugly feeling on many of our Eastern roads among the engine crews could be permanently cured by the companies paying for overtime. The stealing of overtime by the companies is costing them dear and a day of reckoning is coming—better stave it off.

Forty-second Street Station, Third Avenue Line, Manhattan Elevated Road—Looking North.

## New Mogul Passenger Engine for the N. Y., Ontario & Western.

All the operating officers of the N. Y., O. & W. road are very much pleased over the performance of the new moguls for passenger service just put on the road.

Our engraving shows one of these, and from it a good idea of the make up of the machine can be had.

The boiler is a straight-topped one with the dome set well back, coming up through cab far enough back not to interfere with the view of the engineer.

This boiler has shaking grates, which are supported by six separate frames, or carry-irons, and while the firebox is 8 x 10 feet, the grate frames can be passed through the furnace door, which is a very important matter in the item of repairs or renewals.

Another new feature is the use of a steel driving-box with brass gibs; this arrangement is giving less trouble than any kind of box they have heretofore used.

There is another unusual departure from ordinary practice in the design of rod strap. The main rods have spade-handle straps, but they are made in three pieces, the strap-ends being secured to the butt-end of rod by three bolts. This arrangement gives all the advantages of the spade-handle, as the brasses can be taken out by removing one bolt at rear, but it makes a plain rod and avoids the usual trouble from spade-handles, namely, cracking in the corners. The three pieces composing the strap are straight pieces, easily forged and as easily closed sideways on a loose brass.

The general dimensions of engine are as follows

Gauge of track, 4 feet 8½ inches.

Rigid wheel base, 14 feet 6 inches.

Total wheel base, 22 feet 2½ inches.

Driving journals, 8 inches diameter, 11 inches long.

Cylinders, 19 x 24 inches.

Slide-valves, Richardson balanced, ⅞-inch lap.

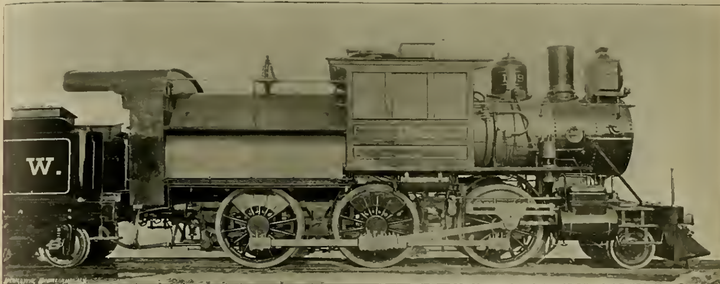
Boiler, 58 inches diamater at smallest ring, shell-plate 9/16 inch thick, longitudinal seams double riveted, with welt strip inside; firebox-sheets ⅜ inch thick, tube-sheet 9/16 inch; hollow radial stays 1 inch diameter, box 10 feet long and 8 feet wide, 236 two-inch tubes, 12 feet 6 inches long, No. 12 wire gauge, set with copper ferrules on each end and safe end a back No. 10 wire gauge; dome 28-inch diameter. Fuel, anthracite pea coal.

Driving-wheels, 62 inches diameter, 3½-inch steel tires on a 56-inch center.

Weight of engine ready for road 130,000 pounds.

The engine is fitted with Westinghouse automatic air-brakes and train signal; American outside equalized driver-brake and steam heating equipment.

The tender has a water capacity of 3,800 gallons.



Slack Coal Burning Mogul Passenger Engine. Designed by Superintendent of Motive Power Geo. W. West, for New York, Ontario & Western. Built by Dickson Locomotive Works.

## A Locomotive Carrying 500 Pounds Pressure.

The stackless and fireless locomotive shown herewith was recently turned out by Baldwin's for the Jefferson Coal Company.

She will use compressed air, taking her supply from storage tanks. The following are her principal dimensions

Gauge, 3 feet.

Cylinders, 8 x 12 inches.

Driving-wheels, 24 inches diameter, with 20-inch centers.

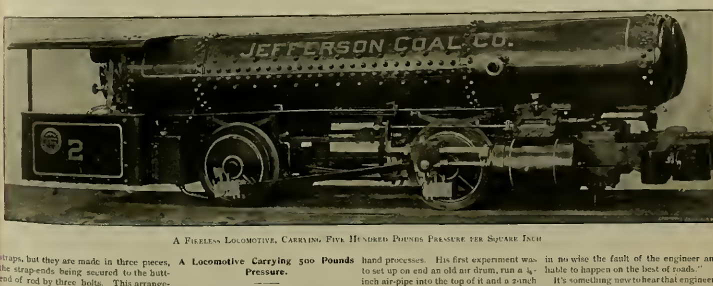
Two air-reservoirs of steel, 7/8 inch thick, of 60,000 pounds tensile strength, right one 13 feet 9½ inches long, left one 16 feet ¼ inch long, both 23¾ inches outside diameter, straight pattern.

Storage pressure 500 pounds, but capable of carrying 600 pounds if desired Tested to a water pressure of 750 pounds. Working pressure in cylinders 100 pounds.

Weight, 15,820 pounds in working order

Wheel base, 5 feet 6 inches.

One tube is made shorter in order to give room for the engineer and the necessary handling gear.




A Fireless Locomotive, Carrying Five Hundred Pounds Pressure per Square Inch

## Filling Locomotive Sand-Boxes by Compressed Air.

Of all the ingenious devices gotten up to use compressed air, none of them have gone quite so far nor helped to lighten so onerous a job as has Mr. E. W Snare, in charge of the Philadelphia roundhouse of the P., W. & B. road. He has made some successful experiments in using air to carry sand to the engines in the roundhouse. This he does without moving mechanism, without lifting an ounce of sand, without getting sand all over the engine, and in far less time and with less help than by hand processes. His first experiment was to set up on end an old air drum, run a ¾-inch air-pipe into the top of it and a 2-inch sand-pipe out of the bottom. This sand-pipe was carried up above the engines and a T connection made at each stall.

The operator has a large hose that he attaches to these T's. The hose has a stop-cock on the end to enable the operator to shut off the supply promptly when the box is filled.

When air pressure is applied above the sand the big pipe commences to deliver sand at once. This flows solidly with no air or dust in it until the sand in the supply tank gets so low that the air blows through it

It seems almost incredible that sand would flow through such a long line of pipe from air pressure in the tank, but it is found that fifteen pounds pressure will start it.

Mr. Snare intends to use a large tank placed where the sand can run from the drier into it.

Just at present his apparatus is out of gear on account of the falling down of a part of the roundhouse roof.

Those figuring on improvement in their sand-handling plant should investigate this system. It has advantages that recommend it very strongly.

## "Falling In" of Crown Sheets.

One of the men who took an engine in the recent strike on the Ann Arbor road dropped the crown sheet of one of their new Mogul engines the other day, and the newspapers report that General Manager H. W. Ashley said of it

"The explosion was caused by the crown sheet of the engine falling in, an accident in no wise the fault of the engineer and liable to happen on the best of roads."

It's something new to hear that engineers can't help the dropping of a crown sheet—they always get fired for it.

But if the Ann Arbor crown sheets are predisposed to this "falling in," we should advise the use of the famous vegetable preparation invented by the late lamented Mrs. Pinkham; or the employment of engineers—real live ones—has been known to stop it.

No more copies of January, February or March of this year. Subscriptions can commence no farther back than April

### Advice to an Invention Promoter.

BY JOHN ALEXANDER.

I have just got a letter from a brother-in-law of mine—who has more money than horse sense—that made me mad. I assume that a fellow has a right to get mad when he comes to think that his own sister is married to a rich man that don't know more than about twice—especially about mechanics.

"American" Passenger Locomotive for Argentine Republic. Built at Glasgow, Scotland.

Bob is a good enough fellow, and knows a whole lot about business, and has had experience in the banking line that I am free to confess I have got along without. He is one of those Connecticut Yankees, however, that are forever dropping some experimental money on chimerical devices that are going to "revolutionize" the world.

He invariably asks my opinion about mechanical questions, but always *after* he has dropped a thousand or so.

Let any man come along with a scheme to do something by machinery that can't be done at all; let him approach Bob Willitts "on the quiet," ask his advice and mention something about a "dead monopoly on the whole business," and "getting in on the ground floor," and Bob is his victim.

Two-Cylinder Worsdell Compound Freight Locomotive for Argentine Republic. Built by Neilson & Co., Glasgow, Scotland.

If Bob asks "I don't just see how your automatic shaving machine can be set so that these revolving razors will fit all kinds of faces and cut beards in all the fancy patterns?" the inventor has only to say, "Why, we do that with electricity," Bob reaches for his check-book at once, goes in "on the ground floor," gets a "dead cinch" on the "controlling interest"—then he writes to me

All an inventor has to do to explain anything that is unexplainable, do something that is undoable or perform any other miracle, to convince Bob Willitts is to say, "Do it by electricity."

Bob owns a controlling interest in a thing to control immigration (by electricity) and to irrigate the Yuma desert (by the same stuff), and a stem-wringing scheme to breed horses with white Angora goat's wool on them—by the use of a pair of dry batteries and thirty feet of No. 13 copper wire—insulated.

Bob goes off the handle on the scheme in hand for about two weeks, and then reluctantly drops the thing, firmly believing that in time some one will take it up and perfect it.

Last week, Thursday, he wrote me about his latest "cinch" I can always tell when he is laying awake nights wondering how he will invest the nine million dollars that he is sure to make out of the new scheme that is going to "revolutionize the whole business."

Bob won't invest in a legitimate mechanical enterprise, he must have a "revolution" or nothing. Yet in the banking business he demands the glitteringest of gilt-edged securities before he lends a sou. He does all his "plunging," "gambling" and "revolutionising" in mechanics, and what Bob don't know about mechanics would make a fifteen volume encyclopedia and have a pamphlet left over

Here is an extract from his letter

"DEAR JNO I write to get a little help from you in the railroad line. I want you to touch the proper button in the general office to get me the loan of an engine (preferably yours) to put on, for a public demonstration, a new oil burning device that I control. You can say to the officials that I will apply this at my own expense, that it will burn 50 per cent. less oil than the engine now burns coal—value for value—that it will prevent fires, ashes, dirt or cinders; being a much fiercer fire, *it will double the power of the engine*, absolutely prevents smoke, automatically extinguished in case of accident, *self-regulating—burns just enough for the work automatically*, thus doing away with the necessity of a fireman and saving the expense of his wages," etc., etc.

This last I knew was to be done by electricity—though Bob had forgotten to mention it.

"I want you," the letter continued, "to write me what you think of the new idea and make any suggestions you care to, as, of course, you know that I am more familiar with the first mortgage bonds of the Old Colony than with the details of the locomotives, though I see the operating expenses are 57 per cent of the gross earnings, this you must acknowledge is an enormous per cent., and if the introduction of oil fuel could cut this down to 25 per cent., as it promises to do—or to even 40 per cent., there is a fortune in it on one road, let alone all the roads in the country. It's a wonder to me some one has not thought of this before."

I had an evening at home last week, and I took and sat down and wrote Bob a letter, and if he falls into any more traps it will be his own fault, for I have certainly pointed out the straight and narrow way.

After mentioning the self-evident fact that I had "sat down with pen in hand," and making a few observations on the health of the Madam Alexander and the young Alexanders, I jumped into Bob something like this—Bob is a Sunday School superintendent, so I thought I would come at him from that side

"DEAR BOB:— * * * 'A fool and his money are soon parted.' * * * 'By their works ye shall know them.' * * * Bob, I think you are the hayseediest bunco-bait I ever heard of. Knowing that Mary and the babies are provided for in their own right, I can't help hoping that the oil-burner man done you up for all the profit you will make in a year. Oil burning on locomotives has been tried 30 times in the past thirty years and always with the same result. It burns, it costs more than coal; it throws more smoke if not regulated with most exacting care; it has caused more shop fires than coal; it is dangerous to handle; it means cremation in a wreck; and there are forty other reasons why it is not good fuel for a locomotive.

"But all that has nothing to do with a man of your alleged sense letting a professional inventor make you believe that by burning oil you could get *more power* out of a locomotive. The fire won't increase the size of the cylinders or add to the adhesion of the wheels—your tea-kettle won't get any hotter and the steam from it won't have any more *power* in it if you should boil it over an oil fire instead of on your gas stove. Haven't I warned you, time and time again, about these automatic, self-regulating things that are going to *learn a trade* and *think*—by electricity?

"You look upon operating expenses as you do on interest—it's different. These schemes that are going to save a certain per cent of the expenses of a road—before they are tried—are good things to let alone until after the trial.

"You ask my advice because you say I am a mechanic. If John Smith sued you for assault and battery I suppose you would hire a lawyer ten days after the case had been tried and you had paid your fine. Why don't you apply your other business methods to mechanical ventures. Mechanics is *business*—just the same as banking.

"If a man earning $40 per month came to your bank and asked for the loan of $1,000 for ninety days, saying he would pay you as fast as he earned it, I am quite sure you would want to know how he expected to pay $1,000 in ninety days from a salary of $40 per month. I suppose (?) he would satisfy you entirely if he explained that he could do that easy enough—by *electricity*.

"Don't you suppose that common sense and machinery will work well together. Do you think that all the wonderful machinery of the world works by some hocus-pocus,—all the difficult problems being solved by a squirt or two of electricity,—or do you suppose they were overcome by the real application of some mechanical device, established and working by some known principle?

"Last year I tried to interest you in the invention of two of our young mechanics, they had a new process for making a well-known household utensil that cheapened the product a few cents and made a better article. A few thousand dollars would have established them in business; but they had nothing new, to you,—you had heard of flour sifters before;—nothing revolutionary in it, they didn't propose to run houses 37 per cent. cheaper with their sifters; you wouldn't put up a cent—the boys couldn't promise to increase the *weight* of flour by the use of their sifter—as the oil man increased the *power* of the engine.

"Moral: They got their capital elsewhere, established a business and paid 11 per cent last year, this year they will pay 15 per cent. on a larger capital. That's legitimate business. You want to gamble on a 'sure thing'—sure for the other fellow.

"It's truly wonderful how some men, supposed to be sane, will go into schemes as ridiculous as an expedition to the moon. I should think you would get tired after awhile.

"Have you ever sold that valve-gear stock?—that wonderful device that was going to save 45 per cent. of the steam, because it *cut off* the steam at one-quarter of the stroke—you explained it to me yourself.

"What will you take for that rotary engine?—the one that was going to have a *constant piston speed* of 1,500 feet per minute and work steam as expansively as a Corliss—without figuring on what the steam would lose catching up to the piston?

"How much money have you got invested in that scheme to propel a ship with a jet of water and a steam-pump—going to 'revolutionize' ocean travel, saving 50 per cent. of the coal and 34 per cent. of the time?

"I believe you are a stockholder in the locomotive tire with flat spots—the one that was going to establish a new law of mechanics and increase adhesion by increasing *surface* instead of *weight*, the one that was going to pull four cars more than a full train (with the spots).

"Why didn't you get rich out of that scheme to double the efficiency of fuel by sprinkling it with a little salt canal water, with a Chinese name?

"I believe you are vice-president of the air-brake company that was going to refill the auxiliary reservoirs while the brake was on—forgetting, if you ever knew—how many eminent mechanics have lain awake nights for years trying to keep the air *out* of the auxiliary reservoirs when *you* want to put it in.

"Yes, Bob, 'get in on the ground floor' and 'control' that oil apparatus—I know from the blueprints it couldn't be controlled on the engine.

"I'll send you a man next week with a car-coupler that, if once adopted, will 'revolutionize' the business—paralyze it, in fact.

"There is a man in our asylum working on a patent hen-food to make pullets lay Easter eggs—sort of a dye-house attachment. You ought to be president and financial backer of that company—it has *bright* prospects.

"I see a South American has patented in the United States a net for catching boa-constrictors. Couldn't you form a syndicate and get control of that patent? We are a little short of constrictors in this country, but you'd have a 'monopoly' on the business, and when you 'got there' things would *squirm!*

"But say, Bob, seriously, look out for those common, everyday mechanics who need capital to push the manufacture or sale of some prosy, everyday tool, device or utensil. Don't put up a cent to help a man with a simple improvement on a lathe or planer, or a locomotive or a wheelbarrow, you reserve all your cash and backing for 'revolutionizing' inventions.

"Edisons, Morses, McCormicks, Stevensons and Westinghouses are as thick as mosquitoes—woods full of 'em.

"If you really want to get a dead cinch on a sure thing I'll sell you the patent on my fodder-can or make you a present of my registering wrench or the grapevine valve motion.

"If you could get a ship load of linen pants up to Greenland I believe you would practically control the whole trade and have a monopoly of the business—or an ice factory in that place where bankers and lawyers and other sinners go, would be a paying investment and make a benefactor of the founder, as it would tend to reduce the 'whippin and whaling and mashing out teeth.'"

Well, sir, that thin-skinned rooster actually got mad at that letter, and wrote me a sarcastic postal card thanking me for my *smartness*.

There's no pleasing people with advice, ingratitude is as catching as the itch—that's the reason I think so many of my friends are jackasses, and keep it to myself—like as not they'd get wuzzy about it if I told 'em so.

### Then and Now.

General Foreman Osborne, of the D., L. & W. shops at Hoboken, N. J., has in his possession an interesting old directory of the city of Newark for 1839. In the back of it we noticed a cut of an old-fashioned locomotive and a common stage coach loaded with passengers, under it an advertisement for the Morris & Essex Railroad—now the D., L. & W. The following passage shows how small were the beginnings of some of our busy lines:

"This road was chartered January 29, 1839, and the company commenced running their cars by horse power from Newark to Orange, November 19, 1836; from Newark to Madison by steam power on Monday the second of October, 1837; and from Newark to Morristown on the first day of January, 1838. The average daily receipts from Newark to Morristown (for passengers) from first of January to first of May, has been $72. An eight-wheel car, capable of carrying from seventy to 100 passengers, was placed on the road the 15th day of February, 1838, and a second engine was put on the road in May, 1838. The cars now leave Newark and Morristown three times a day. The road has also been surveyed from Morristown to Easton, and from thence to Carpenter's Point."

To-day on the same line, there are more than 100 passenger trains, with five to ten times the capacity of the old trains, which stop at Newark daily.

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On some of the engines of the North-eastern Railroad, of England, the air-pump exhaust pipe leads into the tank, thus heating the water. If the North-eastern runners use as much oil in the steam cylinder of the pump as many American runners do, they could use the boiler as a soda water fountain. On this road a drip-pipe leads from the exhaust-pipe to the back drivers, oiling the flanges.


CARRIAGE YARD OF THE NORTH BRITISH RAILWAY, UNDER CALTON HILL, EDINBURGH, SCOTLAND.

The locomotive engineers and firemen of the St. Louis & San Francisco road have formed, at Springfield, Mo., a reading-room club. The organization intends to furnish rooms with a good library of practical books and have models of rolling stock, machinery and various appliances that can be used for the information and instruction of members. Mr. O. G. Strobach is secretary and treasurer.

Baldwin's have just turned out the latest "largest engine on earth," for exhibition at the World's Fair. The engine is a 4-cylinder compound decapod for the Erie. She has a 76-inch boiler, and cylinders 14 x 27 x 26 inches. Her main rod weighs 850 pounds. The engine weighs 176,000 pounds, empty.

In answer to inquiry we have to say that the photograph of engine 385 was taken by Mr. F. W. Blauvelt, of this city, who does that sort of thing for pleasure and not for profit. The builders of this famous engine, the Baldwin Locomotive Works, would be the proper place to get a photo of her.

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**Special Notice.**

*We invite correspondence on practical subjects from all men in the Motive Power and Rolling Stock departments of Railroads.*

*We will illustrate proprietary devices that are novel or interesting and that properly come within the scope of the paper. This will be done without charge, and without reference to advertising considerations.*

*The editors reserve the right to use or discard matter for the reading columns entirely on its merits. The reading columns will not be sold.*

*Correspondents must give their names and addresses, but not necessarily for publication.*

*Mailing address can be changed as often as necessary, always give old and new address, and if you subscribed in a club state who got it up.*

*Please give prompt notice when your paper fails to reach you properly.*

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### New Subscriptions Must Commence with April.

Although we fortified for the siege, we are obliged to announce that we have run short of the issues of February and March. All subscriptions for 1893 must, from now on, commence not earlier than April. We shall try and keep enough to supply all back numbers from April. Those who want to add copies of issues of 1892 and this year can order now and we will try and get copies for them. All back numbers closed out early—no year-before-last business for us. SINCLAIR & HILL.

### Self Help for Ambitious Workmen.

A month seldom passes but we receive information about educational clubs and forms of mutual improvement societies being formed by railroad trainmen and workmen seeking to secure the means of improving their education. All this is very gratifying and displays a manly spirit of self help, but in these days when so many public men are interesting themselves in providing easy means of self-education to all classes we think that a little more public encouragement ought to be given to railroad men. In a great many manufacturing cities, night schools are becoming a thoroughly recognized portion of the educational arrangements, but most of railroad towns are still very backward in providing night schools where ambitious youths could continue the limited education received before they had to begin to work for a living.

Railroading is a very different thing today from what it was twenty years ago and every year introduces so much new mechanism and refinement of operating appliances that better educated men are required for doing the work successfully. It is the duty of the communities where railroad men or citizens bear the burdens of taxation, to provide the means of education for those who are growing up to citizenship. Ambitious young men and public spirited individuals have hitherto done the principal work of supplying school facilities for those who could only attend in the evenings, but this is not fair or just. Providing means of education that is to make better and more useful citizens ought not to be left to individual enterprise. Unfortunately our educational equipment has been arranged for the needs of agricultural communities and it is extremely hard to get it modified to suit railroad and manufacturing communities.

Ridiculous mistakes have been made in many places where the local authorities have attempted to provide night schools for workmen. Teachers for such schools have been selected from the list of day school instructors, and the instruction attempted has closely followed the day school exercises. The teachers try to impart purely literary instruction to pupils who are in urgent need of arithmetic, geometry and applied science. Between teachers and students so situated cordial relations are not likely to exist very long. Interest languishes on both sides, the attendance falls off and finally the school is closed with the intimation that the young men of the place do not care to attend evening schools.

If night schools for practical men are to be made useful and attractive, educated, practical men ought to be employed as teachers. They would understand the wants of their pupils, be in sympathy with their shortcomings and understand how best to give the necessary help. Draughtsmen and graduates of technical schools engaged on railroad work generally make very good teachers for an evening school.

The majority of mechanics and trainmen do not desire technical education unless it can be obtained without personal or mental exertion, but in nearly every shop and engine house there is a small group of thoughtful, industrious men who will study if they have the opportunity. This is the class from whom our industrial leaders have been drawn in the past, and the same class of men will furnish the foremen, master mechanics, superintendents and managers of the future. Every year makes it more difficult for an ignorant man to rise above the level of a workman. New influences are constantly arising to force onward the man who studies the principles relating to his business. Study is not so pleasant as play at first, but a little perseverance will make it more enjoyable than most pastimes are. Applying one's mind with determination is half the battle and it is surprising how easily difficulties disappear before steady labor. Self-denial and perseverance are necessary to those who pursue knowledge under difficulties, but the reward is worthy of the exertions made.

### Preserving Antiquities.

We have often wondered when wandering from one railroad shop to another when the time will come that the men in charge will be able to run their business as it must be managed by private manufacturing firms that meet competition and avoid bankruptcy. Manufacturers are constantly selling old tools because it does not pay to use them, but railroad companies seldom or never do this. Tools are never scrapped as long as any work can be got out of them. In some places we find a mild sentiment in favor of dispensing with old tools and buying new ones. The time when this action will be taken is when earnings are unusually high and expenses low. That millennium never comes. The earnings may be quite up to the road's capacity and the expenses may be lower than they ever were before but something else than buying shop tools will be found to be done with the money.

This condition of affairs tends to make patchers of the men in charge of the work. No matter how broad a man may be a decade or two spent scheming to make old things look new will narrow him and pervert his judgment. Having the capability of perceiving the point when it no longer pays to repair machinery is a somewhat rare attribute, but ability in this direction is stunted by railroad employment. The service cultivates the species of men who find it torture to send an unbroken article to the scrap heap till years of repose in some place where it is an obstruction has shown that it could never be used again.

In passing through a car shop some time ago our attention was arrested by a peculiar coil spring and case that were lying under a bench amidst many other odd castings and forgings. On inquiring what the spring was used for we were informed that it was the spring of a Creamer brake. It was a curiosity, and so were several other things in the same vicinity. They had all been carefully laid aside in hopes that they might be useful sometime and twenty-five years had passed and they were still waiting.

How often we can note similar practices in machine shops. An engine gets a new set of axle boxes. Two of the old ones are in pretty fair condition and they are laid away carefully under a vise bench to be handy for some other engine of the same class that may come in with a broken box. A discarded eccentric strap taken off another engine and not more than ¼-inch out of round is laid to repose near the axle boxes, and the adjacent spaces are filled with discarded feed pipes, infirm pumps and their fittings, old stack cones, nozzle tips, an odd rod strap, several half-worn piston rings, a cylinder-head with a crack in it, a few brake-heads of different patterns, a sandbox cover and the inevitable oil-box cellar besides a mass of other miscellaneous litter considered too good for the scrap heap.

A shop run under the influence of this kind of saving sentiment is usually a museum of worn out articles, every recess and corner being filled with material that long ago ought to have passed through the rejuvenating cupola or forge. Good money has been paid for tons of pig and bar-iron whose place ought to have been taken by the scrap reserved as available stock. Stuff of this kind is rarely available when wanted, and its individuality is seen only at the annual resurrection caused by stock taking. Those who try to make repairs with half-worn articles generally spend more on refitting them than new ones would cost, and at the end have inferior attachments.

A predilection for preserving half-worn articles is an inconvenient and expensive habit, but a fondness for keeping articles whose pattern has been changed is infinitely worse. In this case casting-houses and store-rooms are littered with articles kept on hand because they have not been used and never will be. A vague hope is entertained that rough castings and forgings of an obsolete character will come in handy for some purpose; but successive annual stock-takings pass, and they all remain on hand, showing apparent plenty in the presence of real scarcity.

When the pattern-house is critically examined, what a store-house of antiquities it presents to the eye! Cylinder patterns that have not been used for a dozen years, oil boxes that this generation has seldom seen in use, pumps that are never used any more, and hundreds of details, whose purpose the old pattern-maker hardly remembers, are still preserved because the house has never been burned down, and the wood has not rotted out. And all this time the pattern-house is so badly overcrowded that searching for a pattern not in regular use entails hours of diligent labor.

We do not blame the men who are responsible for the practices described. The vicious influences above them develop the taste for clinging to everything that promises to save a cent's outlay. We merely suggest that periodical self-examination is a good practice. When this rouses a spirit of reform an inspecting tour around the shops would be likely to bring forth good fruit.

### Nepotism.

Railroad men generally are not familiar with the word at the head of this article, because railroading in the past has been fairly free from the practice it implies. We are sorry to see that the practice in this respect is rapidly changing, to the great detriment of railroad companies' interests and to the injury of the railroad men whose natural ability and training entitle them to expect promotion. Nepotism means literally a fondness for nephews, but it has been widened to cover favoritism shown to nephews and other relations and the bestowal of patronage in consideration of relationship rather than on merit. From this it will be seen that nepotism stands directly on the opposite side of the social fence from what is known as civil service rules. For the last few years there has been much heard on railroads about promotion according to civil service rules, which means according to merit, combined with length of service. This is the ideal method of raising men from the lower to the higher positions in railroad life; but unfortunately the practice of promoting by merit and seniority is less general than it ought to be, and there is a growing spread of nepotism that is greatly to be deplored.

We know of no line of business where favor will do less to make a man efficient than in railroad positions, yet we are daily seeing men pushed into responsible places with no recommendation whatever except that they have an uncle or a cousin or a wife's relation on some pinnacle of power. This practice is notorious on some railroads, the president or general manager having relatives or on-hangers ready for every position of responsibility that becomes vacant. No others receive any consideration. Where this practice prevails there are two peculiarities very noticeable: the road is poorly managed, and discontentment racks the service from top to bottom. We are not aware of any popular method by which railroad stockholders can lessen the profits of a railroad so effectually as by permitting all places of trust to be filled by incompetent relatives of the managers. If the directors of railroads realized how dearly they were paying for the privilege enjoyed by the management of converting the service into a charity institution, they would be ready to pension the needy relatives so that the benefit of competent officers might be enjoyed.

### A Railroad Hero.

When a man is killed on a railroad in Mexico, those whom the authorities think are at fault are thrown into prison.

On the 11th of March a bad wreck occurred on the Mexican Central. A south-bound freight train was taking water at Encarnacion station, when it was run into by a north-bound freight train.

Engineer J. T. Sweeney of the south-bound was fatally injured, both legs being amputated. His fireman was also fatally injured. Sweeney was dying when taken from the wreck of his engine, but he realized that conductor Frank Hartman and engineer W. G. Beatty of the north-bound were responsible for the wreck, and that under the severe laws of Mexico they would receive harsh punishment if captured.

He called Hartman and Beatty to his side and made his will, telling them where he had money on deposit. He then gave Beatty and Hartman $500 which he had on his person, and told them to use what was necessary to leave the country and to leave at once.

The wounded man died a few minutes afterward, and the two men started out of town on foot. As soon as the authorities were notified, a squad of soldiers were sent in pursuit of the fleeing men, but they have not been captured.

If it was not heroic for Sweeney to think of the safety of his friends when they were in danger—though they were the cause of his own death—then the earth rolls her green fields to the sun without a hero upon her face.

perienced—and the more the valve is "monkeyed" with the more trouble will

altitude, and trails the smoke, which makes its use very undesirable on passen-

cannot quit at any time. Sauce for the goose is sauce for the gander

Mr. C. B. Lytle has been appointed superintendent of the Duluth, South Shore


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## Fatigue of Iron.

A highly practical and successful superintendent of motive power who prides himself on freedom from theoretical nonsense has taken us to task about our theories on metals being susceptible to "fatigue" We do not know that the word properly describes the condition metal gets into preliminary to breaking, but highly practical grounds exist for the belief that metals become weakened by use even when no incipient fractures exist. There is a bending or a lengthening and shortening action going on even when the change is too minute for measurement except with exceedingly exact instruments. The movement of the metal causes molecular changes which reduce the adhesion of the particles and thereby make the metal weaker. Nearly every observing mechanic has noticed breakages where it appeared that iron or steel originally good had become so brittle and roughly crystalline that it was unfit to sustain an ordinary [illegible]

A case occurred some years ago on the Central Railroad of New Jersey which appears to be a good practical illustration of the correctness of our theories concerning the fatigue of metals The company named got six new switching engines that were put into the same hard service in a yard where there was a great deal of running over switches and frogs that subjected the running gear to severe shocks. The engines were all of the same pattern, strongly built with unusually heavy axles, Colonel Ricker the designer, believing in a good margin of strength. After these engines had been in service for several years one of them broke an axle. An inspection of the fracture showed that what was originally a fine, fibrous iron, had become coarsely crystalline, the molecular change no doubt having been induced by the constant jars. Within six months all the six engines failed with broken axles, and the fracture in each instance showed the same condition of the iron.

Mr William Woodcock, who was superintendent of motive power of the Central when these breakages happened, believed that re-working restored the strength to iron that had become weakened through use He determined to put the theory to a practical test so he worked up the broken axles into piston-rods, crank-pins, rod-straps and other parts of locomotives that are subject to severe and complex strains. The metal gave excellent service.

## A Crime.

One of our correspondents makes a timely protest in this issue against one of the worst practices in our railroad shops—the changing of parts of the emergency-valve in the air-brake.

That railroad managers should buy the best and latest brake for its equipment, and then have some ignorant employé change something that renders the quick action of the brake impossible, is too bad—it is worse than that.

The quick-action brake is a grand, good thing, a life and property saver, and an advance in the mechanics of railroading. It is necessary where very long trains are handled, it is simple and reliable once put up correctly, let alone and handled anywhere near right.

Because some thick-skulled shoemaker has it in charge and has trouble with it is no reason on earth why he should be allowed to "remove emergency piston No. 8 and substitute a small brass bush."

This is equivalent to letting a raw recruit take the trigger off his gun because it prevented his getting his hand in the guard to carry the gun—almost any experienced officer would teach him how to carry his gun and still leave this piece ready for use.

No matter how much trouble is experienced—and the more the valve is "monkeyed" with the more trouble will be had—there is no possible excuse for this kind of work. The air-brake companies will gladly put their equipment right at any time and could, if necessary, recommend men to keep it in repair that at least knew enough to *not* plug it up.

It behooves every superintendent of motive power to see to it that none of his men are nullifying the quick action of the brakes by criminal ignorance—and a brass bush. Some sharp lawyer will get a proven case of this into court some of these days, and some one's reputation will get smudged and some railroad company will pay damages that ought to be paid by those who have charge of the power to stop and start trains.

## A Big Mortgage.

A great deal of talk has been excited in financial and railroad circles during the past month by the announcement that the Cleveland, Cincinnati, Chicago & St. Louis management had arranged for the placing on the property a blanket mortgage representing no less than fifty millions of dollars. It is one of the most comprehensive financial transactions in railroad history, and one that is likely to greatly benefit the valuable railroad property concerned as well as those who furnish the capital The so-called Big Four lines form a net-like system of tracks over two thousand miles in extent, radiating from Indianapolis and embracing all the principal towns in Ohio, Indiana and Illinois We believe that this railroad company provides traveling and freight accommodation to a greater aggregation of people than any other railroad in the country. In spite of the natural advantages possessed, the company has not been very prosperous. The way that it was built up has been a great drawback to the company. It is formed from the absorption of a great many small lines, which have proved valuable feeders, but brought with them great diversity of machinery that has been difficult to keep in repair and expensive to operate. Of course, the right policy would have been to scrap old machinery and work all the rolling stock into standards; but immediate needs for earning money and for keeping down avoidable outlay prevented the carrying out of the policy that would pay best in the end. The result was that a year ago, out of 550 locomotives belonging to the company, there were more than one hundred diverse classes.

Great progress has been made lately in reducing the rolling stock towards uniformity, but the work has been hampered for want of the necessary capital. The big mortgage will not only provide the means for putting the machinery in satisfactory condition, but will enable the management to provide much new trackage and siding facilities that are badly wanted to develop the business of the road.

A paragraph which appeared in our columns a month or two ago on "Spark Arresters," has stirred up quite a discussion on the subject, and the indications are that the different appliances used for preventing spark throwing will have their merits and defects pointed out by the men who are best able to judge about them, viz., the engineers. We have every reason to believe that the extension smokebox is far from being a satisfactory spark arrester, but we do not think that returning to the diamond stack is in the line of progress The diamond stack may be as good a spark arrester as the extension front, and yet be a very undesirable appliance for the purpose. Those who have experience with diamond stacks and extension fronts are certain that the latter is more cleanly than the former, which is a good reason for the extension front being adopted, other things being equal. The diamond stack scatters the sparks at low altitude, and trails the smoke, which makes its use very undesirable on passenger trains. The netting and cone are also more troublesome to keep in order than the attachments of the extension front The only real objection to the latter is that it puts extra weight on the engine truck.

There are so many inventors nowadays ready to promise a saving of from 20 to 50 per cent. through the use of their devices that railroad men are slow to look at any reported improvement in connection with motive power that does not promise to save one quarter of the fuel. The greater part of the devices offered as fuel savers are worthless, but others have merit. A conscientious man selling a good thing may not care to exaggerate its merits, and modestly claims 10 per cent. of saving Very often that finishes his prospects with a general manager or master mechanic. They are so much accustomed to the tales of colossal liars that modest men make no impression. Nevertheless, the man who offers to save 10 per cent. of fuel is likely to be more worthy of a hearing than the man who talks of 50 per cent.

A few years ago there was an agitation in favor of chilled cast-iron for a great variety of purposes and those who fanned the agitation made believe that chilled cast-iron was highly superior to the finer brands of steel for a great variety of purposes. Cutting tools were all to be made of chilled iron and it was reported that this material made wonderfully durable files. In our travels we occasionally stumble upon cutting tools made of chilled iron, but there is no enthusiasm about the saving effected. Of the cast-iron file we see and hear nothing.

The car builders and several other manufacturers of railroad rolling stock appliances in the neighborhood of Detroit have been making rather noisy threats of moving to another locality on account of the high taxes assessed on their plants. Chicago is spoken of as a more desirable location. There are no labor troubles in Detroit This cannot be truly said of Chicago. High taxation is bad but there are inflictions sometimes endured by manufacturers that overshadow the heaviest taxes ever imposed.

They have curious ways of attending to engineering matters in China. A case was lately reported by a correspondent of *Engineering* where a river broke through its banks, inundating a large extent of country. The Emperor gave orders to the engineers of the district to close up the gap, and they did their best but failed. They were immediately stripped of their decorations and cast into prison. Another set of engineers were appointed; they succeeded in closing the breach and received great honors.

Almost every European mechanic who leaves a railroad job there to take one here, is at once struck with the apparent recklessness with which American builders puncture locomotive boilers and screw pipes into them Over there most of the roads require that every hole in a boiler shall have a flange riveted to the shell, and many of the pipes are placed inside the boiler. No doubt we overdo the puncturing business.

During the month of March we had the pleasure of mailing 130 sacks, containing in all 9,017 pounds of papers. The receipts of the Postoffice Department are in this office, where they can be seen This is saying nothing of 3,550 copies disposed of by the American News Company. Circulation amounts to something — it amounted to 11,000 pounds of LOCOMOTIVE ENGINEERINGS in March.

A road will have no right to discharge its men if the decision stands that they cannot quit at any time. Sauce for the goose is sauce for the gander.

## PERSONAL.

Mr Dan'l Coxe, Supt M. P of the D., S & S., has returned to business after a winter's sojourn in Florida.

Mr. Chas. W. White has been appointed traffic manager of the Suwannee River Railroad, with headquarters at Ellaville, Fla.

Mr. J. R Leonard, trainmaster of the Mohawk division of the N Y. C R R, has been promoted to be assistant superintendent of that division.

Mr G. H. Brown has been appointed division master mechanic of the Chicago, Milwaukee & St. Paul R R., with headquarters at Dubuque, Ia.

We regret to learn that Mr R F Kredell has resigned his position as master mechanic of the Farmville & Powhatan R R, on account of ill health.

Mr. J B. Kilpatrick has been appointed master mechanic of the Des Moines Valley division of the C., R. I. & P., with headquarters at Valley Junction, Ia.

Mr. D J Jerber has been appointed master mechanic of the Connecticut River division of the Boston & Maine, with headquarters at Springfield, Mass

Mr. M D Monsarratt, vice-president of the Texas, Mexican & Gulf divisions of the Southern Pacific system, has been appointed president of the San Antonio & Aransas Pass R R.

Mr. R O. Cumback has resigned as general foreman of the L E. & St L shops at Huntington, Ind., to accept a similar position on the Illinois Central at their shops at Amboy, Ill

Mr. S. C. Hoge has been appointed superintendent of the Macon & Nor R R, with headquarters at Macon, Ga Mr. Hoge was formerly superintendent of the Georgia Southern & Florida.

Mr. A. E. Manchester, division master mechanic of the Chicago, Milwaukee & St. Paul, at Dubuque, Ia., has been appointed assistant superintendent of the Milwaukee system, with headquarters at Milwaukee, Wis

Mr. A G Hollingshead, general foreman of the Wabash R. R shops at Tilton, Ill has been appointed assistant master mechanic of the company's new shops, located at Ashley, Ind, on the new Detroit & Chicago line

Mr. C. S. Hull, superintendent of the Cumberland Valley Railroad, at Chambersburg, Pa, sends in a very interesting sketch of the life and services of the old engine, "Utility" She ought to belong to the G A R

Mr. G. A. Quinlan has been elected vice-president of the Houston & Texas Central R. R. He was previously chief engineer and general superintendent of that road. He is known as one of the best railroad men in the South

Mr J. W FitzGibbon has been appointed master mechanic of the Chicago division of the C, R I. & P, with charge of the company's shops. He was formerly on an Iowa division, and was selected for the new position owing to his ability as a shop manager.

Mr Robert Hitchcock, master car builder of the Connecticut River Railroad, has resigned, after being in the employ of the company for forty-one years Consolidations are hard on the faithful men who have done valuable work in building up the property

Mr C. E Lytle has been appointed superintendent of the Duluth, South Shore

& Atlantic, with headquarters at Marquette, Mich. Mr. Lytle was formerly chief train dispatcher of the Duluth, South Shore & Atlantic R. R., but has lately been on the Lake Erie & Western R. R.

Mr. J. N. Sanborn has been appointed master mechanic of the Springfield division of the Illinois Central, with headquarters at Clinton, Ill.

Mr. D. McMurray has been appointed master mechanic of the East St. Louis Connecting Railroad, with headquarters at East St. Louis.

Mr. P. Hallenbeck has been appointed superintendent of the Iowa division of the Chicago & Northwestern Railway, with headquarters at Boone, Ia.

Mr. C. M. Babcock is appointed master mechanic of the New Orleans division of the Texas Pacific Railway, with headquarters at Gouldsboro, La.

Mr. John H. Greene, of St. John, N. B., has been made mechanical superintendent of the Nova Scotia Central, with headquarters at Bridgewater, N. S.

Mr. Oscar Antz, a member of the Master Mechanics' Association, has accepted the position of chief draughtsman of the Lake Shore car department, at Cleveland, O.

Mr. J. S. Chambers has been appointed master mechanic of the Amboy district of the Illinois Central. Mr. Chambers has been for several years master mechanic in charge of the St. Joseph's Terminal Company's rolling stock at St. Joseph, Mo.

Mr. Addison Hills, assistant to the president of the Lake Shore Railway, celebrated his eighty-sixth birthday last month. Mr. Hills is one of the oldest men now in railroad service on the Vanderbilt system. He entered railway service in 1837, and has been with the Lake Shore since 1868.

Mr. Charles Dunlap has been promoted to the position of general superintendent of the C., R. I. & P., with headquarters at Chicago, succeeding Mr. Royce, resigned. Mr. Dunlap rose in this company's employ through various grades. He was for some time general superintendent of the Western lines.

Mr. C. O. Wheeler, general manager of the Gulf, Col. & Santa Fé R. R., has resigned. Mr. Wheeler had been closely associated with the late Mr. Allan Manvel. It is generally understood that his withdrawal from the Santa Fé system is on account of the new management adopting a policy which he cannot conscientiously indorse.

Mr. W. W. Thompson, supervisor of locomotives of the South Side Rapid Transit Road (elevated), of Chicago, has been East during the past week hunting up rolling stock for the new elevated. The Fair business is expected to call for the use of many more cars than the road can buy, beg, borrow or steal on such short notice.

One of the most popular citizens of Cleveland, O., is Mr. Robert Blee, who was long general superintendent of the C., C., C. & I. R. R. He retired from active railroad life several years ago, but he maintains his connection with the city where his headquarters were, and last month his popularity was manifested by his election as mayor of the city.

Mr. Joseph Harris, who succeeds Mr. McLeod as president of the Philadelphia & Reading, is a railroad man of mature experience and is a good conservative business man. He is a civil engineer by profession, and did engineering work on different parts of what is now the Reading system, on the Delaware, Lackawanna & Western, and was for a time general manager of the Central of New Jersey. The property is safe in his hands.

Mr. L. C. Brastow, division master mechanic of the Jersey Central at Ashley, Pa., died last month. He was one of the oldest master mechanics with the company, having been in charge of the rolling stock of the Lehigh & Susquehanna road before it was absorbed by the Central of New Jersey. He joined the Master Mechanics' Association in 1871 and took a keen interest in the proceedings, although it was not convenient for him to take an active part after he had ceased to be chief of his department.

Mr. P. C. McNiven, who was for some years superintendent of the Canadian Locomotive Works at Kingston, Ont., is in Africa for the benefit of his health. He is suffering from a throat trouble that threatens to shorten his days. He has been devoting attention to railroad matters in Africa, and finds that lime in the feed-water causes great expense to the companies. He writes asking if those who have had experience with lime-charged water on this side of the globe cannot suggest remedies to the African railroad men.

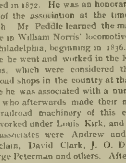
Mr. W. S. Morris, superintendent of motive power and rolling stock of the Chicago & West Mich. R. R., has been appointed superintendent of motive power of the Chesapeake & Ohio R. R., succeeding Mr. Garstang. Before going to the Chicago & West Michigan R. R., Mr. Morris was a master mechanic on the Wabash R. R., having risen to that position through various grades. He is one of the brightest young railroad men in this country and was seriously considered for the position of general superintendent of motive power of the Reading system.

Mr. C. H. Ackert some weeks ago tendered his resignation as general manager of the Iowa Central Railway, and accepted the same day the general management of the Elgin, Joliet & Eastern Railway. Officials of railways, particularly in the Northwest, are favorably impressed with Mr. Ackert's ability as an organizer. He leaves the Iowa Central Railway with the best wishes of both business men and employés, as was shown by the presentation of as fine a Geneva stop-watch as could be procured. We predict a bright future for him. During his management the Iowa Central paid a dividend for the first time.

Mr. D. H. Neale, associate editor of the *Railroad Gazette*, died April 5. Mr. Neale was an Englishman by birth. He received an excellent engineering education and training, and possessed in a high degree the faculty of writing his thoughts in clear, vigorous English. He came to this country in 1883 to make notes of the Exposition of Railway Appliances at Chicago for *The Engineer*, of London. Shortly afterwards he joined the editorial staff of the *Railroad Gazette*. He relinquished the position four years ago and went to be mechanical engineer on the railways of New South Wales, but returned to this country again about six months ago.

Mr. David Preston, mechanical superintendent of the Canadian Pacific, died at Montreal last month of blood poisoning. His death exemplified the serious consequences that sometimes result from a trifle. Mr. Preston was troubled with corns on his feet, and applied one of the patent remedies, which caused blood poisoning. An attempt was made to save his life by cutting off his foot, but that was not sufficient and his leg was amputated. Exhaustion from the last operation caused his death. Mr. Preston began railroad work on the Scottish North Eastern, and rose to an engine driver there. The general manager of that road having come to take an official position on the Grand Trunk, a number of the employés followed him, among them Mr. Preston, who went to work as a fireman on the road. He rose through various grades to be master mechanic on the Grand Trunk. Three years ago he was appointed mechanical superintendent of the Canadian Pacific.

Mr. Charles R. Peddle, purchasing agent of the Vandalia Line, whose portrait is here shown, died at Terre Haute, Ind., on April 19th. Mr. Peddle rose through the mechanical department, and at one time took a very active part in the Railway Master Mechanics' Association, which he joined in 1872. He was an honorary member of the association at the time of his death. Mr. Peddle learned the machinist trade in William Norris' locomotive works in Philadelphia, beginning in 1836. From there he went and worked in the Reading shops, which were considered the best railroad shops in the country at that time. Here he was associated with a number of men who afterwards made their mark on the railroad machinery of this country. He worked under Louis Kirk, and among his associates were Andrew and James Vauclain, David Clark, J. O. D. Lilly, George Peterman and others. After working in these shops for a time he went upon the road as a locomotive engineer. Desiring to learn all there was to be acquired



in the business he went to New England in 1848 and worked in several of the locomotive building shops. He was now what he considered a good all-around man, and seeing superior opportunities in the West he went to Indiana and got a job running an engine on the Madison & Indianapolis road. Three years later he was appointed master mechanic of the Terre Haute & Richmond, which grew and flourished swallowing other lines until it became the Vandalia system. He was made purchasing agent ten or twelve years ago. Mr. Peddle took a great interest in educational matters, and was considered one of the leading citizens of Terre Haute.

The Brooklyn City Short Newtown railroad has placed orders for two more "Kodaks," which has come to be the popular name for direct-coupled generators. The units employed in this station are a 250-horse power generator coupled direct to an 18-30 x 16 Westinghouse compound engine at 250 revolutions. The power station of this road will contain eight of these generators, of which five are already in place. A single one of these Kodaks has handled thirty-eight cars over the considerable grades of this road continuously.

The Manhattan Elevated Railroad of New York has applied a Smith exhaust pipe to one of the engines. The decrease of noise from the exhaust steam is so decidedly apparent with this pipe that we expect it will soon be in demand for every locomotive where the noise of a sharp exhaust is objectionable.

We have received the Transactions of the American Institute of Electrical Engineers, for the year 1892. This is a bound volume of their monthly reports. The volume contains a list of the members and other information in its 850 pages of great interest to electrical engineers.

### Knowledge and Skill.

Our readers frequently request us to publish articles describing operations that turn on manipulative skill. This cannot be done. No article can instruct a man how to push a file level or how to hit the same spot with a hammer twice in succession.

"Chordal," in one of his letters to the *American Machinist* ten years ago, said:

"In handiwork there are two elements—skill and knowledge of skill. Thus in hand turning, the knowledge of skill tells us that a certain kind of chattering proceeds from a certain peculiar handling of the tool. Skill shifts the tool around properly and the chattering stops. Probably the exercise of skill in holding the tool properly cannot be described, and if it could, he who was the most skillful would probably be the most or the least adapted to describe it. You see a man filing something rounding; you take his file and file it flat. He asks you how you did it, you answer that you do it but do not know how you do it. I do not believe that any man knows how he files flat. There are lots of things the skillful do which have no 'how' or 'wherefore' to them that can be got out of them.

"The witness on the stand said, 'I know it to be so,' and the attorney, on cross-examination, said, 'On your oath, how do you know it to be so?' and the witness said, 'On my oath, I do not know how I know it to be so.'

"A man may know lots of things without knowing anything about how he knows them. There are many elements of manual skill, only a portion of which may be stated in descriptive terms.

"When one man wants to learn draughting, the first thing he begins to inquire about is some book out of which to learn draughting. When some other man wants to learn draughting, he goes at it and draughts, and the going at it and the keeping at it constitutes the learning. All the books under heaven will not stuff a man so full of knowledge that he can say that he is a draughtsman before he has commenced to draw. If it was a question of books, all he would need to do would be to acquire all of the knowledge that is in them. I am a sort of a draughtsman myself, and I give it as my honest opinion that books on draughting should be read only by draughtsmen, and not by people who wish to become draughtsmen. These books should be entitled, not 'Information for People Desiring to Learn to Draw,' but 'Information for Draughtsmen.'

"In my opinion, the art of draughting is one of those things which, so far as the art itself is concerned—that is, the skill of it and the practice of it—will force itself upon a person. He will draw in spite of himself, if there is any earthly necessity for his drawing, if the necessity and the honest desire arise, he will draw, and draw, and draw. He becomes a draughtsman—may be a good one, may be a poor one—and the books will do him good in either case. He needs the books to improve himself as a draughtsman, but I hardly think that he needs them to initiate himself as a draughtsman. I draw a broad distinction between the geometry of the art and the art itself—between the perfectly-drawn line and a comprehension of what the line means. He who is up in the science of lines and figures and bodies is a scientific draughtsman, but he is no more a draughtsman than he who knows nothing of them. The skill to delineate the creeping spider or the ugly lathe leg has nothing whatever to do with the laws of natural history, or the laws of the strength of material. A draughtsman may be more useful from a knowledge of the strength of material, precisely the same as he may be more useful by reason of being versed in natural history. When I speak of the art of draughting, I mean the art pure and simple, of delineation, not of design or of mechanical analysis, or of comprehension of the thing delineated."

## The "John Bull" Locomotive and Train.

One of the most novel sights that has been witnessed on an American railroad for many years was the old locomotive "John Bull," shown in the annexed en-

The "John Bull" Locomotive and Train.

graving, hauling a couple of worthy companions in the shape of ancient cars over the great Pennsylvania Railroad, from Jersey City to Chicago, on her way to the World's Fair. The start was made on Monday, April 17, and occupied six days for the 913 miles of the journey. No circus ever attracted more attention. All the way throughout the route vast crowds of people, embracing all classes, lined the side of the track and climbed to every sort of vantage point to look upon the curious cavalcade.

This locomotive "John Bull" is regarded with great interest by Pennsylvania Railroad officials, because she was the first engine used on the Camden & Amboy Railroad, the oldest part of what is now the great Pennsylvania system. The engine is a historical relic for several reasons. It was the first locomotive ever run in the State of New Jersey, it was the third or fourth locomotive that had done work on this continent, and it was the model from which Mathias Baldwin built his first locomotive, the "Old Ironsides."

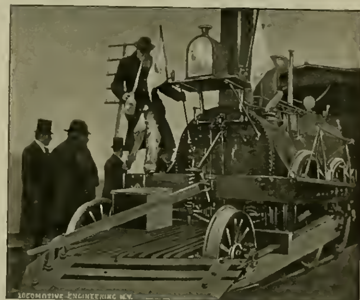
For several years previous to 1830, progressive Americans were watching with keen interest for means of improving the means of inland transportation. Canals had been tried and found wanting. Routes of travel that were frozen up half the year could not satisfy the sons and grandsons of the men who had established a new nation. Oliver Evans, a famous Delaware engineer, had made a success of the high-pressure high-speed engine and preached schemes for applying it to land travel. He ran a scow by steam through the streets of Philadelphia in 1804.

Sundry coal tramways in the North of England had been partly operated by steam locomotives, and the Stockton & Darlington Railway was opened in 1825 and continued to be operated by locomotives. These things were known to all well-informed Americans, and in all directions agitation was going on to give this continent the benefit of the latest inventions in the methods of transportation.

In 1830 the Camden & Amboy Railroad was chartered. Work was begun almost immediately, for Robert L. Stevens, one of the most energetic and far-seeing citizens of this republic, was president of the company. The year before was notable in railroad history by the landing in New York from England of the "Stourbridge Lion," the first locomotive to turn a wheel on an American railroad, and also for the wonderful success of Stephenson's "Rocket" on the Liverpool & Manchester Railway. President Stevens ordered from England one of the most approved style of locomotives, and the engine afterwards called the "John Bull" was delivered in Philadelphia in May, 1831. She was transported by sloop to Bordentown, N. J.

The work of transporting the engine and setting her up was entrusted to a bright young mechanic named Isaac Dripps, who became first superintendent of motive power in this country. He died only last year.

Although the "John Bull" was built only a few months after the "Rocket" made her first famous run, considerable advance in locomotive design were embodied in this engine. She belonged to a form of construction which for years was a model for English locomotive builders. She had horizontal inside cylinders with crank axles, conical firebox, multitubular boiler, blast pipe in the smokebox, drop hook valve motion and slide valves set between



The Old Man Drops a Little Oil.

the cylinders. The latter are 12 x 18 inches. The Pennsylvania Railroad people say that this engine was built by the Stephensons at Newcastle, England, and that she belongs to what is known as the "Planet" class. We doubt the correctness of this statement. The engine is not like the "Planet," which had a plain wagon top firebox with dome on top, a pair of small leading wheels and driving wheels 5 feet diameter. Stephenson's people never built engines with conical topped fireboxes. This was Bury's style of construction, and the "John Bull" has the appearance of belonging to the "Liverpool" class of this famous builder.

The old cars shown in the engraving were Nos. 7 and 9, belonging to the Camden & Amboy Railroad.

The old engineer whom we show talking to the conductor is A. S. Herbert, who ran the engine in the early fifties. W. J. Bailey, the conductor, is one of the oldest veterans in the company's service, and has been a passenger conductor since 1859. Mr. J. N. Sanford, who is now master mechanic of the Meadows shops, acted as fireman, work he had formerly done regularly for the old engine.

THE OLD PASSENGER COACHES.

Hardly less unique than the locomotive itself are the passenger coaches of this historic train. Some twenty-five years ago a farmer near South Amboy bought one of the discarded coaches of the old Camden and Amboy Railroad. He removed it from its trucks, and, planting it on posts in the ground, converted it into a chicken-coop. It served in this capacity until a few months ago, when a representative of the Pennsylvania Railroad, looking for relics, happened upon it, and entered into negotiations for its purchase. The thrifty farmer, realizing that lapse of time had endowed his hennery with increased value, demanded a price which represented compound interest on the original purchase-money, but the matter was adjusted, and the passenger coach of fifty years ago transformed into a chicken-coop is once more fixed upon its trucks and will go to Chicago as a part of the "John Bull" train. After its recovery the coach was refitted and reupholstered, so that it appears now in all the pristine glory of its palmy days. The history of the other coach is not quite so romantic. It was found some years ago in a lumber yard in a New Jersey town among a mass of rubbish, and quietly tucked away in the Meadows shops by a far-sighted official of the company, who foresaw that just such an occasion as this would bring it into requisition some day.

A TRUCK IN THE MARL-PIT.

It is hardly necessary to say that Mr. H. S. Hayward, superintendent of motive power of the United Railroads of New Jersey, who prepared the train for exhibition, was compelled to do a considerable amount of bustling in order to collect all the parts necessary for an exact reproduction of the train as it was in 1836. Not a single one of the relics was complete in all respects, but scrap piles were turned over, repair shops ransacked, and even old blacksmith shops were invaded in the hope of finding some bit of iron which had once been used on the old road. Diligent and persistent search met with reward. When everything else had been secured it was found that one truck was missing. Search was immediately instituted, and some one reported that he had seen an old-fashioned truck in an abandoned marl-pit in New Jersey. It was excavated at once and proved to be the truck of an old Camden & Amboy passenger coach. The wood was worthless, but the iron, though covered with the rust of years, was scraped and cleaned, and with renewed wood-work the truck was placed in position beneath one of the coaches of the present train.

And so it went until every piece of wood and iron that entered into the composition of the old train was duplicated.

Look Out for "Snake-Heads" in Crossing the Meadows Park

## Heat and Combustion.

BY ANGUS SINCLAIR.

HEAT VALUE OF FUEL.

When the design of a furnace is good, when the firing is done with skill and intelligence, and when the rate of combustion is moderate, a small percentage short of the theoretical heat value of the fuel will be obtained in the furnace. This loss will range from 10 to 30 per cent., according to the nature of the fuel.

The text-books on combustion usually tell us that one pound of gaseous hydrogen entering into combination with eight pounds of oxygen produces heat equal to 62,000 units. As the hydrogen dealt with in the combustion of coal is in a solid condition, the liberation of heat is considerably less, and is calculated to be about 40,000 heat units.

One pound of carburetted hydrogen when properly consumed generates about 27,000 heat units. Oxygen combines with the hydrogen of the compound to form water, and with the gaseous carbon to form carbon dioxide. It is in this form that the hydro-carbons of the fuel generally burn.

One pound of solid carbon uniting with

2⅔ pounds of oxygen to form carbon dioxide generates about 14,500 heat units.

One pound of solid carbon uniting with 1⅓ pounds of oxygen to form carbon monoxide generates about 4,500 heat units.

LOW CALORIFIC VALUE OF CARBON MONOXIDE

Every student of this subject is likely to be struck with the difference in the intensity of the heat generated by a pound of carbon under the two conditions of combination Carbon dioxide is worth as a heating medium more than three times the same quantity of carbon monoxide, yet the only difference in their generation is that carbon dioxide obtains a full complement of oxygen (two atoms), while carbon monoxide has been formed with one atom of the heat-producing oxygen This is an eloquent argument in favor of admitting a free supply of oxygen to the fire It explains why the steam gauge pointer frequently moves upward after the fireman has given the grates a gentle shake, or after he has raked the caked crust on top of the fire

Carbon dioxide, with its 14,500 heat units, represents precisely the same quantity of coal as carbon monoxide, which generates 4,500 heat units. The only difference is in the quantity of oxygen taken out of the air, which costs nothing Carbon monoxide may be formed in the combination that takes place on the body of the fire through want of sufficient air and yet be made to perform its proper share of heating if means are taken to supply it with oxygen before it enters the tubes

COST OF HEATING THE MIXED GASES

Although a pound of carburetted hydrogen or a pound of carbon represents the production of intensely high temperature when burned with the full admixture of air, there are several things which materially reduce the heat available for heating or steam generating purposes All the gases of combustion and all the air used to supply oxygen has to be heated, which under unfavorable conditions uses up a large proportion of the fuel's energy.

The amount of heat available for practical purposes depends to some extent upon the volume of gas that has to be heated and on the capacity of the various gases for absorbing heat The specific heat of gases is of as great importance in this as the specific heat of iron and water is in other lines of industry.

SPECIFIC HEAT.

Lest some of our junior readers should not understand the term specific heat, I might mention that different substances require different quantities of heat to raise them in temperature. This is called the specific heat of the substance Water has a higher specific heat than any other substance except hydrogen. A quantity of heat that will raise a pound of water one degree will raise over 30 pounds of mercury and nearly 9 pounds of iron to the same heat. In the scale of specific heat, water is entered as 1, and all other substances represent fractional parts of that number Iron is .115, mercury, .033, hydrogen, 3.405, oxygen, .218; nitrogen, .243, steam gas, .48, and carbon dioxide, .217; air, .238

TO CALCULATE THE TEMPERATURE OF THE GASES.

Now we follow the heat performance of a single pound of good coal, and suppose that by combination with oxygen it generates 14,500 units of heat. The burning of fuel in a locomotive firebox or in any furnace that requires rapid combustion necessitates the saturating of the fire with air in order to supply all the oxygen necessary for combustion. To make certain that there shall be no shortness of oxygen, about 24 pounds of air must be admitted into the furnace for every pound of coal burned. This makes 25 pounds of mixed gases to be heated There is 3⅔ pounds of carbon dioxide with a specific heat of .217, there is 9⅓ pounds of nitrogen with a specific heat of .244, and 12 pounds of air with a specific heat of .238.

The rise of furnace temperature due to the combustion of one pound of coal under the conditions stated is calculated by multiplying the different gases to be heated by the figures representing their capacity for heat. When the products are added together, the sum of them represents the units of heat necessary to raise the temperature of the whole mixture 1 degree Fahr. When the heat units generated from a pound of coal are divided by the sum mentioned in last sentence, the quotient shows the total elevation of furnace temperature The problem is thus stated:

$$(3\tfrac{2}{3} \times .217) + (9\tfrac{1}{3} \times .244) + (12 \times .238) = 5.93 \div 14{,}500 = 2445$$

Calculating the rise of temperature due to the combustion of the hydro-carbons in the fuel is done in the same general way as the calculations given in the foregoing paragraphs, changes being made to suit the combining proportions and the capacity for heat of the different gases involved

These figures, 2445, represent in degrees Fah the net elevation of temperature when all the gases related to the particular pound of coal under consideration have been heated. If it were possible to supply the necessary oxygen by using only 12 pounds of air, the elevation of furnace temperature would be about 4,700 degrees Therefore, the smaller the volume of air used in combustion consistent with giving a full supply of oxygen the greater the heat available for useful purposes. There is no more heat generated with the smaller volume of gases, but it would be spread through a more limited space, which would concentrate the heat and keep the furnace temperature higher As the difference between the water to be heated inside the boiler and that of the heating gases would be greater, a larger proportion of the heat would be abstracted by the water.

WHAT BECOMES OF THE HEAT

All the heat generated by the combustion of one pound of coal is not utilized in steam making. The gases must pass away through the smoke stack at a higher temperature than the water to be heated inside the boiler, and this carries away an important share of the energy of the fuel The nearer the products of combustion come to the temperature of the boiler the less waste of heat there will be. The lesson of this is to keep down the smokebox temperature by taking as much heat as possible out of the gases as they pass through the tubes. The ideal way of using fuel for steam making would be to so arrange furnace and boiler that the waste gases pass away very little hotter than the water to be heated. This is attempted with some forms of boilers where fuel is expensive, but it requires very large boilers A boiler of this kind carrying steam of 100 pounds pressure has an internal temperature of at least 337.5 degrees of Fah. If the gases pass off at 400 degrees Fah. the avoidable waste of heat will be at its lowest.

Suppose the furnace of this boiler was supplied with twenty five pounds of air per pound of coal, as in the example already worked out We found that it took 5.93 heat units to raise the temperature 1 degree. As 400 degrees of heat passes through the chimney we have 400 × 5.93 = 2,372 heat units that are not utilized in steam making. These figures being subtracted from 14,500, the units of heat derived from the coal, we have 12,128 heat units that have been available for heating the water.

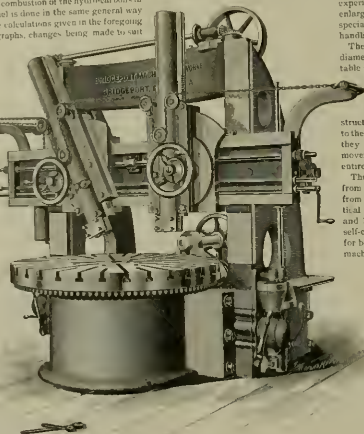
But suppose the combustion takes place in the firebox of a hard-worked locomotive and the smokebox temperature is 900 degrees Fah., a heat intensity common in practice We multiply 900 by 5.93, the heat units required to raise the temperature of the gases 1 degree, and we have 5,337 to deduct from 14,500, leaving only 9,163 heat units for steam making. This is a very serious reduction.

Boilers worked with intensely forced draught necessarily waste much fuel in the exhaust gases It is to restrain this as much as possible that the feed water is admitted near the front of boilers, that being thereby made a cool part and likely to abstract heat from the gases that become cooled in the part of the tubes nearer the fire.

OPPOSITE CONDITIONS THAT WASTE HEAT.

It will be noticed that there are two curious contradictory conditions in the combustion of fuel that militate against economy If a sufficient supply of air is not admitted to the burning fuel combustion will go on by the creating of carbon monoxide, a product of low calorific value If a liberal supply of air is furnished, a large volume of extra gas has to be heated, which lowers the temperature and makes combustion less effective than it would be if the furnace were kept hotter

The theoretical principles relating to combustion having been briefly outlined I shall proceed to give practical illustrations of how fuel is burned in furnaces



New Design of Boring Mill.

## New 62-Inch Boring and Turning Mill.

The machine illustrated is manufactured by the Bridgeport Machine Tool Works, E P Bullard, proprietor, Bridgeport, Conn, and is the result of eight years' experience in the manufacture of tools of this class It embodies all the essential features of their smaller mills and contains many new ideas, which have been suggested by past experience. This company have recently enlarged their works and added many special tools and fixtures for making and handling machines of this character.

The capacity of the mill is 62 inches in diameter and 52 inches in height. The table is 58 inches in diameter, is powerfully geared and has sixteen changes of speed. The teeth on table, as well as on pinion, are accurately planed. The heads are constructed so that either one may be brought to the center, and can be set at any angle they carry the tool bars, which have a movement of 30 inches. Each head has an entirely independent feed in any direction

The feeds are all positive and range from $\frac{1}{64}$ to ¾ of an inch horizontally and from $\frac{1}{64}$ to $\frac{1}{16}$ of an inch in angular and vertical directions. The cross-rail is raised and lowered by power. The machine is self-contained, thus avoiding the necessity for building an expensive foundation The machine weighs 20,500 lbs.

## Seams of Boilers.

With the thick sheets that are now becoming a necessity for the modern locomotive boilers the lap joint that has found so much favor with American boiler designers and boiler makers appears to be a line of weakness. Those who still cling to the lap joint overlook the fact that the proportion of strength of this form of seam rapidly diminishes as the sheets are increased in thickness

In a paper read at the New York Railroad Club by Mr. W. F Dixon, chief draughtsman of the Rogers Locomotive Works, some points worthy of consideration are given about boiler seams. He said

"As soon as the boiler is put in service deterioration begins, and it is the retarding of this as much as possible that should be considered in the design. There is no doubt whatever that when the butt joint is used, corrosion along the seam is much less than with the lap joint. Why this should be is not altogether clear The most plausible hypothesis is that with the butt joint the strain due to the steam pressure is uniformly distributed over the whole circle, while with the lap joint, when the boiler is under steam there is a tendency for the plates to straighten out, the result being that the plate bends to some slight degree each side of the lap; this tendency causes scale that may be deposited there to flake off and leave the surface of the plate exposed to furrowing or corrosion Another theory is that chemical action takes place more rapidly when the plate is subjected to a high tensile strain, and if this is really so, and there is much ground to show that it is, then it is easier to understand why corrosion would be most active where the bending strain is greatest, viz., at the laps, and although a lap joint can be made that will give as high a percentage of strength as the butt joints, yet the established fact that the butt joint lessens corrosion warrants its adoption in most cases, especially with large boilers carrying high pressure.

## EQUIPMENT NOTES.

The Chicago & Great Western is in the market for locomotives.

The Toledo & Ohio Central contract for eight cars has not yet been let

The Chicago Great Western are about to place orders for additional power.

The Soo line has let 15 engines, 8 to Schenectady and 7 to the Rhode Island.

The Boston & Albany have placed orders with Schenectady for ten consolidations.

It is reported that the Santa Fé have let fifty engines to Baldwin and fifty to Brooks.

The Louisville & Nashville have placed an order with the United States Car Co. at Anneston, Ala., for 700 cars.

The Wilkesbarre & Eastern had not yet closed for their eighteen coaches and chair cars on the 1st, but will probably do so very shortly.

Rhode Island Locomotive Works are building two compounds, two-cylinder type, for the South Side Rapid Transit Co of Chicago.

The Chicago & Great Western have ordered 750 box-cars of 60,000 lbs. capacity. They will be equipped with air-brakes and standard couplers.

The Norfolk & Western have placed orders with Billmeyer & Small, York, Pa., for eight vestibuled day coaches and seven second-class passenger cars.

Jackson & Sharp have taken orders for four coaches for the New York, Susquehanna & Western road. This road is in the market for several cabooses.

The Boston & Albany's 700 box cars go to the South Baltimore Car Co., 300 coal gondolas are to be contracted for for this company. Order not yet placed.

The Brooks Locomotive Works are building eight heavy freight engines for the Cleveland, Lorain & Wheeling; ten moguls for the Lake Erie & Western

President Ingalls, of the Cleveland, Cincinnati & St. Louis, has intimated to the stockholders that he needs 50 new locomotives in addition to the 60 ordered lately.

The Seaboard Air Line are buying rolling stock for their new extension to Atlanta They have ordered fifteen coaches from Pullman and fifteen locomotives from Baldwin's.

The Bangor & Aroostook road have placed orders with Jackson & Nordin for six cabooses, 100-box cars and 150 gondolas, also seven engines, with the Manchester Company.

The South Side Rapid Transit Elevated Railway of Chicago are on the market for locomotives and cars. The president of the company has given instructions that simple engines shall be tried.

The order for fourteen new locomotives mentioned in our last issue as being about to be placed by the Kansas City, Fort Scott & Memphis has gone to the Pittsburgh Locomotive Works. They will all have Latrobe tires and Lukens steel boilers.

The Schenectady Locomotive Works are building five locomotives for the Central Vermont and ten consolidations for the Boston & Albany. Among other orders recently received by this firm are compound consolidations for the Minneapolis, St Paul & Ste. Marie.

Immediately on the decision being made to run a train from New York to Chicago in twenty hours over the New York Central and the Lake Shore, the latter company ordered five new locomotives from Brooks' people for the express purpose of handling the train. They have cylinders 17 x 24 inches and driving wheels 6 feet in diameter They have Belpaire boilers, 54 inches diameter, and will carry a working pressure of 180 pounds. The engines weigh 100,000 pounds and are lighter than some of the other passenger engines used for the heavier trains.

## English and American Locomotives in Argentine.

A report was made some time ago to the president of the Western Railway of Argentine concerning the relative efficiency of English and American rolling stock, which contains information of much interest to our locomotive car builders. It appears that the Western Railway obtained control of the Southern Railway of Argentine rolling stock, which had been equipped with English rolling stock. Western Railway had in use principally rolling stock from the United States, which enabled the officers to judge fairly between the relative value of the two kinds. Speaking of the English rolling stock on Southern Railway, the report says that "as regards quality of material and its strength, it is all that could be desired, but the builders did not take into account the character of road-bed and track on which it was to run, and, therefore, made it too heavy and the wheel-base too rigid.

"The locomotive might run well enough on European roads, which are substantially built and well ballasted, but such is not the case in this province, where most of the railways are built on loose soil. The result is a large increase in the maintenance of way and repairs to rolling stock, and, consequently, a heavier burden on the income of the road."

One class of engine used is the Crampton type, with cylinders $16\frac{1}{2}$ x 24, and a single pair of driving-wheels 77 inches in diameter. The boiler has 1,014 square feet of heating surface. Twenty-nine thousand four hundred and fifty-eight pounds of weight rest on the driving-axle out of a total weight of 86,698 pounds. The engine, delivered at Buenos Ayres, cost $14,238. Of this engine the report says "The unequal distribution of weight is very injurious to the permanent way The high boiler pressure of 160 pounds was necessary to overcome somewhat the lack of traction power. When running at less than usual speed against the moderate kind, there was much trouble with the boiler priming."

Another class of engine of similar dimensions to the other, but having two pair of driving-wheels coupled, is spoken of as being a little more satisfactory. The report says "The weight is imperfectly distributed, there being excessive weight on the engine truck; the system of support is interior, while the absence of equalization has the disadvantage of making it impossible to distribute the shocks due to inequalities of work The excessive pressure at which the boilers are worked necessitates frequent and important repairs, such as the renewal of most of the tires and stacks. The tube-plates and the fireboxes are destroyed in a short time, notwithstanding the good quality of the material, owing to the high pressure of 160 pounds per square inch, although high pressure should be admissible without doing injury. All this was proven by the cost of repairs, which amounted in two years to $1,800 in gold "

There is a class of compound locomotives built by Beyer, Peacock & Co., Manchester, which appear to have given a good deal of trouble They are of about the same general dimensions as the simple engines and are the Worsdell & Borries type of compounds, and in regard to these engines the report says "It is evident that this system of locomotives for passenger trains was adopted without proper consideration of the conditions of service Their greater weight as compared with the high pressure locomotives, the repairs required by them, and the qualifications of the men who were to run them, should have been taken into account. Above all, it should have been borne in mind that the inventors of several systems of compound locomotives have found that an economy of 18 to 20 per cent. at a low rate of speed, was reduced to 2 per cent when the speed exceeds 18 miles an hour. Therefore, if all their economy does not compensate for their greater cost and the cost of repairs to permanent way, no practical advantage can be derived from the adoption of this system for our roads."

The pressure required in the boilers of these locomotives is 175 pounds per square inch, this being necessary to obtain useful work; but this has the inconvenience of necessitating continuous and serious repairs to the boiler. The journal-boxes are repaired and replaced very frequently, owing to the rigidity of the springs, and, as if this were not enough, the cylinders are very easily striated, by the heavy weight of the piston, due in our opinion to a blunder of construction which prevents the stem or rod of the piston from keeping its center in action in relation to the axle of the cylinder. The intercepting-valve with which these locomotives are fitted and which helps them to start with the low-pressure cylinder in case the piston of the high-pressure cylinder is at the dead point, must work automatically, that is to say, it must put the boiler in communication with the low-pressure cylinder when the locomotive stops, by means of a small auxiliary pipe. But it happens that it never works with regularity and we have noticed in many cases that it requires from eight to ten minutes to start the train, having to back or reverse in order to effect this, a circumstance which generally causes the breaking of traction hooks and bars, without taking into account the annoyance to the passengers from the heavy jerks, or the delays occasioned by the time required to take out the damaged vehicles and transfer the passengers.

There is another class of compound locomotives which are principally used on freight service. They cost $16,688 in gold and cost $1,950 in two years for repairs. The report says that "these locomotives have the same defects as the others have; in the consumption of fuel they are worse."

The report says that American rolling stock is much more suitable for their roads. Moreover, it costs less, and necessitates much less expense for keeping it in repair than the European stock

After giving some particulars about the Baldwin locomotives in use, the report says that the construction of this class of engine, notwithstanding its simplicity, is first-class, except in a few details. The locomotives for mixed trains have withstood very severe tests during the period when the railway had not the number necessary for its service, as, notwithstanding the excessive work done, the results were very satisfactory.

There are three kinds of Baldwin engines on the road, whose average cost delivered was about $10,000 in gold. One class with cylinders 15 x 20 inches; another with cylinders 17 x 24, and the third, cylinders 18 x 24 inches These engines are reported to be more economical in the consumption of fuel than the English engines The repairs are light, costing about $250 a year, as compared with about $900 a year for the English engines The engines are reported to be very powerful for their weight and with a good distribution of weight, which makes them easy on the track. After three years' service the boilers are said to be in a marked state of preservation. The report concludes, "It may be concluded, from data furnished in this report, that the Southern Railway locomotives are but iron masses, entirely injurious to the roads and interests of the company, and that a large part of its rolling stock is unnecessary for the service of its lines, as neither the conditions of its roads nor the necessities of its traffic require it. So unfavorable has been the result of the compound locomotives that it was necessary to withdraw them from the Mar del Plata service last summer and to use in their place the freight locomotives, owing to the tractive power of the former being less than was required.

There appears to be some curious practices among the boiler inspectors in New Zealand. The engineers do not appear to be instructed on the pressure that their boilers ought to carry safely. The following occurred in a report recently made by a surveyor "I may mention that engineers of steamships have actually come to me asking what their boiler pressure was. This comes about from the present system, whereby engineers placed in charge for the first time during the intervals between the surveys have no means of accurately ascertaining the authorized boiler pressure, especially if their vessels have been laid up for some time. In the case of a small steamship at Gippsland, which had been laid up for some time, I have reason to believe that the engineer got over the difficulty of ascertaining the pressure at which the safety-valves were set by starting a good fire under the boiler, and then watching the result from a hill on which he sat at a safe distance. Fortunately the valves worked well, and he then looked at the pressure guage for the information sought."

Work was started about the beginning of last month in the fine shops at Depew, near Buffalo, recently erected by the New York Central. When in full working order these shops will have capacity for doing all the repair work belonging to the western part of this great system. The shops are very commodious and have excellent machinery. There is stall room for fifty locomotives. We hear complaints from Buffalo that Mr. John D. Campbell, who has charge of the shops, has been stealing mechanics from shops that did not like to part with their men. We have heard this kind of complaint before.

Depew, where the New York Central shops are located near Buffalo, promises to be a manufacturing center within a few years. The buildings for several factories are in course of erection. Very few dwelling houses are up but the saloon interests are well advanced. There are about fifteen saloons in the place already.

On April 5th the Empire State Express ran 148 miles in 146 minutes and made one stop and slowed down once besides reducing speed twice to take water. A considerable part of the run was made at a speed of 76 miles an hour.

The American Railway Equipment Co. has arranged to handle the Excelsior metallic packing for rods.

The Pittsburgh & Lake Erie is erecting repair shops at Riverton, near McKeesport, Pa.



## OUR ENGRAVINGS.

Of late we have had a great many inquiries as to who made the fine half-tone plates shown each month in LOCOMOTIVE ENGINEERING. Credit is due the expert anywhere and we are glad to recommend the engravers of our plates to those wanting good work at reasonable prices. All the half-tones and reproductions we use are made by the STAR ENGRAVING & PRINTING Co., 607 & 609 Sansom St., Philadelphia, Pa.

SINCLAIR & HILL.

### New York Central's World's Fair Locomotive.

The annexed engraving illustrates an extremely handsome locomotive, built by the New York Central Railroad Company in their shops at West Albany, for the World's Fair exhibit. The engine is a splendid specimen of excellent workmanship, and is, we consider, the highest development of a fast and powerful locomotive. As a machine combining power and speed we think the engine ahead of anything ever built. If this engine cannot be pushed with a light train to reach a speed of 100 miles an hour we will conclude that such a velocity is beyond the capacity of steam locomotives. The engine was designed by Mr. William Buchanan, superintendent of motive power, and every detail has been worked out with very great care. The cylinders are 19 x 24 inches, the driving wheels are 7 feet 3 inches outside of tires, and the boiler provides about 2,000 square feet of heating surface, and carries a working pressure of 180 pounds.

THE NEW YORK CENTRAL'S COLUMBIAN FAIR ENGINE. DESIGNED TO RUN ONE HUNDRED MILES PER HOUR.

### The Erie Engineers' Locomotive.

The locomotive "E. B. Thomas," shown in the annexed engraving, will be exhibited at the World's Fair, and we are very much mistaken if she does not excite as much attention among railroad men as anything to be found in the Exposition. Some time ago a company was formed among the engineers belonging to the Erie system for the purpose of building a locomotive after the ideas of the promoters of the enterprise, and exhibiting her at the World's Fair. The money was duly subscribed and an order was given to the Cooke Locomotive Works to build an engine according to dimensions and specifications furnished by the men. Mr. J. W. Johnson, traveling engineer of the New York, Lake Erie & Western, was inspector of the engine during her construction, and she bears the stamp of his ideas of what a good high-speed passenger engine ought to be. The very handsome engine shown was turned out of the Cooke Works, at Paterson, N. J., and is now in the Fair grounds at Chicago. She pulled express trains from Jersey City to Chicago and displayed unusual power and speed.


PASSENGER ENGINE DESIGNED BY THE LOCOMOTIVE ENGINEERS OF THE ERIE RAILROAD NOW AT THE WORLD'S FAIR.

The engine as will be noticed is of the eight-wheel type, with cylinders 19x26 inches, and driving wheels 72 inches outside the tires. The boiler is straight with the dome set on the first course ahead of the firebox. The boiler is 66 inches diameter and has 265 2-inch flues, 12 feet 2 inches long. The firebox is supported by radial stays. It is placed on top of the frames, is 126 inches long and 41¼ inches wide. The total wheel-base is 23 feet 6¾ inches, and the rigid wheel-base 8 feet 6 inches. In working order the engine weighs 134,650 pounds, of which 88,750 pounds are on the drivers and 45,850 on the truck.

The engine has particularly large bearing surfaces. The driving journals are 8½x12 inches, and the truck journals are 6x10 inches. One criticism we would make of the engine, which is that she has an odd size of driving-wheel centers. They are 65 inches, and there seems to be no good reason why they should not have been made to the Master Mechanics' standard of 66 inches. There are, however, few locomotives to be found with fewer flaws in design.

As a compliment to the engineers who entered into this enterprise, the following makers of railroad appliances contributed their goods to the engine: Otis Steel Co., steel for boiler and firebox; National Tube Works, tubes, Midvale Steel Co., tires, driving and engine truck axles, crank pins and rods; Westinghouse Air-Brake Co., air-brakes, American Brake Co., driving and engine truck wheel brakes, Nathan Manufacturing Co., injectors and sight-feed lubricators, Ramapo Wheel and Foundry Co., Snow's boltless wheels for engine and tender trucks, Ashton Valve Co., safety valves; M. C. Hammett, Richardson balanced slide valves; Cooke & Strong, bell ringer, C. C. Jerome, piston and valve stem packing, Fox Pressed Solid Steel Co., pressed cylinder head casings; Star Headlight Co., headlight; Crosby Steam Gauge Co., chime whistle; Railroad Lamp & Signal Co., gauge lamps; American Brake Beam Co., brake beams.

### Broken Stay-Bolts.

Any information that will lead to the prevention of broken stay-bolts in boilers is a direct benefit to railroad men and all others connected with the operation of locomotive boilers. In spite of all the discussion there has been on the subject of broken stay-bolts, there appears still to be lack of reliable information on the subject. In connection with a paper which Mr. W. F. Dixon read about "Locomotive Boiler Construction," the existence of contradictory views among practical boiler makers and boiler designers was made apparent.

Mr. Dixon said: "The most troublesome things about a locomotive boiler are the stay-bolts, broken stay-bolts, after low water and hot crowns, being the most prolific cause of explosion that there is. When fireboxes were small broken stay-bolts were not such a pest as they are at this day of large boilers and high pressures. As is well-known, stay-bolts usually break close to the outer sheet, and may generally be found broken in the two or three upper rows along the sides, except towards the ends of the box, where they extend down as far as the sixth or eighth row from the crown. They are very rarely found broken near the mud ring. The cause of their breaking is generally understood to be due to the constant bending backwards and forwards they undergo, due to the difference in expansion between the firebox and shell sheets. The outer or shell sheet being thicker than the inner is more rigid and consequently the stay-bolt naturally breaks there.

How to remedy this trouble is one of the most perplexing problems that confronts the boiler maker of to-day; indeed, it seems improbable that we shall ever be free from broken stay-bolts while we continue to stay our boilers as we do. Various ball-and-socket joints for the ends of the stay-bolts have been tried, and all have so far either failed in their mission or proved themselves such unmitigated nuisances in the way of leaking that they were discarded. A step in the right direction seems to be increasing the diameter of those bolts which are most liable to fracture. Wide water spaces are also advantageous as they make a long stay-bolt necessary, and the longer the stay-bolt the less will its angle of deflection be as the firebox expands and the longer it will last. The sharp V thread so largely used on stay-bolts is probably the worst possible form that could be adopted, the sharp angles at the bottom of the threads presenting admirable opportunities for a crack to start and for corrosion to begin. The most suitable form of thread would be the Whitworth—rounded off top and bottom—but there are the same objections to be raised to its use in this connection that led to its rejection and to the adoption of the U. S. or Sellers thread for bolts and nuts. A compromise between the two that fills the requirements fairly well is a fine thread having the Sellers contour, *i. e.*, flattened off top and bottom. It is easy to manufacture, and, while not ideal by any means, is yet vastly superior to a sharp thread, while at the same time allowing of equally tight work.

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There will be a great many highly interesting sights for railroad men at the World's Fair, but one of the cars that proved among the most attractive exhibits at the Exhibition of Railway Appliances in 1883 will be absent. This is the dynamometer car built by Prof. P. H. Dudley. Prof. Dudley's engagements to inspect track with the car this summer will prevent him from exhibiting it at Chicago.

---

The Jos. Dixon Crucible Co., of Jersey City, are sending out, free, a book on lubrication by graphite and a sample of their make of that splendid lubricant. If engineers would use a little of this on gaskets and rubber packing they would not find it burned into the metal so hard as at present.

---

Who has drawings or picture of any kind of the engine "Excelsior," whose boiler was on separate trucks? She was built at Reading, if we remember right.

# Practical Letters from Practical Men.

**Facts Wanted. There's a glut of Opinions.**

Write on one side of the paper, state your point plainly and briefly, and then quit. We supply the generalities. No letters noticed unless name and address accompany.

### What Knocked Out This Cylinder Head?

*Editors:*

We had a case of breakdown here which has caused some discussion. A ten-wheeler Brooks engine broke a link-pin at bottom of rocker arm and knocked out cylinder head on that side. What caused the cylinder head to be knocked out?

*Green Bay, Wis.* HANDY.

### Another Machinist's Opinion About Home-made Tools.

*Editors:*

You should have headed that article on home-made tools "The Truth and Nothing but the Truth," and said further that nine-tenths of the home-made tools are not worth a continental when done.

W. DE SANNO,
Pan Handle Shop.

*Indianapolis, Ind.*

### A Chance for Coppersmiths.

*Editors:*

Why is patented planished iron that is used for jackets always dished in the center while common or other thin sheet-iron lays flat?

I have read letters and correspondence from all classes of mechanics in a railroad shop except coppersmiths. Why don't some of them start the ball rolling?

D. D. COLEGROVE,
*Algiers, La.* Coppersmith.

[It is always customary for the chair to appoint the mover for a committee as chairman of that committee. The editors, in this case appoint Mr. Colegrove a committee of one to write an article on coppersmiths' work in railroad shops, choosing his own subject—brazing, bending pipes, fitting, making oil cans or keeping up repairs; it's a splendid field of unworked virgin soil. We have set some inquiry on foot about that planished iron business.]

### Running a Steamboat With a Locomotive.

*Editors:*

In the away back times there used to be a steam ferry at what was known as Clark's Ferry, on the Susquehanna above Harrisburg, Pa. I think there was a dam there, and the steamboat was used to tow canal boats from the west to east side of river. In place of the regulation steamboat engine, one of the old time Baldwin half-crank engines was used. She was placed intact on board the boat, and permanently blocked up—the trucks being removed. It must be remembered that in these old engines the crank-axle did not run in the driving-boxes, they being outside bearing; the journal proper was a short section of axle fitted into center of hub, but in this case the journal extended out beyond the driving-box and the projecting part was made square. The driving-axle being in line with paddle-shaft, a sleeve with a square hole was slipped over the end of the journal and acted as a coupling. The man on the foot-board could use the throttle and reverse lever the same as in railroad practice. It was quite an ingenious affair, and the old mill never stuck on the centers. Whatever became of the boat the writer never knew. Perhaps some of the readers of LOCOMOTIVE ENGINEERING can tell us something about it, for the paper seems to go even to the uttermost parts of the earth.

*Indianapolis, Ind.* W. DE SANNO.

### Reminiscences of the New Castle and Frenchtown Railroad.

*Editors:*

In looking through your paper, from month to month, I have been very much interested in your cuts and descriptions of the early locomotives, but I have failed to see anything yet published regarding the New Castle & Frenchtown Railroad or the early locomotives on it, and as I have been looking this matter up for my own gratification, I thought possibly it might be of interest to some of the readers of your valuable paper, and I will therefore give you some facts concerning it.

The New Castle & Frenchtown Railroad was finished in the winter of 1831–32 and ran from New Castle, Del., to Frenchtown, Md., connecting the Chesapeake and Delaware Bays, and was for many years the connecting link and great thoroughfare for passenger travel between the North and the South.

It was 16½ miles long, and at that time was the best laid road in the country.

The first locomotive tried on this road was the first one built by Colonel Stephen H. Long, who established the Norris Locomotive Works at Philadelphia.

Colonel Long obtained a charter in March, 1830, incorporating the "American Steam Carriage Co. of Philadelphia," and the first locomotive built at their works was tried on this road on July 4, 1831, at which time about two miles of the road had been finished.

This locomotive weighed 3½ tons and was not a success, the failure being attributed to lack of capacity to furnish a sufficient supply of steam.

The next day the Colonel had better luck, his engine then going to the end of the rails that were laid and back, drawing two passenger cars packed with people (say seventy or eighty) with apparent ease, and it had 50 lbs. of steam at the end of the experiment.

The Colonel, however, was not satisfied with it, and the machine was brought to Philadelphia again, and a new boiler was constructed for it at Rush & Muhlenberg's works at Bush Hill. This engine was again taken to New Castle and tried upon the road, but it again failed. It would go very well for a time, but on the 31st October, 1831, a pipe burst and it became disabled. This being repaired two days thereafter, another trial was made but with equal want of success, which was ascribed to lack of power. Alone this engine went very well and rapidly, say at the rate of 25 miles an hour, but would not draw a satisfactory load.

Soon after the above date Colonel Long removed his engine from the road.

When the road was finished two locomotives, built by Robert Stephenson, Newcastle-on-Tyne, were imported.

When the English locomotives were landed at New Castle, Del., it became necessary to select a skilled mechanic to put them together as speedily as possible.

Through the agency of Mr. Wm. D. Lewis, the most active director of the company, this task was assigned to Matthias W. Baldwin.

These engines were of the most improved English type and greatly superior to any that had been made in this country. In putting these engines together, Mr. Baldwin had all the advantage of handling their parts and studying their proportions and in making drawings therefrom.

This proved of great service to him when he received an order in the spring of 1832 to build a locomotive for the Philadelphia, Germantown & Norristown Railroad. This engine, called the "Ironsides," was placed upon the above road in November, 1832, and proved a decided success.

The "Ironsides," in its general arrangement, was a pretty close copy of the English engines on the New Castle & Frenchtown Railroad, but with changes that were real improvements.

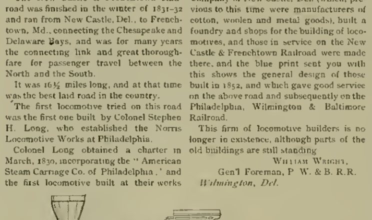
For twenty years this road continued in operation in conjunction with a line of steamboats from Frenchtown to Baltimore.

In 1834 the New Castle Manufacturing Company of New Castle, Del. (which, previous to this time were manufacturers of cotton, woolen and metal goods), built a foundry and shops for the building of locomotives, and those in service on the New Castle & Frenchtown Railroad were made there, and the blue print sent you with this shows the general design of those built in 1852, and which gave good service on the above road and subsequently on the Philadelphia, Wilmington & Baltimore Railroad.

This firm of locomotive builders is no longer in existence, although parts of the old buildings are still standing.

WILLIAM WRIGHT,
Gen'l Foreman, P. W. & B. R.R.

*Wilmington, Del.*



NEW CASTLE ENGINE, 1852.

### Treatment of Men on the Interoceanic Railway of America.

*Editors:*

In the February number of your paper I see an article that doesn't speak in any favorable way of the Interoceanic Ry., of Mexico. I will say this much in regard to the subject, that the officials are all first-class men to work for, there is no red tape, and any one who is able to run an engine is able to get along all right, as has been proven by the hiring of some engineers that I know would not make a success in some places. This road at one time worked all native engineers, at a small salary, from $1.50 to $3.00 per day, and worked them just as many hours as was necessary. Now since Mr. W. R. Barclay took charge of the motive power department and hired as many American engineers as the management allows, he raised the wages up to where they are—with a great deal of struggling, which every one who was here at the time knows. I think it is unfair for the men to make any complaints through your columns, as every day there are native engineers applying for jobs, who would willingly work for half what Americans are paid. Hoping this will give every one concerned a clear idea as regards the article mentioned, R. COOK.

*Puebla, Mexico.*

### The Fate of the "Cork Leg" Engine.

*Editors:*

I note that John West inquires in the April LOCOMOTIVE ENGINEERING in regard to the final disposition of the "Pioneer," or as she was commonly called, the "Cork Leg," which was the first locomotive run upon the Vermont Central Railroad. Permit me to say that this engine came to the road named from some road down in Massachusetts, and when received was an old scrap without cab and with a "foot brake." (Think of that, ye worshippers at the Westinghouse shrine!) She did not, however, run farther north than Northfield, and was destroyed and scrapped within a year after she came to the Vermont Central, and was succeeded by the "Flying Dutchman" and "Abigail Adams," both of which locomotives no doubt Mr. West will remember.

My authority for the above is Hon. J. W. Hobart, who began railroading in 1848, as he expresses it, "driving a yoke of oxen hauling material for the railroad fence." Mr. Hobart was very soon installed as agent at the head of the work as the road was building north from Braintree, until it reached Montpelier, where he remained as agent for some time, but eventually graduated successively through the positions of master of transportation, general freight agent and general superintendent to general manager, from which latter position he retired in 1891, after having served the same company through its varying fortunes of forty-three years.

CLARK L. PIERCE.

*St. Albans, Vt.*

### An Engineer's Opinion of Brake Handling—Increasing from Service to Emergency Applications.

*Editors:*

While discussing the merits, construction, operation, etc., of the air-brake, we should not lose sight of the all-important question, "How should it be handled?"

It is certainly simple enough to operate, but to do so in a skillful manner requires, first of all, a thorough knowledge of its construction, its operation, and a fair share of good judgment; the latter we usually acquire by practice, but the former requires special application.

I think, if we would become skilled in the handling of air-brakes, that we should never make but one application in making a stop. By practice men will become skilled so that it will be an easy matter to do so. It is the smoothest way and requires the least air, and, what is more important, consumes less time, which means everything in these days when you *must make the time* on fast runs.

I believe that the difference between men's ability to make time with air-brake trains on passenger or freight can be oftener traced to the manner of brake handling than to any other cause; particularly on runs where stops are numerous, as in local service.

Some men seem to think there is no variation of power about the brake, but there is a great range of power if the equipment be in good order. There is considerable room between a partial and a full application for service stop, enough to enable one with a little practice to nearly always make a stop without making two or more applications.

The principal fault in handling air is a lack of confidence in it. The brakes are generally applied too soon, necessitating a complete release before reaching the stopping point, and the result is that after making repeated applications the auxiliary reservoir pressure becomes exhausted, and when the stopping point is reached there is no air left to stop with. Some people are pleased to call a case of this kind a failure of the brakes, when it is only lack of judgment. We can understand how and why the brake fails, after making several applications in quick succession, if we remember that the braking power is measured by the capacity of the auxiliary reservoirs. It is an *easier* way to first reduce the speed and then drift along, making the final application at such a speed as to avoid any possibility of running by; but when you are on a run that taxes the engine to the utmost capacity

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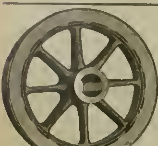

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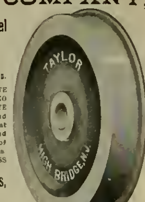


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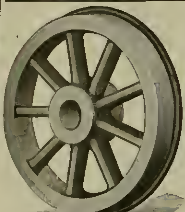

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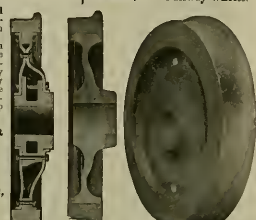

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…ou will not be able to make up any time and likely not even make the running time if the stops are numerous, even though the time can be easily made if not wasted at stations.

Is it not best to acquire the habit of doing things right? Then there is no special effort required when emergencies present themselves where skill is required, and besides, time can be made with as low running speed, which is something to be desired, for the man who can make the time at the slowest speed is counted the best runner.

There is a good deal of information needed as to how to handle the engineer's valve in a manner to operate the emergency feature of the brake. It is generally understood that the increase of brake power due to the emergency feature, is gained by employing the train-pipe pressure to assist in forcing out the piston in brake cylinder, reducing the amount of air drawn from the auxiliary reservoir, and in that way it increases the power of the brake. It is generally known that if the handle of the brake-valve is suddenly moved to the extreme right, the emergency action takes place, but it is not so clearly understood how to bring it into operation when a service application is on.

Air-brake instructors tell us that when a partial application is on, and the emergency is desired, to move the handle quickly to the extreme left for a moment and then to the extreme right, and its action is assured. When the handle is moved to the extreme left, or release position, it is not supposed to be left there long enough to effect a release but merely long enough to recharge the train pipe, and if any of the brakes should release they would, of course, apply again when the handle was moved to the right; but there would be a loss of power that can generally be avoided by one who understands its manner of action; but it is an uncertain action and there is but little gained by it, and in many cases where it is called upon, while a service application is on, it is better to increase it to the full application rather than depend upon such an unknown quantity as the emergency which requires a nicety of handling to operate it to advantage.

I don't wish to convey the idea that I do not believe it to be all it is represented to be, but I have every reason to think that unless it can be used promptly, and before a service application is made, its action depends too much upon skillful manipulation to be given much credit in summing up the efficiency of the brake in service.

*Creston, Ia.* A. W. LONG.

### Pump Governor Causing Emergency Application.

*Editors:*

In the March number of your paper the question is asked whether the pump governor can get into such condition as to cause an emergency application of the brakes after a slight reduction in service-stop. I wish the person who asked this would give a little more fully the particulars of the case he had in mind. What was the length of train, the amount of train-pipe pressure, the style of engineer's valve, etc.? There is no single condition of the governor itself which would cause the difficulty mentioned, as the air-pipe connection from the train-pipe is seldom large enough to exhaust the air with sufficient rapidity to cause an emergency action of the brake, even supposing it should be entirely disconnected.

The brake-valve is kept in running position both for safety and to get excess pressure. An accident might happen through inability to properly release the brakes when the handle had been left in the release position, and no excess had accumulated in the main drum.

It is also true that in setting the brake from the train, either with a conductor's valve or at the rear end, it will not take hold quite as promptly if the engineer's valve-handle is in the release position, as a greater amount of air has to be exhausted to produce the same result, unless the reduction is made suddenly enough to set the emergency immediately.

*Chicago, Ill.* PAUL SYNNESTVEDT.

### Cutting Eccentric Keyways Before Wheels Are Put on Axles.

*Editors:*

The article on cutting eccentric keyways which appeared in the March number of LOCOMOTIVE ENGINEERING, written by Fred. S. Hill, is very good. As I had the pleasure of meeting that pleasant gentleman since the article appeared, and having shown him our method of doing the same thing, he earnestly requested me to write it up for the LOCOMOTIVE ENGINEERING. Modesty at first forbade it, but having treasured up many kinks written by others I concluded that this might be of some use to them.

About four years ago the order came to key the eccentric on all locomotives as they passed through the shops. Our first experience was, after setting the valves, to mark, drill and chip the keyways while the wheels were under the engine. This was found to be a thankless task, for when an engine is so near completion it is wanted in a hurry.

By hard thinking we found a rule which can be relied on. If it does not come right every time it is safe to assume that either the workman was not accurate, or that the eccentric blades do not come in line with the lower rocker arm-pin.

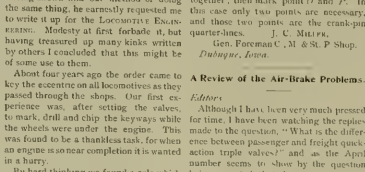

*Fig. 1*

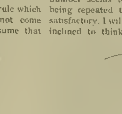

*Fig. 2*

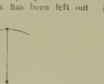
*Fig. 3*

We have keyed the eccentrics on some two hundred locomotives in the past four years, and all were done while the wheels were out from under the engine, and many keyways were put in axle before the wheels were pressed on. In many cases offset keys were required, but this was the reason. Either the workman was inaccurate or the blade did not come in line with lower rocker arm-pin.

The operation is as follows. Take a piece of tin, $U$, Fig. 1, say 12 x 12 inches, and tack it on a bench or board, if convenient. About the center, $A$, draw a circle, $R$, to represent the diameter of driving-axle where the eccentric is located; draw a line, $A$ $B$, to represent the piston-line and equal in length to the distance from center of driving-axle, $A$, to the center of crosshead wrist-pin, $B$, when crosshead is at forward end of guides. At $A$ erect a line, $C$ $D$, at right angles to line $A$ $B$, find the point $E$ and distance below line $A$ $B$ to represent the lower rocker arm-pin when the lower rocker-arm stands at right angles to line $E$ $A$, which represents the center line of motion. At $A$ erect another line, $F$ $G$, at right angles to $A$ $E$, for convenience we will call this the valve-line. Next find how much the top rocker-arm $T$ $T$, Fig. 3, will travel when the lower rocker-arm, 2 2, has traveled the distance equal to the throw of eccentric. This will be equal to the travel of valve; from $A$ as a center scribe a circle $S$ with diameter equal to valve travel. Now find the lap and lead, say ¾-inch lap and $\frac{1}{16}$-inch lead; add these together and you have $\frac{13}{16}$-inch. Now from valve-line $F$ $G$, Fig. 1, draw $I$ $H$, which we will call the lap and lead-line, $\frac{13}{16}$-inch. $M$ and $N$ in front of and parallel to line $F$ $G$. From $A$ draw line $A$ $O$ and line $A$ $P$ through where line $I$ $H$ intersects valve travel, circle $S$ at $J$ and $K$. Point $O$ will represent the center of keyway of forward eccentric and point $P$ will represent the center of keyway of backup eccentric on one side of the engine. Now carry to opposite side for same results. The keyways are supposed to be on center line, drawn through the center of outside of eccentric and the axle center.

If working on one class of engines, make template shown in Fig. 2 and set template so $L$, Fig. 2, and $L$, Fig. 1, come together, then mark point $O$ and $P$. In this case only two points are necessary, and those two points are the crank-pin quarter-lines.

J. C. MILLER,
Gen. Foreman C., M. & St. P. Shop.
*Dubuque, Iowa.*

### A Review of the Air-Brake Problems.

*Editors:*

Although I have been very much pressed for time, I have been watching the replies made to the question, "What is the difference between passenger and freight quick-action triple valves?" and as the April number seems to show by the question being repeated that the answers are not satisfactory, I will try to put in what I am inclined to think has been left out. I measured these valves some years ago, and while some slight changes have been made, the figures will illustrate my position.

Quick-action passenger triple valve (Plate D 22). Diameter of piston 3½ inches and piston travels 1¼ inches in emergency, graduating port Z begins to take air at ⅛ inch travel of slide-valve, and this valve travels ¼ inch more before piston stem strikes graduating stem. Size of graduating port in slide valve, $\frac{3}{16}$ inch. In port to brake cylinder, ¼ inch. Emergency port begins to take air at $\frac{11}{16}$ inch travel of slide-valve. Play of slide-valve on piston spindle $\frac{3}{32}$ inch, making piston travel $\frac{11}{16}$ inch before emergency begins to act, and graduating spring is then compressed ¼ inch, and when down on piston seat, ⅜ inch, resistance of new spring at ¼ inch travel of graduating stem is … pounds, at ⅜ inch travel 57 pounds. Now there is no use going over that which has been written, so I will call attention to the fact that the lower edge of graduating port Z, Fig. 9 A, Plate 3, Westinghouse instruction book, on passenger slide-valve, is $\frac{11}{16}$ inch from top edge of valve, and there is $\frac{3}{16}$ inch space from upper edge of the hole to port Z, Fig. 9 A, while on the freight valve this hole Z is $\frac{1}{16}$ inch from top, and there is ¼ inch space between Z and S, and consequently the passenger slide-valve would have less distance to travel from there to produce an emergency application. If I have made this point clear, it is evident there is a larger degree of fluctuation permissible in the freight slide-valve than in the passenger, and to make the action clear and, perhaps, explain why freight train-pipe is largest, as per Brother Hamar, I will copy an extract from *Locomotive Engineers' Monthly Journal*, page 348, April number, by C. P. R.

"The 1-inch train pipe on a 60-foot car, with hose, couplings, crossover pipe and drip cups, would have about the same cubic capacity as a 10-inch brake-cylinder with 8-inch piston travel; therefore, when the emergency application is made by pushing engineer's valve-handle to extreme right, and the train-pipe pressure of 70 pounds reduced quickly to 60 pounds, the quick-action attachment of triple valve is set in operation, and the train pipe pressure of 60 pounds equalizes into the empty brake-cylinder, giving a pressure of about 30 pounds in each; then the pressure of 70 pounds in auxiliary equalizes with the 30 pounds pressure in brake-cylinder to a pressure of 60 pounds, giving about 20 per cent. more power than a full power service application."

If this is examined and compared with the instruction book, it will be seen that the air from auxiliary has to come through ports in slide valve in emergency action, and C. P. R. has not allowed for the fact that it would not quite give 60 pounds, as air would begin coming from reservoir to brake-cylinder at once, and thus lessen the difference in pressure between reservoir and train-pipe; but I do not want to criticise, I wish to make it plain that the size of the port S, as compared to the size of train-pipe auxiliary brake-cylinder is the gauge, or regulator, that allows so much air to pass from auxiliary to cylinder, while another quantity is coming from train-pipe (as piston travel will affect this, don't say slack adjuster). Hence the reason for 1¼-inch train pipe in freight service, as the $\frac{1}{8}$ inch hole S, Fig. 9 A, plate 3, will hold back the air in auxiliary of the size used in freight service till enough air has flowed in from 1¼-inch train pipe to make nearly 60 pounds altogether.

But, says some one, the port S is the same size in the other slide-valve. That is so, but is more sensitive, because it is nearer the emergency, and the size of ports given in the April number modify this, but not altogether, as I have tried a number of passenger coaches and could get but 57 or 58 pounds, and am satisfied that on short travel, at least, the same thing will occur.

I have always understood that both sides of freight triple-exhaust were threaded for convenience in piping as in hopper-bottom cars, for instance.

As for the other question, any one who will take the isinglass card with plate 2, Westinghouse instruction book, will see, by placing brake-valve handle in running position that port G only communicates with space above piston 17, and thus furnishes pressure from train pipe to air-gauge through hole S, and union fitting 15, on gauge-pipe to number 14 and after handle is moved to lap this is cut out. In service stop the preliminary exhaust ports H and C are connected for an instant and as E communicates with chamber D of course train hand will fall. After passing this point, train hand is cut out and air from 10 x 12-inch reservoir equalizes or refills chamber D, raising black hand, but an examination will show train pipe is empty if handle is left in extreme right.

As to our Portsmouth friend, I think a gauge on train pipe, to see how rapidly air is reduced, might help, but if there are no leaks, as probably there are not (else all the brakes would apply), the cause must be local.

I once had such a case in which the piston-spindle was cracked half off at graduating-pin, and it did not show under the solder. It was not found till it broke off although examined. I now put such case between lathe centers and then strain them a little. A 12 x 33-inch reservoir with

an 8-inch brake-cylinder (as is generally found under tenders) will equalize at from 62 to 63 lbs. with 6-inch piston travel, while, with the same travel, an ordinary coach will equalize at from 53 to 54 lbs. and if the coaches would just release by turning air on a 3½-inch piston on coach at 54 lbs., it would be more difficult to release a plate *D* 20 triple with 3-inch diameter piston and 63 lbs pressure, and I generally find this to be the trouble.

Brother Relyea's problem is the same as came near doing injustice to an engineer here once. He would carry his handle between release and running position, and after he was reported and I was called to instruct him, I found the port J in rotary valve was so far to the right it would just open to port F to feed valve enough to feed train pipe a very little, but not enough to work well. "Conundrum's" question is of the same style, and I would look for some obstruction between piston 17, plate 2, and 10 x 12-inch reservoir that would allow air to strain through slowly.

Friend Shallenberger has my sympathy on the hose question. Could there not be made a general kick about it? I don't think it is worked up as it should be.

I wonder if "Inquirer's" engineer did not stand by the old "Durkee" in the Troy & Boston shops below Eighth street one night when I put some kerosene in her pump a good many years ago. Well, I did, and when the pressure got up, I went behind the tender to let out the air and in some way set it afire. I learned a lesson and stirred things up till the air pressure went down.

I think "Texas" in working the new brake-valve, plate D 5, with the figure 5 attachment, went through what we did here. We had some in this condition; when they were in release they would blow in till I took out the rotary valves and plugged the "squizers" with wood, which was taken out when we got reducing valves, and here I will tell you something comparatively new. An engineer came in equipped with new valve and reducing valve and reported brake would not go on in service stop, and then he had to use emergency. On trying the valve, the air man found piston number 47 all right, but the blamed thing went crazy when put up. I found the valve apart on the bench, and in cab, gasket number 61, plate D 5, had opened through, on top of piston valve 47, and as air would go through hole in gasket faster than it would run out of preliminary exhaust, piston number 47 could not rise.

GEORGE HOLMES.

*Roanoke, Va.*

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### Diamond vs. Straight Stack.

*Editors:*

In this month's (February) issue of *The National Car and Locomotive Builder* I notice an article from J. Snowden Bell on "Diamond Stack *vs.* Extension Smoke-box," in which he favors the former and is very much opposed to the latter.

It seems strange that that smoky contrivance the diamond stack, after having served its purpose until succeeded by something better, has still got its advocates, who do not seem disposed to allow it to pass quietly out of existence.

If Mr. Bell had seen as frequently as I have the difference between two engines composing a double-header on a heavy passenger train on a long and heavy grade, one with diamond stack, the other with open stack, alike in all respects except their front ends, the former belching out clouds of dense black smoke almost continuously from one firing to another, while from the latter it was comparatively slight and only for a few moments after each firing, I think, if for no other reason than smoke abatement (to say nothing of better combustion), he would have chosen the open stack, even if there happened to be a considerable length of smokebox in front of it. The cause of this was due, not to any difference in the boxes, of course, but to the stacks, for any one observing the puffs of smoke produced from an ordinary lamp-chimney by tapping the top with the flat of a piece of cardboard has a very simple illustration of the draft-obstructing and smoke-producing qualities of the diamond stack principle, the recoil of the exhaust from the netting-shield producing the same result.

It is bad enough to be compelled to obstruct the draft to some extent, but to baffle the exhaust as well is to needlessly increase the obstruction. The open stack is one of the best features of the extension-box combination.

In regard to the steaming qualities of the extended box, I know many good locomotive runners who, to their credit be it said, are not at all backward in letting their superiors know a thing is not worth a tinker's cussing word if such is their belief, but I have yet to hear complaints against the general good steaming qualities of engines properly equipped with the extension-box; on the contrary, I have frequently heard them say engines were improved in steaming after being equipped with extension-box combination.

Yet, superior though it is to the diamond stack, no doubt, in many cases there is room for improvement in the interior arrangement. We know the less the obstruction to the draft the better the combustion, yet, ignoring this, we put up diaphragm plates which are almost perpendicular, and some of them within a very few inches of the flue-sheet; baffles they may well be called. Deflectors should give the draft an easy curve to bottom of box, and no more than is required to drift the cinders to front end. I have seen excellent results obtained by simply changing from the baffle to the deflector. We would not think of pumping water of the same volume and velocity against angles so arranged if it could be avoided, yet we do not seem to give the same consideration to the very important matter of free draft; our long acquaintance with the diamond stack has evidently left us still erring somewhat in the matter of draft obstruction.

It is generally conceded by those who have to do with both combinations, that as a live spark arrester the diamond stack is not to be compared with the extended box, and this for reasons well understood, but in regard to the merits of the long extension as a dead spark arrester, to quote Mr. Bell, the average passenger does not urge them with any great degree of enthusiasm, particularly in summer.

The design of the originator of the long box no doubt was to collect all the sparks of a journey at the forward end, and with some kinds of coal this may perhaps be partially accomplished, but as a general thing we know that an engine has not run many miles of her journey before the cinders have accumulated to the path of the draft current, after which all cinders entering the box are kept in agitation until finally drawn through the netting, and this incapacity of the long box to do the work for which it was originally designed is probably one reason for "the material shortening up of extension," which Mr. Bell notices.

It would certainly add to the comfort of passengers and the cleanliness of the cars in summer if this dead cinder-throwing could be reduced by the use of some device easily operated from the cab, and by its regular use the diaphragm-plate could be kept higher, offering less obstruction to the draft, resulting in freer steaming, less fuel consumption.

One of the hand-rails might be used for working a device of this kind, the steam-valve being placed behind the stack. On trial I find this an easily operated and effective mode of discharging the cinders. Perhaps some of your readers will tell us what they are doing in this direction.

With a good device for discharging cinders as they collect, the utility of the long extension might be questioned, for experience has shown that boxes somewhat shorter afford sufficient netting area to give equally good results in regard to live spark-throwing, and the long box, aside from the "cook-stove on wheels" appearance, has the more important objection from its position as a lever, and with the truck as a fulcrum, of transferring weight from driving-wheels to truck.

Therefore, the question may become, "Full *vs.* medium extension," but the diamond stack is destined to eventually become obsolete.

A. A. MAVER.

*Stratford, Ont.*

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### What is a Spark Arrester? Facts Wanted.

*Editors:*

In view of Mr. Sinclair's perfectly reasonable theory, as reported in your April issue, "that an engine having no spark arresting obstructions to the draft could be made to steam with such large nozzles, that no more sparks would be thrown than what pass through the best spark arresters," and of the cold facts known to every one who works or travels on a railroad, as to the failure of extended smoke-boxes to prevent fire throwing, is not the abandonment of the latter by the Union Pacific system, worthy of a somewhat more attentive and favorable consideration than you have given it in your article on "Diamond Stacks and Extension Fronts"? I make the suggestion, not as an advocate of the diamond stack, although my observation has been that it will do better work, both as to spark prevention and free steaming, than the extension, but as a renewal of ineffectual efforts, in the past, to obtain from a technical journal any admission, however limited, of the merit of a short front.

Neither the diamond stack nor the extended smoke box is, in and of itself a spark arrester *at all;* each of them is simply a receptacle in which a spark arresting appliance is placed, and many different designs and constructions of such appliances have been used in each case. It is quite possible that it may be better to locate the spark arrester in the smokebox than in the stack, but this fact (if it be a fact) does not, in the least degree, tend to prove that there is any advantage in, or any justification for, the present fashion, now very noticeably on the wane, of extending the smokebox 100 per cent. more or less. There are many engines now in service, with open stacks and short fronts, which are undeniably giving at least *as good* results as those having extensions, and for this, if for no other reason, it would seem only fair to deal with the *spark arrester* proper, and not start with the assumption that it must be put into an extended smokebox in order to be "modern."

Beyond the statement, which may be accepted as correct, in the "Diamond Stacks and Extension Fronts" article, that the wear of netting is greater in the former than in the latter, I am unable to find any "pros and cons" in the report of Mr. Montgomery's remarks. He says that the extension front, *properly constructed* (a qualification so general as to be meaningless, since we have *all varieties* of them) "is superior as a spark arrester," and again, that "it was a success over the old-fashioned diamond stack," but does not say *what* diamond stack he compares it with. Mere assertions like these are not arguments, neither do they carry with them any reasons on which they are based, yet they are the sum and substance of all that I have heard or found in print in support of the extended smokebox.

A few evenings ago, while waiting for a train at Plainfield, on Mr. Montgomery's road, I saw a Baldwin compound of the 385 class go by with a fast Blue Line train. This engine, burning hard coal, and having an extension whose huge proportions would satisfy the most enthusiastic advocate of that device, was throwing fire at a rate which I never saw exceeded, if indeed equaled, by any diamond stack, and I do not think that any one who knows the facts on that road will maintain that I have overdrawn them, or that this was, by any means, an unusual performance.

If, with the supposed light exhaust of a compound engine and with hard coal fuel, such a result is manifested by the extended smokebox, is there not some reason for the belief that it might be well to get rid of the excess of weight on the truck, and give the engine a chance to steam freely, by cutting off the excrescence, even if we have to follow the example of the Union Pacific, and enlarge our nozzles, as they have been able to do when using a short front and diamond stack?

J. SNOWDEN BELL.

*Pittsburgh, Pa.*

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### Answering All the Air-Brake Questions.

*Editors:*

Concerning a number of interesting articles on air-brakes published in your April issue, we should like to say a few words.

Mr. Shallenberger's remarks on the care of air-hose are most timely. More attention should be given to this subject. Any one who has not read the article should turn back and look it over.

What Mr. Hutchins says about the slow-acting triple on the engine calls to my mind a problem o'er which I have often pondered. Why, in nine cases out of ten, do the "powers that be" put a slow brake with little leverage on an engine that is to handle quick-action cars? There is no doubt at all but many break-in-twos result from this condition.

Now that the safety appliance law has become a definite thing, why would it not be a good plan for Congress to legislate that all brakes shall be kept in good order? Are there any suggestions on this?

Mr. Hamer, R. F. E., asks some funny questions. The first, about the single exhaust in passenger triple, he will find answered in a recent issue of your paper. Why the size of the train-pipe should have anything to do with the use of the freight triple in passenger service I cannot comprehend. The freight train-pipe is larger than the passenger because it is *shorter*, and approximately the same amount of air is needed to produce the same equalized pressure after an emergency application. As to question three, the feed port in the rotary of the engineer's valve registers with the equalizing port to the upper cavity when the handle stands about a half inch beyond the service stop in the direction of emergency. The train-pipe in such position may be and in fact is empty in spite of the fact that the gauge does not show it.

Mr. Texan does well to call attention to the need of strong frames for the pumps. Reform in this respect is badly needed on many roads. The remarks about the use of engineer's valve in release position when there is a defect hole in the rotary-valve seem to me rather hazy. The valve is not supposed to be left in the release position.

The trouble with Mr. Relyea's engineer's valve was that there was some discrepancy, in running position, between the relative position of the guide spring on the handle and the feed port through the rotary-valve. This port did not open until the handle had gone too far. Whether the fault was in the location of the port or in the spring, or notch, it is impossible to say without examination. In the case of the engine on which the gauge pointer dropped to zero in service application and slowly rose again to within about 5 or 7 lbs. of the original pressure when the handle was returned to "lap," the trouble was probably caused by some obstruction which closed communication between the upper cavity in the engineer's valve and the small equalizing reservoir. A blind gasket anywhere in the pipe connection between these two would produce a similar result, as any one can prove by simple experiment.

In response to "Inquirer's" inquiry, we should say that the quickest way to release

brakes in any case is to put the brake-valve handle on lap until a heavy pressure has accumulated in the main drum, and then to move it to full release position.

Kerosene is very liable to volatilize and explode if put into a pump under heavy pressure.

The use of air from the main drum, either for sand-feeding apparatus or anything else, is liable to cause a dragging of brakes if the governor be attached to the train-pipe and the train-pipe have but little leakage, for when the pump stops the excess in the drum may reduce slightly below the train-pipe pressure before the governor will permit the pump to go to work again, and in the meantime the back leakage from the train-pipe to the drum may be sufficient to lightly apply the brakes.

Mr. Walker's first question as to emergency in service application I should like to have him answer himself, as the three conditions he mentions are the only ones I ever discovered that would cause such trouble. The tender-brake he mentions as not releasing properly had probably equalized at too high a pressure, either from too short a travel of piston or from the reservoir being too large in proportion to the cylinder.

In conclusion, let us criticise the so-called "Improved" brake-gear illustrated on page 173. It appears to us that, with the ordinary proportions of brake beam-levers, this arrangement gives one truck twice as much power as the other. Will the inventors kindly enlighten us on this point?

*Chicago, Ill.* PAUL SYNNESTVEDT.

### Is there Anything Wrong with this Way of Testing Air Signaling Apparatus?

*Editors:*

Will you kindly allow space in your paper for me to express my views on defects in train signal when caused by reducing valve?

As we all know who are in actual road service, it often occurs that the pressure in the train signal rises to nearly that in the main reservoir, which causes the air whistle to blow while brakes are releasing. This generally occurs as you are nearing the terminal, or after running some distance, and is very annoying, and, in some cases, dangerous, especially where the stops are short, as a man might mistake it as a signal from the conductor and start the train, thereby injuring some passenger.

This is caused by the diaphragm in reducing valve becoming spongy, or by a little dirt, or in cold weather by frost no allowing the diaphragm to work properly. Now, my way to detect this defect has been, after getting engine on ash pit I stop the pump and reduce pressure in main reservoir by setting and releasing the brake until I get a signal from air whistle. That shows me the actual working pressure in train signal. I often find that the air equalizes between main reservoir and train signal as high as sixty pounds, then I report air equalizing at too high pressure between main reservoir and air signal. The air-brake inspector almost always contradicts my report and says the air signal is all right. I ask him if he knows what pressure there was on air-signaling valve. He says that he attached the gauge to air signal and pumped up the pressure and it reduced at thirty pounds. I said that is all right for you, but my gauge shows sixty pounds working pressure. Then I asked him if there was any way to determine the pressure in the train signal other than attaching a gauge to signal pipe, and he answered no. I thought he was mistaken, and I went to the air-brake instructor and asked him the same question and received the same answer. I then explained to him my way of testing by reducing pressure in main reservoir after actual service instead of pumping up pressure, and claimed I got the best results and that this was the only way to get the actual working defect in reducing valve.

As the instructor claims my way is not the scientific or practical way to test any defect in reducing valve and that the same would not be recognized by the Westinghouse air-brake instructors, I submit the foregoing for further comment.

*Meadville, Pa.* NYPANO.

### Changing Steel By Hammering.

*Editors:*

In a letter in the April number I promised to write a letter on iron and steel, but I will have to confine it to steel alone. Railroad companies and a great many of our manufacturers compel blacksmiths to work up, and then hold them responsible for the amount of abuse the tool or forging has to stand, without first inquiring as to what facility he has for doing a good job. They simply tell him that such a shop does it in a certain length of time and so much better. Perhaps the shop that is mentioned has a furnace and steam-hammer and the necessary tools to do the forging with, and also uses a class of steel that is most suitable for the certain tool or forging the smith is asked to make.

As a rule the man that purchases the material only considers the amount it costs per pound, and our steel manufacturers

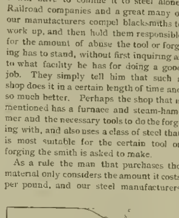


FIG. 1.

are well aware of this, it seems, by the grade of steel some of them put on the market.

Perhaps they are compelled to put an inferior grade on the market in order to compete with those that sell nothing else. Now this inferior grade may give satisfaction for certain classes of work, but the man that has a steam-hammer and furnace at his command has got the advantage of the man that is without them.

You take our steel at present and you can make a wonderful improvement in it by working carefully under a steam-hammer.

To convince yourself of this take a bar, say ¾ x 1¼ inches, and quench it at refining heat, then draw a piece to about ⅝ x 1 inch and quench that at a refining heat in a solution that will cool quick enough to refine your steel.

I have known it to make such a difference in the grain of the two pieces of steel that when sent to the mill where it was made, they were not sure that both pieces were their own make.

Now toolsmiths are very often asked why one tool holds so much a finer and smoother edge than the other. We generally find a tool as shown in Figs. 1 and 2 gives us more trouble than the one shown in Fig. 3. The cause of this is the amount of forging on Figs. 1 and 2 is very little compared with Fig. 3, and again, it makes a difference whether these tools are forged under a hammer or on an anvil. I have been compelled to draw steel under hammer in order to use it for the tools as shown in Figs. 1 and 2.

Now a great many smiths may say that this is all folly, but I have tried nearly all the different makes of steel, both English and American, and find that some will average a good deal better than the other, but I have not found any yet, even the finest grade, but what you can change the grain by working it carefully under a hammer—at least nineteen bars out of every twenty will show a difference. The greatest difference will be in the larger sizes.

What I want to get at is to find out if this refining could not be done at the mill, where they have all the necessary tools to do it with, which a great many railroad shops are without. W. G. LOTTES.

*Madison, Wis.*

### Duty vs. Good Nature and Suspension.

*Editors:*

In your March number I notice a communication from M., K. & T. in regard to handling freight trains with four or five air-brake cars on head end. Now on our road, the C., M. & St. P., the orders are to use the air all the time or in making every stop, or slowing up, or holding train down hills use the air, as air was put on the cars to use. Some time ago our officials here put up an order not to use air only in cases of emergency, but when the officials at the head of the road found it out it was quickly recalled and orders put up to use it all the time, and brakemen have orders to ride on top of trains down all hills and through all stations, and it is the conductor's duty to see that rear brakeman is out on top and the engineer's duty to see that head brakeman rides out on top, conductor and engineer both being held responsible for brakeman not riding on top, as the air-brakes fail sometimes or engineer may let them run too far before using air, and if

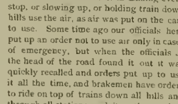


FIG. 2.

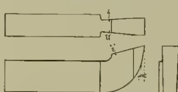


FIG. 3.

brakemen are on top they will be ready to set brakes at the first call.

Almost every day there is trouble between some engineer and brakeman about brakeman not getting out on top, as whenever there is air enough to handle train brakemen do not want to get out on top, and sometimes refuse, then there is trouble, and all the engineer can do is to report brakeman to superintendent, and then all the brakemen on the road get down on him and call him a stinker.

If engineer or conductor does not make brakeman get out on top and it is found out by the train-master, the engineer or conductor gets fifteen or twenty days and brakeman nothing. I think the brakeman should be the one to get laid off or discharged and not the engineer or conductor. A great many of our engineers and conductors are too good-natured to ask brakemen to get on top, and several of them have been suspended for it. There ought to be some remedy for this.

*Ottumwa, Ia.* FRED F. LEE.

### Quick Valve-Setting.

*Editors:*

In reading the remarks of F. C. Charles in regard to Mr. Campbell's valve-setting, I was struck with the vagueness of his criticism, and could not help saying to the apprentice, to whom I was reading his article, "It is too bad he has not given us *his* plan for setting valves."

Several years ago I remember reading an article in our paper from Mr. Campbell, wherein he explained his ten-minute plan. Until then I had been studying a plan to do the job more quickly than was usual, and had about succeeded in my ideas but lacked the opportunity to test the method.

You can imagine my delight when, on opening my LOCOMOTIVE ENGINEERING, I found in it Mr. Campbell's ten-minute scheme, which agreed with my own and gave me the encouragement I needed. I showed the article to my room-mate, saying, "I wanted that badly."

Well, sirs, very soon after that I was successful in getting a position wherein I had the opportunity to try my pet idea, as I called it, at valve-setting.

It did not take me much longer than ten minutes to do the trick, and—will you believe it?—that engine reduced her coal-bill for the month $90.

Of course I do not claim that it could not have been done by any other system of setting. But this I do know, that no other man there could have done it, simply because they were not readers of our paper, LOCOMOTIVE ENGINEERING.

Keep a-shooting with your valve-setting pointers, Mr. Campbell, there may not be much in some of them, but in the main they are all right.

I am able to tell you that I know a score of young men readers of your paper who have obtained better jobs, consequently better pay, through the knowledge gained from reading Mr. Campbell's valve-setting pointers. F. C. Charles says "he *tries*" to tell how to set valves, but don't succeed.

Maybe it would be beneficial to some of us if F. C. Charles would give us his plan to set valves by. I'll bet him a little apple he cannot beat the ten-minute plan.

"YOUNG WHISKERS."

*Fernandina, Fla.*

### Call for Meeting of Air-Brake Men.

*Editors:*

Considerable has been said from time to time in reference to air-brake men organizing and meeting in convention regularly for the purpose of exchanging views and experiences, determining upon some uniform method of instruction for employes, and means for betterment of maintenance of the air-brake equipment now so generally in use on railways in this country, but the little headway which has been made towards organization can be said to be due to the lack of concerted action on the part of the air-brake men themselves.

Numbers of railway officials to whom the subject has been mentioned express themselves highly pleased and in favor of it, and believe much good would be secured to all railways that would send representatives to the convention. Inspectors themselves have long since recognized the need of such organization, and while voicing their sentiments, each one has waited for some one else to take the initiatory step. And now that the Traveling Engineers have organized and generously provided a clause in their constitution whereby air-brake experts are made eligible to membership, a number have availed themselves of the opportunity and have become members, but many others are still holding back, believing that nothing short of a separate and distinct organization of air-brake men will fill the want, and in which belief there seems to be considerable wisdom.

While the air-brake men appreciate the generosity of the Traveling Engineers' invitation to them to become members of their association, yet they believe an amalgamation of the two impossible, and feel they should be separate and distinct, for there would be numbers of subjects brought under discussion that would be almost entirely foreign to many air-brake men, and in which their interest would not exceed curiosity, were the two combined. The air-brake man is usually selfish, and has frequently been called a "crank," and perhaps his devotion to his profession has warranted the "title." Should he go to a convention he would want to talk air-brakes the whole time, nor would he care to be relegated to a back seat until such time as uninteresting (to him) topics were disposed of before he would be given an opportunity for spouting on his pet theme.

Expressions of doubt as to the wisdom of

the air-brake men organizing separate and distinct from the Traveling Engineers have been frequently given; yet the majority of them believe that satisfaction to their interests can only be had from independent organization. While the interests of the occupations are analogous yet they are separate and distinct as are those of the Master Mechanics and Master Car Builders and bear a similar relationship. It is believed that the Traveling Engineers and Air-brake Men's Associations should be separate as are the Master Mechanics and Master Car Builders, and that the plan of meeting followed by the latter associations (one shortly after the other has finished) could be adopted to mutual advantage by the former. This belief is deduced from conversation had with other air-brake men with whom I am frequently brought in contact, and with whom the subject has been thoroughly discussed. This plan would permit those Traveling Engineers whose duties are combined with those of air-brake inspector on their systems to take an active part in both conventions with but one leave of absence from their duties.

Quite an interesting impromptu meeting of air-brake inspectors took place in St. Louis about a month ago, which proved so successful that I have been persuaded to give a starting push to the ball toward permanent organization. F. H. Eddy, of the Fitchburg Ry.; E. D. Desoe, of the Boston & Albany; J. N. Smith, of the Old Colony, J. L. Andrews, of the N. Y., N. H. & H. Ry., and H. S. Kolseth, Westinghouse Air-Brake Company's Boston representative, came to St. Louis to visit the Westinghouse Company's Instruction Car to get "points" to aid them in building proposed instruction cars in the future, and also the system of instruction used by the gentlemen in charge of this car, whose wide experience in this line has led them to adopt. So numerous were the kinks and problems presented for solution, and for which the apparatus in the car was admirably adapted, that it was decided by the gentlemen in charge to abandon the routine work of regular classes for the following day (Saturday), and devote the entire day to experimental work and general discussion of air-brake topics with the visiting inspectors. Telegrams were sent to other inspectors about St. Louis, and the number was increased by the presence of C. C. Farmer, of the M. K. & T. Ry., W. C. Walsh, of the L. & N. Ry., Otto Best, of the N. C. & St. L. Ry.; F. Fisher, of the Mo. Pac. Ry.; Robert Wark, of the St. L. I. M. & S. Ry., and J. B. Cozart, of the Mobile & Ohio Ry. So satisfactory to all of the inspectors present was the discussion that expressions of regret came from all sides that the meeting must so soon adjourn, for the good done in that one day's convention made each man wish, like Oliver Twist, for more; and it was unanimously voted that another meeting be held in the near future in some convenient place, and steps be taken toward permanent organization. It had been settled in the minds of several present (who had hitherto doubted) that air-brake men could convene and intelligently discuss business in a manner that would prove beneficial to themselves as well as the interests of the company which they represented.

Since the meeting in St. Louis a decision has been reached by those present, and I am hereby directed to state that a meeting of air-brake men will be held in Pittsburg, Pa., June 8, 1893, to effect permanent organization. All air-brake men are cordially invited to attend, and it is hoped that all who can will be present and assist this organization of which we all have long felt the need. Railway officials are beginning to recognize the fact that there is hardly another branch in the service which is carried on at a greater waste and needless expense, and which by proper knowledge and attention can, with so little additional expense (if any), be made to serve its intended high purpose, as the air-brake, and as we are working for the good of our companies, it is believed that we will receive the sanction and support of our officials, and the leave of absence required to attend these meetings it is hoped will be promptly given for the asking.

As our object is to better the service and condition of the air-brakes, we believe that any man whose services contribute to that end may become an active member. Hence, air-brake inspectors, air-brake instructors, traveling engineers and air-brake repairmen may become members, and are requested to be on hand in Pittsburg next June to assist in organizing.

ROBERT BURGESS,
Air-Brake Instructor L. & N. R. R.
*Louisville, Ky.*

### Keeping to Runs, Not to Engines.

*Editors*:

I will endeavor to enlighten the writer of the article in the March number of LOCOMOTIVE ENGINEERING whose article is captioned "An Unfair Rule," and signed "A Reader," Huntington, Ind. I must state that there is quite a distinction between our rule and the one he has reference to on the Chicago and Erie. The clause pertaining to that in our schedule is as follows:

"When an engine is assigned to a certain run, and it is necessary to take engine in shop, either for general or local repairs, engineers and firemen will be furnished with another engine." I must say that this clause pertains to all cases. We are assigned to runs here, not engines; and when it is our turn to go out or our time to go out, whether on freight or passenger, the company has to furnish an engine or something in the shape of an engine. We stay with our runs, not with engines. So I hope the reader will see where he was mistaken in that rule. Freight men don't have to lay off, supposing their engine is detailed to go on a first-class run; whether passenger or freight men, they go out on their run with whatever kind of an apology for an engine is furnished them, and oldest men have the preference of runs in freight or passenger. And I must state that it works all O. K. here for the men, though I don't think it is so profitable to the company, as in general men don't keep up their engines as they would if they had regular engines. Hoping this will be all satisfactory to the inquirer,

JAS. W. ANDERSON.
*San Bernardino, Cal.*

### An Engineer's Opinion on the Difference Between Straight and Diamond Stacks.

*Editors*:

I noticed with interest an article in last number of LOCOMOTIVE ENGINEERING on diamond stacks versus straight shots and extensions; I am entirely in sympathy with the latter as regards steaming qualities and "spark arresters," to say nothing of looks and cleanliness. I have run and fired engines during the past ten years and have concluded that without the extension front sparks have got to come out and the greater part of them are good and hot—especially when they drop down the engineer's neck or in the fireman's eye.

The Union Pacific changed straight stacks for diamond to prevent throwing fire, but I fail to see any change in the number of fires set along the road, and I have asked a great number of the men how they liked the change. With the exception of one or two engineers they said they were not as good as the straight shots in any way, as they did not steam as free, threw more fire, were very dirty to ride after on account of cinders flying and trailing smoke and that the second engineers and firemen on double-headers had to keep front windows closed all the time to prevent being burnt up.

Before this change extended over the whole U. P. system I rode from Denver to Cheyenne on a U. P. passenger train and the whole equipment was perfect I thought. The engine was a beauty, clean and in fine shape with an "extension front" and "straight stack" and I noticed no cinders and no smoke and all the passengers including myself were enjoying the ride. I also noticed every time engine was shut off that she *popped*, so she was evidently steaming well. I stayed in Cheyenne a day and then continued my journey west. Everything was fine until we reached Rawlins. Engines were changed here and we got a fine engine but with a diamond stack. Every one noticed the change as soon as we started. The day being warm the windows were opened but the cinders and smoke rolled in so fast that we had to close them and then we nearly suffocated. It seemed as if every passenger on the train was mad, and I did not blame them, as I knew just what the trouble was and they did not. I think engines in passenger service at least should be equipped with straight stack and extension, if only for the comfort they give their patrons. I have always found that no matter what kind of spark arresters are used some kinds of coal make sparks that will fly out. I have also noticed that where diameters of stacks were decreased larger nozzles could be used.

IMPROVEMENT.
*Anaconda, Mont.*

### In Favor of the Seniority Rule.

*Editors*:

In the April number of LOCOMOTIVE ENGINEERING appeared an article from T. J. Henderson, of San Bernardino, California, on the examination and licensing of locomotive engineers. Now, if you can allow me a small space in your valuable instructor, I would like to argue the case with Mr. Henderson. He says, "We want better engineers, better conductors, and in fact better posted men in all departments of railroad life." He has, I presume, forgotten to mention the other side of the question. Better paid men in all branches of railroad life. He speaks of "*we*." The people of the United States, the taxpayers, the railroad men and the voters are "*we*," and "we," as he terms, are the people who vote the funds and give the lands to the railway corporations, and help support them by paying very dear for all favors received. Practical No. 1 railroad men have made railways what they are to-day, and if corporations cannot pay such men fair compensation for their services they should, by law, be compelled to close down.

Mr. Henderson also argues that railroading in America has reached its zenith and is now on the decline. Consider me on the negative of this question also. "Seniority," so says Mr. Henderson, is the stumbling block over which we are to fall. Do you realize, Mr. Henderson, that such an assertion is a burning insult to a first-class blue-blooded railroad man who has a position of honor, and is duly credited with the same by his many years of faithful, unerring and devoted services, rendered strictly in behalf of the corporation by whom he is employed?

A true supporter of seniority expects only what is due him, and what is due a man should be claimed by all, both senior and junior workmen.

Seniority has proved a grand success upon one of the largest trunk lines in the world and that line is the A., T. & S. F. The management (if they give the men their just dues, and I rather guess they do) will admit that they at present have as good a lot of railroad men and obtain as good results as any and better than most of roads.

Upon your non-seniority roads, the nephew, the white-shirt-high-standing-collar and silver-tongued man fall heir to all of the fat positions, and often does ruination and disgrace fall upon all concerned. Many times the offices of train-master, superintendent and master-mechanic are filled by inexperienced men, because of being the relative of some lord. Can such men control men and produce such good results as those who have risen from the ranks, so far as their qualifications permit? I think Mr. Henderson's three rules for condemning seniority are quite strong for supporting it. Ponder them over and reflect a bit and you are bound to admit that true seniority will do away with the backbiting and dragging down.

It has frequently come to my notice that a man who could drink the most liquor and do the most informing and misrepresenting his fellow workman never exchanges a bright bit of knowledge, and was opposed to joining in the march of equalization and progress, was always the man who fell heir to some honorable position; where, on the other hand, had seniority prevailed such a man would never be enrolled on the list.

A railroad man from New York is as good as one from California, so why do you condemn our only elevating medium, "seniority"? And, Mr. Henderson, don't be at all alarmed about the present mode of examinations now in vogue upon our various trunk lines, for many a first-class non-seniority engineer of many years' experience has struck the Santa Fe for a position and then hit some non-seniority road for a job, because he couldn't cut the mustard with the superintendent of machinery and motive power in his examination.

IRA D. MAYHALL.
*La Junta, Colo.*

### Affairs on the Chicago Elevated.

*Editors*:

Quite a few of us here on the "Chicago Elevated" read your paper, and of course saw the communication in the March number from the President of the Ananias Club signed "Engineer." He differs from the *Ghost* in "Hamlet," inasmuch as he unfolds his tale. He thought it too good to keep. Let's see what of truth is in it. The time, as he says, is fast. The engines are able to make it, though, and do make it *to the second nearly every day*. The stops are sharp, but they also are made. No one that I know has been given a single day for any failure to make them. It is also true that you are forbidden the use of the "emergency" except in case of danger. No one here complains that this is a hard rule to comply with, and it is seldom violated. You are expected to stop on a 15-inch margin, but before "Engineer" left they were considering the advisability of making it *fifteen feet*, and issuing an order not to start the rear car first.

No one was called upon for examination without *months* of time for preparation.

The company furnished the books containing a list of the questions and answers. No one was asked any senseless questions and any engineer ought to have passed after ten hours' study. Some stated openly they would not submit to any examination.

It seems that "Engineer" passed the gauntlet of the dreaded examination in safety and it certainly was not a severe one or he wouldn't have mistaken a Pintsch gas tank under each car for a Westinghouse air-brake auxiliary reservoir. Of course he was somewhat rusty on modern railway appliances and thought that the big auxiliary was necessary on account of the sharp stops.

He undertakes even to find fault with our weather in this banana belt. He ought to go up into Dakota about the middle of January next (where they have to hunt for the mercury with a diamond drill) and make a trip or two on a snow plow with three or four healthy moguls behind him, and I can assure him something would "blow across his vision" and meander down his spinal column, too, that would completely eclipse anything he saw here in the blizzard line. If he survived it he would know more about weather than he does now.

To sum up with, no one is oppressed here. The pay is as good as he gets—if not better. The engines are good and well kept up. The entire line is to be

lighted with electricity in a few weeks, and everything that the expenditure of money and the employment of skill and brains can do is being done to make the road a model one of its kind.

*Chicago, Ill.* ALLEY L ENGINEER.

[The letter published last month about matters on the South Side Elevated Railroad of Chicago has brought upon us an avalanche of letters on both sides. We are glad to publish the above letter from one of the men running on the road giving his side of the story. We have not room for any more discussion of the subject as it is not of interest to the great mass of our readers.—EDS.]

### Conger's Three Brake Puzzles.

*Editors:*

Another puzzle for the air-brake men. The brake on a coach with quick-acting triple began sticking as we supposed, and failed to release promptly. After some days it would occasionally not release at all; when it did the air came out of exhaust-port very slow. Triple was taken down and examined at each end of the road, finally given up as a bad one, was taken off car, and I took it all to pieces finding the difficulty at once.

Another one.—A driver brake piston on one side of engine refused to work after it had worked all right for six months. The other side worked O K; the triple and all air pipes clear to driver brake cylinder were taken down and found to be O K, no blind joints. Brake piston did not stick in cylinder; put a lever on top of the cams and it worked down easy. Finally the cylinder head was taken off and trouble located at once; remedied with a cape chisel.

Still another question.—When the pressure retaining valve is cut in so it holds 15 pounds in brake cylinder after triple releases, what pressure is in the brake cylinder on a second emergency application with an auxiliary reservoir pressure of 70 pounds? The first time it is set full on how many pounds does the pressure equalize at? How much more brake cylinder pressure do we get the second time it is set with pressure retaining valve working?

C. B. CONGER.

### Why Would the Tank Triple not Work?

*Editors:*

The tank brake on one of our freight engines would not set from engineer's valve even when valve was placed in emergency position, but would set by opening stop-cock in train-pipe when connecting with train. Of course, the trouble was in the triple-valve, for after triple-valve was oiled and cleaned the brake worked all right. Will some one explain why brake would not work by reducing train-pipe pressure through engineer's valve, when by reducing pressure through stop-cock brake would set all right?

THOS. CRODEN.

*Los Angeles, Cal.*

### Setting Eccentrics on Old-Time Insiders Before Wheels were Put Under Engine.

*Editors:*

I was much pleased with the paper in your March edition by Mr. Fred. S. Hill as to proper methods and sure ways to lay out eccentric keyways on locomotive axles before the wheels are put under the engine, and giving his experience in the matter.

I consider bringing up these matters occasionally a good feature, as instructions for those who have not had experience in such matters, and probably may save them time and trouble.

I agree with Mr. Hill as to his doubts of there being a sure rule, and I also agree with Mr. A. A. Maver's remarks in the April edition, and if in order will, as in a revival meeting, give what experience I have had.

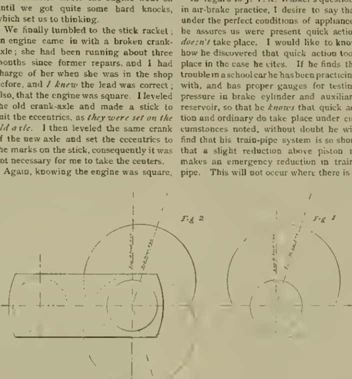
About 1858 the railway I was then working for—and with which I served my time—had principally crank axles, consequently the eccentrics were in two parts and were all keyed on. Of course we thought we were doing first rate if, after we set our valves, we marked the eccentric with a V-chisel, took all down, put our keys in and put the work up again.

Another point we lost in those days with inside connected engines, the two valves were in one steam chest, and we could not get to the back of the valve with the two valves in place. Consequently we had to set one side at a time, which gave double distance to move the engine.

We got out of this rut after a while by marking the stems with a tram and putting both valves in. But the keying of the eccentrics under the engine went on until we got quite some hard knocks, which set us to thinking.

We finally tumbled to the stick racket; an engine came in with a broken crank-axle; she had been running about three months since former repairs, and I had charge of her when she was in the shop before, and *I knew* the lead was correct; also, that the engine was square. I leveled the old crank-axle and made a stick to suit the eccentrics, as *they were set on the old axle*. I then leveled the same crank of the new axle and set the eccentrics to the marks on the stick, consequently it was not necessary for me to take the centers.

Again, knowing the engine was square,




it was not necessary for me to run the valves over. This gave me the points where the eccentrics should be for that class of engine. I did not rest here. I made a stick for every class as they came in the shop and compared notes, and so got this part of it down fine. I finally got onto another racket, something similar to one mentioned by Mr. Hill (understand, though, that I had to get my information from "my sticks" to accomplish this; also, that they were direct-acting engines). When the eccentrics were off the axle, I struck a line showing full throw of eccentric. I then found lap and lead line, as we will call it—see Fig. 1. I would then level the left crank with crank back and put the eccentrics on as shown in Fig. 2, by fastening a straight-edge to lap and lead line and using a plumb level. I then put my sticks under and checked it, and if they corresponded I was done with my stick for that class of engine.

But I soon found out that I could not set them all in this manner where some would be plumb others would have forward eccentric plumb and back ones not quite so, as stated by Mr. Maver. Others would have both forward and back eccentric out of plumb, but having gone so far I was not going to be beaten. I got a level similar to Fig. 3, with an index on the bottom, and I would make a note of where the movable bar had to be placed for those class of engines that needed its being moved.

By using this level I could set all four eccentrics by leaving the axle in the one position, using the side of the level in one case and the bottom in the other.

After I had tested this matter to my satisfaction and had confidence in it, I never took the centers on an engine, merely pinching it around both ways and adjust the rods so that the ports would open all alike, keeping the reverse lever in notch used in running the train.

This saved considerable time. I was afterwards foreman of the shop, and used the same tactics until I left, in 1868. Since then I have not been where the eccentrics are keyed.

This is how I came to the conclusion that there is no sure rule for finding the exact spot to place eccentrics, and this is the way I varied it to get results. D. B.

*Scranton, Pa.*

### Walker's Questions on Brake Behavior.

*Editors:*

In regard to J. V. K. Walker's questions in air-brake practice, I desire to say that under the perfect conditions of appliances he assures us were present quick action *doesn't* take place. I would like to know how he discovered that quick action took place in the case he cites. If he finds the trouble in a school car he has been practicing with, and has proper gauges for testing pressure in brake cylinder and auxiliary reservoir, so that he *knows* that quick action and ordinary do take place under circumstances noted, without doubt he will find that his train-pipe system is so short that a slight reduction above piston 17 makes an emergency reduction in train-pipe. This will not occur where there is a large capacity train-pipe, and his school car can be corrected by connecting a proper reservoir in with train-pipe, which would be equivalent to a long train capacity. Try it and let us know how it works.

Replying to his second question, would say that the proportion between auxiliary and brake cylinders on engine and on the cars was not the same, so that when air equalized between the cylinders mentioned, there was ten pounds higher pressure in engine cylinders than in cars. Of course a higher pressure was required to release. A smaller auxiliary under tender would correct this. Too short a piston travel with similar reservoirs would act as described, but in a small degree.

*St. Albans, Vt.* PHOSPHIC.

*Editors:*

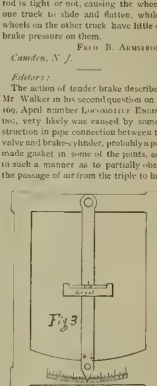
In answer to J. V. K. Walker's question, "What causes quick action to take place in service application of brakes?" my answer is: The preliminary exhaust port in the brake valve seat had been reamed out or enlarged in some way; it is a common complaint among engineers that the brakes work too slow and the reaming out of the exhaust port is resorted to, causing a more rapid discharge of air, which makes the triple valves work quicker. This is one thing that will cause a quick application of the brakes. In answer to the second question, "What made the brakes stick on a tender after they had released on a train of five cars?" I think that pistons on cars had so much more travel than the tender brake piston that the air from auxiliary reservoirs on the cars expanded a great deal more, making it weaker. If this was the case it would take that much less air to raise triple valve pistons on the cars, and the brakes would of course release that much easier. Engineer or some one might have just put new shoes on tender and not adjusted the brakes afterwards. In some places where an old man (or some young man either) is employed to go around and tighten up nuts on tender, put shoes on tender, or wheel out scrap iron or work of that sort, it too often happens that they know nothing about adjusting brakes, and the brakes will be right tight on one tender truck and loose on the other. This is a great mistake, particularly where there is no wedge or floating lever. If the push rod is connected to a cylinder lever that swings on the center, on a bracket, each end swings or travels same distance, and when one pull rod is tight the cylinder lever stops traveling no matter whether the other pull rod is tight or not, causing the wheels of one truck to slide and flatten, while the wheels on the other truck have little or no brake pressure on them.

FRED B. ARMSTRONG.

*Camden, N. J.*

*Editors:*

The action of tender brake described by Mr. Walker in his second question on page 169, April number LOCOMOTIVE ENGINEERING, very likely was caused by some obstruction in pipe connection between triple valve and brake-cylinder, probably a poorly made gasket in some of the joints, acting in such a manner as to partially obstruct the passage of air from the triple to brake-




cylinder, but offering little or no resistance to the air passing from brake-cylinder to the triple valve. MARK PURCELL.

*East Grand Forks, Minn.*

*Editors:*

In answer to J. V. K. Walker's first question, on page 169, April number, would say that the connection between chamber D in engineer's brake and equalizing discharge valve, and small equalizing reservoir was wholly or partially obstructed, thereby greatly reducing the volume of air above piston 17, so that when an attempt was made to make a service application of the brakes the reduction of the pressure in chamber D was so rapid on account of the reduced volume that an emergency application was made instead of a service application, as was intended.

MARK PURCELL.

*East Grand Forks, Minn.*

THE ANSWER.

*Editors:*

The answers are as follows:

1. On close examination a defect was found in the body of the triple; it was a sand-hole that communicated supply part R with emergency part I. It can now be very readily seen that during a service application air expanding from the auxiliary reservoir to brake-cylinder would at the same time pass through the sand-hole on top of emergency piston "8," which would bring in quick action.

2. The reservoir under tender was too large—12 x 30-inch—which, used with an 8-inch brake-cylinder, would equalize much

sooner than with a 10-inch cylinder, such as was under the cars. The tender having the same size reservoir but smaller cylinder would equalize with a much less reduction than 20 pounds, as it took 20 pounds to equalize the pressure under cars to 10 pounds. To equalize it under tender it can plainly be seen why the brakes under cars came off first.

J. V. K. WALKER.

*Portsmouth, Va.*

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### Those Things that Relyea Wants to Know.

*Editors:*

Replying to Mr. Relyea's question in April LOCOMOTIVE ENGINEERING, permit me to say that the reason he had to carry brake-valve handle past running position in order to secure excess pressure, would appear to me to be on account of the handle not being properly screwed down upon its arbor, lacking almost an entire turn, which brought rotary valve into correct position for securing excess only by carrying handle past position.

Answering the second conundrum, I should say there was an almost entire stoppage of the passage from the chamber D above piston 17 to brake-valve reservoir, so that all pressure was exhausted from that portion of the pipe where gauge took its pressure, until, when placed on lap, pressure leaked through from small reservoir and equalized with gauge.

PHONETIC.

*St. Albans, Vt.*

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THE ANSWER.

*Editors:*

In answering my article in your April number, I will say in regard to excess pressure, that there was lost motion enough in handle and in slot in rotary valve to prevent opening port to feed valve when the handle was placed in running notch, besides the handle spring was bent by throwing handle in release notch so hard as to bend the end of the spring, which made it strike the running notch before it ought to.

The action of black pointer when making a slight reduction of pressure was caused by a blind rubber gasket having been put in coupling 23 of pipe leading to small reservoir. There was a hole in the gasket which seemed to have been made by pressure, and in such shape as to prevent free passage of air between small reservoir and chamber D of engineer's valve. The hole in the gasket might have been made by simply running the point of a knife blade through it, probably the person who put the gasket in thought that was hole enough.

W. F. RELYEA.

*Syracuse, N. Y.*

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### Hamar's Questions.

*Editors:*

W. T. Hamar, R. F. E., Atlanta, Ga., asks why quick-action freight triple-valve has a threaded exhaust port on each side of triple valve casing, while that of passenger has only one. By putting a plug in one side and attaching pipe to the other side to run to pressure retaining valve, as is often done, we are enabled to place them under the cars to a better advantage, being able to put them on either side of the car and run the pipe either inside or outside.

His second question, in regard to pipe being larger on freight cars—the branch pipes that connect to triple valves are the same, one inch. But as the freight trains are as a general thing longer than passenger trains, and so many more auxiliary reservoirs to supply, it is only natural that the main train pipe should be larger, to allow more air to pass through the train in the same time.

The third question, the reason that black hand on gauge runs back until the handle spring passes service notch is because while the handle is going over this distance or space air is escaping through preliminary exhaust port out of the valve-chamber above the piston 17, and the black hand is connected to this chamber and equalizing reservoir, and when handle is put at emergency notch exhaust port from chamber is blanked or on lap holding remainder of air in chamber and equalizing reservoir, and letting air out of train pipe through emergency exhaust port, or what is called direct application and exhaust port K, and direct application and supply port L.

F. B. ARMSTRONG.

*Camden, N. J.*

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### That Governor Trouble.

*Editors:*

In reply to L. G., page 183, I would suggest that the diaphragm valve of the governor is too short to reach the seat, thus admitting air to air-piston at all pressures and shutting off pump as soon as air pressure is sufficient to overcome steam pressure. It may probably be remedied by filing about $\frac{1}{16}$ inch off the top of the nut that holds the diaphragm valve in place and putting a liner of same thickness on top of valve, or by using a slightly longer valve.

In the latest Westinghouse governors the diaphragm is much more flexible, and the adjustment of length of valve is less minute.

BEN JOHNSON.

*Kansas City, Mo.*

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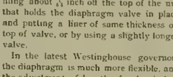
### What is Wrong With This Tester?

*Editors:*

Having to test a number of hydraulic gauges at different times for the system, we have always kept a gauge for test gauge. Having had it in use for some time,




I wanted to see if *it* was correct. I send you a sketch of apparatus we made for the purpose and want to know what is wrong with it. The plunger is exactly ¼ of a square inch in diameter (.565 inch). I put a cap leather on end to keep the glycerine from working out. You see the weight ought to represent twenty-four times on the gauge plus the weight of the frame (which we found by a steam gauge that was correct). By testing the weights with the lever on a platform scales (which was correct) I find I must multiply the weight by 30.

E. S. GRESSEL.

*Havelock, Neb.*

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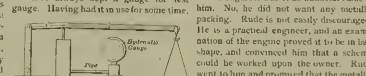
### That Improved (?) Brake Gear.

*Editors:*

In your April number you illustrate an improved brake-gear. In studying the mechanism I infer from the illustration that the live and dead levers *E F G H*




(referring to my pencil sketch) are equal to each other. If so, we will assume that we have a power or strain of 2,000 pounds at the end *A* of cylinder lever. In this case we will also have 2,000 pounds strain on rod *B*. Therefore we will necessarily have a strain of 4,000 pounds on shive *D* or on rod *C*. Hence we will do again as much braking on the truck to the left as we do on the opposite end of the car.

J. C. MILLER,
Gen'l Foreman C., M. & St. P. Shops.

*Dubuque, Ia.*

---

### Metallic Rod Packing Makes a Fine Record.

Metallic rod packing is a great improvement to a locomotive or to any other kind of engine, and the day is not far distant when a builder of engines will no more think of leaving stuffing boxes to be filled with hemp than he would leave off the piston rings and tell the owner to use hemp packing for that part. The day of hemp packing for pistons expired nearly a century ago, the day for fibrous packing for rods passed when the first successful metallic packing was brought into use. The railroads that still cling to hemp pay dear for an inferior material, entail upon their men a vast amount of unnecessary labor, wear out rods prematurely, increasing the cost of repairs, and they incur delays on the road through the fibrous packing giving out between terminals.

These are all points in favor of metallic packing that nearly all practical men will admit to be well founded. When an agent for metallic packing comes along and claims a saving of 10 per cent. in fuel on account of the metallic packing he handles being used, most men who understand much about engines are inclined to sneer, or even use profane protests. Yet there is a man on the road who made this claim and appeared to substantiate it. Not on a locomotive, however.

Our friend, whom we will call Rude, because he is superlatively polished, is agent for metallic rod packing. In the pursuit of his calling he asked the owner of a river steamer to apply the packing to his engines. The owner did not want anything that would cost money, and the saving of labor for his engineer was of no financial value to him. No, he did not want any metallic packing. Rude is not easily discouraged. He is a practical engineer, and an examination of the engine proved it to be in bad shape, and convinced him that a scheme could be worked upon the owner. Rude went to him and promised that the metallic packing would improve the engine so much that she would make ten more turns. If she did not he would ask for no pay for the packing. This was something tangible for the owner, and he agreed, although Rude had put a fabulous price upon his packing, and required the owner to make some repairs that he was willing to overlook. The cylinder was badly out of round and the valve was leaking badly. The cylinder had been in such bad shape that they were in the habit of jamming the piston packing so tight that the engine would not move till the boiler had 25 pounds of steam. After the valve had been faced, the cylinder bored and the new packing put in, Rude was ready for a trial. As soon as the boiler had 10 pounds of steam, Rude called out to start her, and, to the surprise of everybody, the engine went to work. She easily made the ten extra turns. The owner was astonished, but pleased, and he is still talking of the wonderful increase of power and decrease of fuel due to the metallic rod packing.

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### Crown Bar Boiler.

"The crown bar boiler," remarked Mr. W. F. Dixon, "has long and deservedly enjoyed a wide popularity, and when a boiler is small, the pressure comparatively low, say 140 lbs. per square inch, and the water tolerably good, there is probably no better method of staying a crown sheet extant.

"When bad water has to be used—water that is rich in impurities that are precipitated freely—then the difficulty experienced in keeping the crown free from sediment is much increased by the obstruction that the crown bars offer. This trouble is appreciated in regions where bad water prevails, and on that account alone many roads have abandoned the crown bar in favor of the radial stay. When we come to large boilers having wide crown sheets and carrying high pressures, then the crown bar is insufficient to carry the load without the assistance of a large number of sling stays. When putting in the slings it is well nigh, or I may even say quite, impossible to so hang them that each individual one shall have its own proper quota of load no more and no less. When the boiler is under steam some will get an excessive strain while others will be almost inoperative, and the trouble of it is that you cannot tell anything definite about it; there is nothing positive except the continual presence of the unpleasant element of uncertainty, and if the crown sheet should ever start to come down, all the sling stays that could be got into a boiler will not hold it—down it will come. For this reason I consider crown staying the most unsafe of any when, as I have just stated, the boiler is large and the pressure high."

The radial stay system has come into quite general use of late, more especially since the advent of the extended wagon top boiler, and it has much to recommend it, at first there was and still is for that matter, considerable apprehension felt as to its security owing to the angle at which many of the stays must necessarily pass through the sheets, some stays being so pitched that but one full thread could be obtained in the sheet, and although on the face of it this certainly looks like a weak point, yet when the work is carefully and honestly done there appears to be no ground for alarm on this score, as many boilers so built have been in successful operation for years, in fact, we have yet to hear of a single instance of this style of staying giving out under ordinarily fair conditions. The general construction of this type of boiler is so well known as to require no special attention, except that the center six or more rows of stays down the length of the firebox should be fitted with button heads under the crown sheet, so that in the event of low water and a hot sheet the stays will prevent the crown from dropping as readily as it would were there nothing but the screw threads and riveted over-heads to hold it.

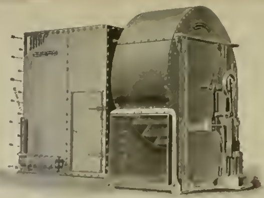
---

### Water Circulators.

Several railroad companies in New England have applied the Mack water circulators to a number of their locomotives and very favorable reports are made about the effects of the change. The circulator consists of a pipe arrangement which connects the front water leg of the firebox with the front part of the boiler. The cold water that stands without circulation in the water leg of ordinary locomotives is by Mack's device carried upwards to the hotter regions of the boiler and a constant circulation thereby induced.

Attachments for inducing circulation in locomotive boilers have been often tried, and they have always effected a saving of fuel. Some years ago Mr. Lewis James, master mechanic of the Wheeling & Lake Erie, experimented considerably with a water circulator. His device consisted of a water leg which extended from the crown sheet to a point slightly below the lower row of flues. There were two openings through the crown sheet, one at each side. One of the openings had a funnel-shaped pipe extending about a foot over the flues.

The practical effect of applying this circulator was that the engine steamed much more freely, and it broke up the scale that had previously been in the boiler. Why this form of circulator was abandoned we have never learned. There is difficulty in keeping a supplementary water leg tight, and it is a troublesome thing to have in a firebox. These drawbacks may have proved fatal to the use of the water circulator.



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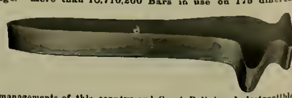

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## Freight and Passenger Triple Valves.

BY PAUL SYNNESTVEDT

Permit me to make a few comments in relation to the difference between the freight and passenger triple valves. I confess I was a little surprised, not to say gratified, to find in the replies given, nearly all the points I had found myself after most careful investigation. I say surprised, because I had put the question to a great many different well-instructed air-brake men, and had never before received anything like a satisfactory answer. Many thought and stated positively that the only difference was in the size of the feed groove.

Of Mr. Nypano I would seek further light, as I confess I do not understand his answer at all. I was not aware that the difference would cause any difficulty in getting the check-valve to close properly, nor was I aware that there was any check-valve between the auxiliary reservoir and the brake cylinder. If he will explain himself further I shall be much obliged, as he evidently has something on his mind which is entirely new to me, and my curiosity is always excited when I scent anything novel. I may say, for the information of your readers in general, that at one time I did considerable experimenting on a pretty good quick-action brake, which seemed to set all right without any check-valve at all between the cylinder and train-pipe, though of course it leaked off when the train-pipe pressure was very greatly reduced, as when the train broke in two.

The statement made by one of the writers, that, "On some roads they take out the emergency valve piston No. 8, and put a small brass bushing in its place," verifies some information to the same effect that I had received some time ago, and I guess this is as good a chance as any to lift my voice in protest against a practice not only dangerous but positively criminal, unless ignorance be offered as the excuse.

I am not unaware of the damage that often results from too frequent use of the emergency feature of the air-brake, especially on long freight trains only partially equipped, but I do not agree that to entirely dispense with this valuable improvement is the way to remedy the difficulty.

The exhaustive tests made at Burlington in 1886 and 1887, on a fifty-car train, showed conclusively that no brake except an emergency brake was fit to use on long freight trains, because of the tremendous jar on the rear cars when the slack ran in before the brake was applied.

This shock in some cases was so great as to seriously injure both the cars and their contents, to say nothing of the hardy investigators who were riding in them, and who, I have often thought, deserve much credit for their courage and perseverance.

Besides this, there is of course the all-important fact, that on a long train there is a gain in time of application in cases of emergency of several seconds in favor of the quick-action brake, and this frequently represents the prevention of a serious collision, and the saving of valuable property, as well as lives and limbs.

No one is really capable of fully realizing the importance of a saving of one second, except he who has had the experience of riding on the locomotive of a fast train, or perhaps being slightly shaken up in one or two wrecks.

The emergency brake is a good thing, and I can only say in concluding these remarks, that it is a great pity that there seems to be a number of people still living who do not know a good thing when they see it.

There is one big improvement the Chicago "L" has over the New York and Brooklyn up-stairs routes—the cars are gas-lighted. You can actually read in them on a dark night.

## Something New in Slide-Valves.

Henry R. Fay, an ingenious locomotive engineer on the Boston & Albany road, has recently invented and patented an improvement on slide-valves, and the device has been put on several engines on the above-mentioned road.

Mr. Fay's device consists simply of four drilled holes from the valve-seat, at the ends of the bridges, as shown in Figs. 1, 2 and 4, and four small cavities in the face of the valve, as shown in Fig. 3.

The object of the invention is to reduce the compression, and the inventor claims especial merit for it in an ordinary two-cylinder compound.

The amount of compression gotten rid of by this device is determined by the location of the ports and the design of the valve.

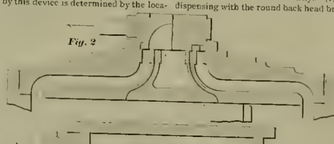


Fig. 2

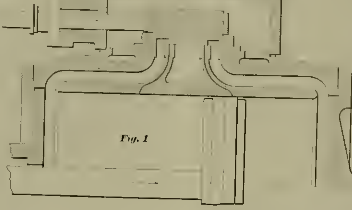


Fig. 1

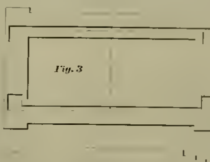


Fig. 3

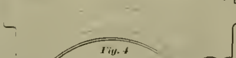


Fig. 4

The inventor believes that at high speeds, where links are hooked up close and compression is excessive, this device will very materially increase the efficiency of the engine and augment the speed.

As can be seen in Fig. 1, the piston is just passing this auxiliary port and compression is beginning to take place, but once the piston passes this hole in the cylinder the steam confined in the forward end of the cylinder can escape from the port through the extra ports in the valve and the holes to the cylinder back of the piston, as shown in Fig. 2.

As will be discovered by examination of the drawings, steam cannot enter these ports when the engine is at work.

Those in use have not yet had time to demonstrate their value, but it is said that these engines drift down-hill very freely.

## Belpaire Boilers.

In his paper on Locomotive Boiler Construction read at the New York Railroad Club Mr. W. F. Dixon said: "Within the last three or four years the Belpaire type of boiler, first introduced by and taking the name of M. Belpaire, at one time at the head of the motive power department of the Belgian state railways, has come into extended use in this country. I may say here that 68% of the entire output of the Rogers Locomotive Works for the last two years have had boilers of this type. When properly designed and well constructed this style probably presents the best solution of the problem of crown staying yet brought forward. The crown-sheet is comparatively unobstructed, and may readily be kept clear of sediment. The staying is positive, all the stays having good bearings in and on the sheets. All the strains may be accurately calculated and provided for, and all the stays may if desired be made of one length, an advantage that is appreciable.

"The two main objections that have been raised against it are the difficulty of keeping the crown-stays tight in the neighborhood of the ends of the braces running from the back head to the top of the firebox shell owing to the constant downward pull of these braces. This trouble may be overcome in several ways: (1) By dispensing with the round back head braces and substituting in their places gussets or plate-braces attached to the roof-sheet by long angle-irons, thus distributing the strain over a large area and preventing its localization, (2) by running the braces forward to the waist of the boiler, a plan which is in many cases impossible owing to their number, (3) by running the braces clear forward and attaching them to the front flue-sheet, a plan I would not recommend owing to the difficulty in keeping the ends tight, the incessant vibration tending to cause leaks, (4) by riveting heavy angle-irons crosswise of the roof-sheet as close as possible to where the brace ends take hold, thereby stiffening the sheet and preventing it 'giving.'

"The second objection to this type of boiler is the difficulty experienced in some quarters of keeping the top corners of the throat of Belpaire sheet tight where they join the shell. These corners have been a thorn in the side of the mechanical department of more than one road. The trouble in the majority of cases appears to be caused by not allowing the flue-sheet sufficient room in which to expand vertically. After a boiler is fired up, the fire-box, being at a higher temperature than the shell surrounding it, expands more. The two are rigidly connected together at the bottom by the mud-ring, so that the only direction in which the firebox sheets can expand is upwards, the result being that the crown-sheet is slightly higher above the center line of the boiler when it is hot than when it is cold. As the flue-sheet is more rigid in an up and down direction, owing to its flat shape, than the side sheets, which are more or less arched or curved, it seems plausible to suppose that a greater strain is brought to bear on the crown-stays in closest proximity to it than on those further back.

"If the first row of crown-stays is close up, the flange uniting the flue and crown-sheets say 1½ or 2 inches from the edge of the flange to the center of the stays, the crown is hardly able to give at all, and the stays are carried up the amount the flue-sheet expands. This of course tends to distort the top of the shell at a point close to where it is riveted to the waist of the boiler. The constant moving up and down which takes place every time the boiler is cooled off, and, indeed, whenever the fire-door is opened, permitting a current of cold air to strike the flue-sheet, causes the seam to work or loosen and allow more or less serious leakage to occur. If, however, the first row of crown-stays is kept well back from the flue-sheet, say five inches from the edge of the flange to the center of the stays, the intervening portion of the crown, while amply strong to withstand the steam pressure, has a chance to bend or give slightly, with the result that the upward thrust on the stays and the consequent distortion of the shell are lessened. If, in addition to throwing the centers of the stays back, a heavy bar-iron brace running crosswise of the shell-top and well down the sides is riveted on just back of the throat or Belpaire sheet seam, the trouble with leaky top corners can be reduced to practically nothing. There is another advantage in throwing the first row of crown stays back from the flue-sheet as far as is consistent with absolute safety, which is that the expansion strains in the flue-sheet itself are lessened, and the chance of cracking the sheet between the flue holes is reduced. On some of the English roads I saw radial boilers in which the two first rows of crown-stays did not go through the top of the sheet at all, but were connected to wrought-iron or possibly cast-steel crossheads, which were in turn pinned to a piece of T-iron riveted to the shell. This arrangement apparently worked well and gave satisfaction, but has the disadvantage of being pretty expensive."

The cars on the elevated road in Chicago are the same size as those on the New York "L," but they have double sliding doors. These affairs stick, won't lock, and require constant tinkering, they have caused more annoyance than all the other ills the cars have been afflicted with. These double doors were going to cause a quick handling of the crowds, but the platforms and gates being the old size there was found to be a congestion just at the gates. It was an improvement (?) of that kind that puts a 24-inch port in a steam chest and 3-inch nozzle at the end of the passage.

Last summer the junior philosopher asked a Scotch engine driver if the company employed any "body-snatchers." He did not just know what "body-snatchers" were until it was explained that they were extra men who were sent to engines ordered out, to take them in case the regular man did not show up the required number of minutes before leaving time. "We dinna ha' the like," said he, "but we ha' the excise man." Then the j. p. was stuck. "Breath testers, mon," he explained, "them as see wha has gang adrift wi' John Barleycorn and lost the abeelity to gang awa' wi' their trains."

## Laying Out Shoes and Wedges.

BY C. K. W.

In laying out the shoes and wedges on a locomotive engine, the principle to be kept in view is, to have the centers of the driving-axles equal distances from each other, the centers on each axle at right angles to the rails, so the flanges will not "cut" or wear sharp, and the face of each shoe and wedge parallel with each other, and also parallel with the other shoes and wedges on that side.

Before laying out the shoes and wedges, the pedestal jaws and inside of each shoe and wedge should be filed true, so when the shoes and wedges are put in place they will be solid, no "rock" in them. The pedestal-braces or binders should be fitted to pedestals so there will be no lost motion when up to place.

When the shoes and wedges are put up, the shoe should be of such a length that it cannot move up or down, or be held to pedestal jaw by a bolt through pedestal, and the head of bolt should be on outside of pedestal, so if at any time after the wheels are put under the engine the shoe can be taken down to put a liner behind it by taking the bolt out. The wedges should be down about ¼-inch from top of binder. Block the shoes and wedges in this position by putting a bolt between them, as shown in Fig. 1.

Get the center of the frames on back cylinder-saddle as shown at *A*, Fig. 1, then with a tram that has one end pointed and on the other end a sliding point, put the straight point at *A*, and with the sliding point make a line at *B* and *C*, Fig. 1, the centers between the pedestals; make a line lengthwise of the frames, and the same distance from the top on both sides make a small center punch-mark where these two lines bisect; these points are on inside of frames, and should be carried to outside of frames by putting a "square" on top of frame and extending points *B* and *C* to top and over the top and down on outside, make another line lengthwise on the outside of frame equal distance from the top; make a small center punch-mark where these two lines bisect.

To make this one drawing answer our purpose, we will suppose the points *B* and *C* are now on outside of frames. Mark off the width of the driving-boxes between shoe and wedge from the points *B* and *C*, then put liners between shoes and wedges and pedestals until the distance between the shoe and wedge on each side is enough less than the width of driving-box so they can be planed. It is best to use as few liners as possible; make them as thick as can be used. From the points *B* and *C* make the lines *D E* on left side and *F K* on right side, the distance between these lines on each side to be 2 inches larger than the width of the driving-boxes. Put a surface-plate or two parallel blocks on top of frames, and with a "square" placed against surface-plate, draw the lines *D I* and *E H* on left side and *F J* and *K G* on right side; make a small center punch-mark on these lines near the top and bottom on each shoe and wedge.

Put a straight-edge across the frames between the shoes and wedges, let it rest on the bolts that are holding shoes and wedges in place, set it so the edge will be the same distance from lines *E H* and *K G*, then make a line on inside of each shoe as shown at *M* and *L*, this line to be same distance from straight-edge on inside as the lines *E H* and *K G* are on outside; mark the inside of each wedge the same way, having the points *O* and *P* same distance from straight-edge as the lines *D I* and *F J* are; make a small center punch-mark at each one of these points, *L M* and *O P*. These points are to be on inside of each shoe and wedge.

Before laying out the back-shoes and wedges, get the length of the side-rods. If solid side-rods are used, great care must be exercised in laying out the back-shoes and wedges, so the distance between centers of driving boxes on each side will be the same as length of side-rods.

With a tram set to the length of side-rods from the points *B* and *C*, make the lines *B1* and *C1*, make a line lengthwise of the frame on each side, and same distance from the top; make a small center-punch mark where these lines bisect same as at front end; from these points mark off the width of driving-boxes and put liners between shoe and wedge and pedestal, until the distance between the shoe and wedge is enough less than the width of driving-boxes so they can be planed. With the tram set to the length of side-rods, put one point at *D* and make the mark *N*, and from *E* to *R*, from *I* to *U*, and *H* to *V* on left side; and from *F* to *W*, from *K* to *X*, from *J* to *S*, and from *G* to *T* on right side. It is a good idea to try these points to see if they are correct by measuring from *N* to *R* and *V* to *U* on left side, and from *W* to *X* and *S* to *T* on right side; if they are the same as on front shoes and wedges, they are correct. The points for inside shoe and wedge can be gotten the same as in front by putting a straight edge across the frames between shoes and wedges.

Make a small center punch-mark same as done on the front shoes and wedges. If a ten-wheeler or consolidation engine, lay out all the shoes and wedges, measuring from the front or main shoes and wedges to the others.

In case the back driving-boxes are different width than front ones, lay out the points *B1* and *C1*; then from these points lay out width of driving-boxes, and 2 inches more, as shown at *N1* and *R1* on left side, and *W1* and *X1* on right side, then set tram from *D* to *N1*, using this length, carry the points from front shoes and wedges back to back shoes and wedges, same as when driving-boxes were same width as front ones.

The shoes and wedges are now ready to be planed and can be set to the center punch-marks on the sides. In planing take off enough, so it will measure 1 inch from the center punch-mark to the face of the shoe or wedge. The reason that each shoe and wedge is laid out 1 inch from face is, after they are planed, they should be put up to place and tried; if out, the points are there to tell if they were planed wrong or laid out wrong.

A handy gauge for measuring from face of shoe or wedge, is made out of a piece of ¾-inch square steel, planed true, and with a sliding steel point, held by a thumb-screw in end, as shown in Fig. 2. As all sizes are given it can be easily made, and be found useful in a great many cases.

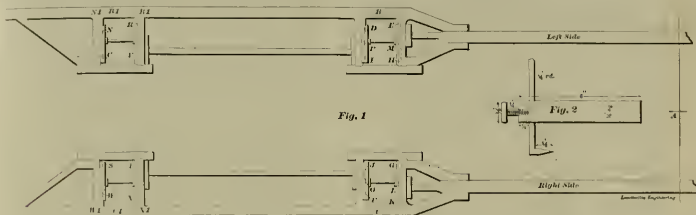


Fig. 1
Fig. 2

## Weight on Engine-Truck Due to Form of Boiler.

There is one objection to the Belpaire boiler, and indeed any straight boiler, apart from any question of boiler-making, to be found more especially in the case of eight and ten-wheeled engines, and that is the unduly large percentage of the total weight of the whole machine that is thrown on the leading truck.

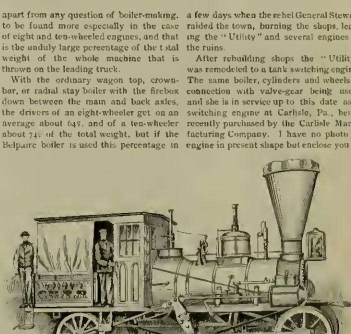
With the ordinary wagon top, crown-bar, or radial stay boiler with the firebox down between the main and back axles, the drivers of an eight-wheeler get on an average about 64%, and of a ten-wheeler about 74% of the total weight, but if the Belpaire boiler is used this percentage in the case of the former sinks to about 61 and in the latter about 68. The reason of this is that with the wagon top boiler a sufficiently large space can be obtained for steam room over the crown-sheet, while keeping the waist of the boiler tolerably small in diameter, but the Belpaire, being straight on top in the great majority of cases, that is to say, without any rise at the back end, the waist must be increased at least four inches in diameter in order to obtain the necessary steam room. The larger the waist the larger the smoke-box and front must be, the branch and exhaust pipes must be longer and heavier and altogether the weight of the front part of the boiler, which comes directly on the truck, is materially increased.

## History of the "Utility."

BY C. S. HULL.

The locomotive "Utility" you refer to in LOCOMOTIVE ENGINEERING of March, 1893, was built by Seth Wilmarth, Boston, Mass., for Cumberland Valley R. R., in the year 1854, and was in use at Harrisburg and Bridgeport, Pa., as a switching engine until 1862 when in a collision she was wrecked. At the time of collision engine was drawing a train of wounded soldiers from battlefield of Antietam on their way to hospitals, when she collided with a Northern Central R. R. engine, badly breaking frame and front end. Engine was taken to company's shops at Chambersburg, Pa., and was only in shops a few days when the rebel General Stewart raided the town, burning the shops, leaving the "Utility" and several engines in the ruins.

After rebuilding shops the "Utility" was remodeled to a tank switching engine. The same boiler, cylinders and wheels in connection with valve-gear being used, and she is in service up to this date as a switching engine at Carlisle, Pa., being recently purchased by the Carlisle Manufacturing Company. I have no photo of engine in present shape but enclose you an old photo of the engine as she was from 1852 to 1862.


THE "UTILITY," AS SHE APPEARED IN 1862.

Those men who worship at the shrine of the "good old times" in railroading, who think the world would be better off and engineers twice as happy as now if we had the old engines of the 40's, will have a chance to compare the ancient mills with the modern ones at the Fair. There will be found a vast difference between the average locomotive of thirty years ago and that of to-day—mostly in size and attachments.

Has any of our readers got a picture of the famous old-time engine "Carroll of Carrollton"?

# Car Shops and Car Builders.

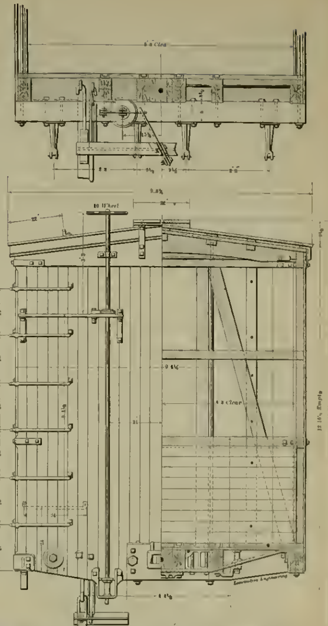
### Southern Pacific Furniture Car.

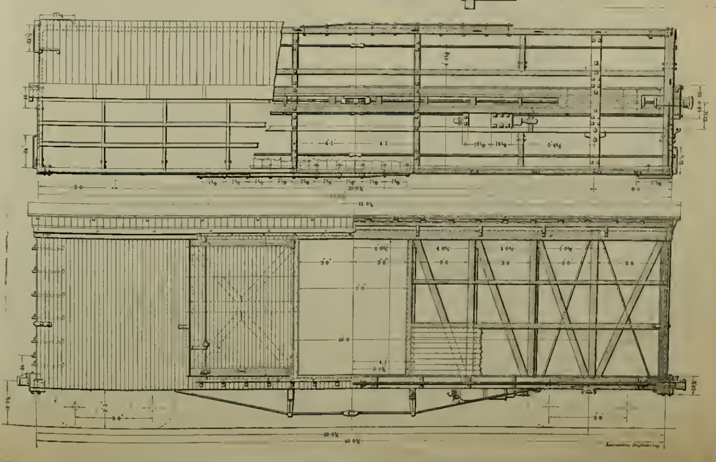
The annexed engravings illustrate a very fine form of furniture car designed and built by the Southern Pacific people at the company's shops at Sacramento, Cal. The cars are very commodious, and the design and wormanship are so good that they stand up remarkably well and bear the heavy shocks of mountain roads without signs of distress, notwithstanding their great length. The framing, as may be seen from an inspection of the cuts, is unusually strong, the plates, posts, braces, etc., being heavier than usual. The distance between posts is 42 inches, they are 2½ x 5 inches, and the diagonals are of the same size. This is stiffened by two heavy girths and rods. The end posts are 5 x 5 inches. Native timber has been used throughout for the building of the cars, California red-wood entering largely in the material. A few of the principal dimensions are: Length, clear inside, 40 feet, outside length, 40 feet 6¾ inches; height from sill to plate, 8 feet 11 inches; width inside, 8 feet 4¾ inches, and over sills, 9 feet 2¾ inches. The cars are equipped with the Westinghouse quick acting brake, steel brake beams, continuous drawbar and iron transoms. The capacity of these cars is 60,000 pounds.

### Dead-Blocks for Cars.

At a meeting of one of the Railroad Clubs a curious statement was made by one of the members to the effect that his company have two lawsuits against them, one for an accident that happened to a car that had no dead-blocks, the other for an accident alleged to have been due to dead-blocks at the end of the car. This is not by any means a rare case. There is so much diversity of opinion between railroad men and others, respecting the utility of dead-blocks, that it is not surprising that lawsuits should arise, alleging danger both from the use and from the absence of this attachment. When all sorts of light draw-bars were employed that were inadequate to sustain the blow of cars coming together violently, there was good excuse for using dead-blocks that would maintain an opening between the cars for the protection of life and limb. Although protection to life and limb was the ostensible object of dead-blocks, in many instances they proved a greater source of injury than of safety. In fact, the vertical form of double dead-block, used so much on Eastern lines, was known popularly in the West as man-killers. This grim term described exactly the action of this form of dead-block upon switchmen who were not skillful in escaping the dangers of the arrangement which seems designed to prevent coupling by hand.

When the M. C. B standard draw-bar was adopted an important advantage expected from the employment of the vertical plane type was that it would dispense with the necessity for dead-blocks. Certain superintendents of machinery appear to have changed their minds on this subject, for the discussions in railroad men's meetings seemed to indicate an attempt to establish some new form of dead-block adapted to the new form of coupling. It appears to us that this proposal is calling for an expensive superfluity. The form of the coupler is such that dead-blocks cannot be employed that will protect it from a severe blow without being dangerous in rounding sharp curves. The use of the Standard coupler obviates the necessity of switchmen going between the cars when coupling, so that dead-blocks are not a necessity for their protection or safety. It is argued that dead-blocks are a necessity during the transition period. If railroad men would agree to apply uniform style of dead-block there might be increased safety from their use when a common draw-head comes against a Standard coupler and fails; but with diverse forms of dead-blocks the danger to men coupling would be even greater than it is without any. Very few practical men will question the truth of this. It would then, we think, be very unwise for the railroad men of the country to go to the expense of applying diverse forms





a dead-blocks for a temporary purpose The subject is likely to come up at the next M. C. B. convention There are indications that some of the members will make a struggle to introduce dead-blocks as a connection of the Standard coupler. Men who have given this subject a great deal of thought, consider that nothing will be lost by letting the subject stand for another year

## A Sensible Continuous Draft-Gear.

The engravings shown herewith represent an improvement in draft-gear, the invention of Mr Geo Dole Wadley, general superintendent of the Central Railroad and Banking Co. of Georgia.

This form of continuous bar prevents the falling of the draw-bar on track when bolt breaks—the accidents from this cause have been worse since the introduction of vertical plane couplers; they are larger than the link-and-pin draw-bar

The greatest improvement consists in putting a taper section six inches long from the head to rod. This prevents the draw-bar from coming off, even should the head break off.

The two sections of the continuous bar meet in the center of the car, and are adjusted by a turn-buckle, a cotter prevents the turn-buckle from slacking off, while by removing it the slack can be taken up and the bar kept close up to the buffing plate.

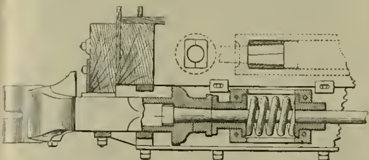
This does away with keys and nuts and the trouble from their maintenance.

Where applied to old draw-bars a sleeve with a taper hole is dropped into the draw-bar to take the taper fit of the bolt.

The illustration shows it with the Butler attachment, but it can be applied to any car with any attachment.

More than 2,000 cars with this draw-bar have been running for the past eight months without a single failure, this has encouraged the designer to form acompany and put themon the market.

The Wadley Continuous Draw-bar Co., with an office at 912 Havemeyer building, New York, and headquarters at Savannah, Ga., will push the sale of this device



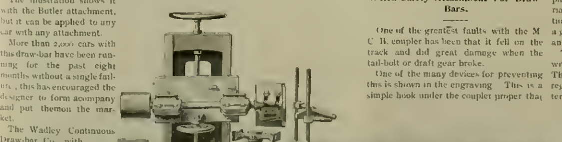
## The M. C. B. Car Coupler.

In the course of a pamphlet on "Safety Appliances," President Haynes of the American Railroad Association has this to say about the Master Car Builders' standard car coupler.

The coupler patentee, whose name is legion, opposes the standard automatic coupler because it is not a patented device, but only a type of which there are different kinds already patented; so many, in fact, that there is no hope of drawing a single capital prize in a lottery where all the others would draw blanks. What a prospect of a glorious monopoly was thereby destroyed! The only kind of automatic couplers that to-day can be bought on the market are of the standard type, and where else except in open market are the 800,000 couplers for cars to be obtained

Link-and-pin couplers cannot be successfully used in freight trains equipped with air-brakes, and there is no other coupler known as a commercial article except the standard type which can meet this requirement.

The distinguishing feature of this latter is that it is a type of which there are many different patents, yet all of them will couple interchangeably with each other, and the field for improvement and for variability is free for all, conforming only to those restrictions embodied in the type, that enable them to be uniform as to this feature of being interchangeable This is the fundamental requisite; in this direction alone lies the way out of danger to employés and toward their protection.



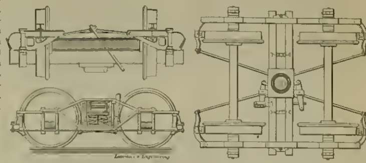
LARGE CAR TENONING MACHINE.

The *American Machinist* has heard about a man out West who has invented an osculating engine. We suspect Utah must be the only region where a labor-saving apparatus of this character would be tolerated.

## Something New in Brake Gear—A Beamless Truck.

The Bloomsburg Car Co., of Bloomsburg, Pa., have recently built a car for exhibition at Chicago with what they call the "Star" brake This is simply a device for doing away with the brake beam. And the plan is plainly shown in the two drawings of the truck shown herewith.

As can be seen, the brake shoes are hung on short levers hinged at the outer end to extensions of the arch bars and connected at the inner ends to its brake rods. These bars are of a very strong form and made of malleable iron. The manner of connecting to levers is shown in the plan.



What this device will do in service, of course, remains to be seen, and its use will be watched with interest.

WELCH SAFETY HOOK FOR M. C. B. COUPLER.

## Welch Safety Attachment For Draw-Bars.

One of the greatest faults with the M. C. B. coupler has been that it fell on the track and did great damage when the tail-bolt or draft gear broke.

One of the many devices for preventing this is shown in the engraving This is a simple hook under the coupler proper that prevents one knuckle from dropping down and out of the other.

This hook is a malleable casting that is put on to the coupler with a bolt and key The photo shows just how it works in pratice. It is the invention of C. L. Welch, of Birmingham, Ala., and has been adopted by the L. & N., Queen & Crescent and Illinois Central.

Fairbanks & Co., of this city, recently made some exhaustive tests of the Smillie coupler The knuckles showed a tensile strength of over 146,000 pounds.

## Large Car Tenoning Machine.

This machine will cut tenons up to 12 inches long on 14-inch timber. The frame upon which the carriage-ways are placed is cast in one piece and bolted to the sole-plate of the column, forming a rigid carriage support This form of construction permits of a low height for the table, a great convenience in handling timbers and material to be worked.

The cutter-heads are of large diameter, with serrated spurs and 6-inch knives They have a simultaneous adjustment for regulating the length of shoulder to the tenons by the hand-wheel and screw at the top of the column, also an independent adjustment to determine the thickness of the tenon by the center hand-wheel The heads are provided with an adjustment to make the shoulders perfectly square, or out of square if desired.

The vertical spindle is $1\frac{11}{16}$ inches diameter, fitted with a vertical head 12 inches diameter, for cutting double tenons up to 4 inches in length, regularly fitted with a pair of 2-inch cutters It has a separate, independent vertical adjustment by which it can be raised to any height or lowered sufficiently to permit the passage of large timbers over it The horizontal arbors are $1\frac{11}{16}$ inches in diameter, the journals lead-ground, and run in long bearings.

The belt is at the end of the machine, away from the operator, and controlled by an automatic, self-acting binding pulley actuated by a sheave, pinion, and weight. This compensates for any motion of the head up and down, and always maintains a uniform tension of the belt. The carriage is broad and of good length, and fitted with friction rollers, which run on planed

ways arranged to retain the table and keep it at a constant right line with the line of the heads. It is supplied with adjustable stops and gauges, a long fence, and a wrought-iron clamp for holding the timbers in position.

The countershaft is placed at the base, with a heavy floor-hanger support for the outer bearing. The vertical head is driven from an independent countershaft placed in the rear, which takes its power from the counter in the machine.

The machine is made by the J. A. Fay & Egan Co., Cincinnati, O.

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### English and American Cars in Argentine.

It is generally supposed that English passenger cars have less dead weight for the paying load than American cars, but a report made about the passenger car equipment on the Southern Railway of Argentine complains that the reverse is the case. Complaint is made that the cars are unnecessarily heavy, very expensive in first cost and that they need a great deal of repairs.

The point is made that the American cars in use are lighter, stronger, cost less and require little repairs. The cars are said to be in perfect order after four years' service. The dead weight per passenger is one-half less than that of the English cars excepting the sleeping cars, which are only a little lighter than those of English make. The system of carrying the cars on trucks is highly commended. They are said to have very little lateral motion compared with the others, and curve much easier.

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The chairman of the committee appointed by the Master Car Builders' Association to investigate the subject of metal for brake-shoes having declined to serve, the secretary of the association is calling for information. He has sent out a tabular circular calling for data about the wear of brake-shoes of different kinds. Exact information on this subject is badly needed, and it is to be hoped that railroad men having reliable records about brake-shoe wear will answer the circular.

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A committee of the Master Car Builders' Association having the subject of draw-bars and brake-beams under investigation have sent out a circular in which they ask the different railroads to intimate the height of draw-bars on their cars. This subject is of peculiar interest at present since Congress has provided a certain means of putting an end to the reluctance displayed by many railroad companies in adopting the standard height, which is 33 inches from top of rail to center of draw-bar.

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Mr. Robert M. Dixon, who is one of the officers of the New York Safety Car Heating and Lighting Co., has obtained a patent on a hot water heater for cars. It consists of a furnace with a vertically set water cylinder in the middle, connecting with which are coils of pipes. The apparatus looks as if it would make a very good heater.

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Two pages of the *Patent Office Gazette* were filled recently with descriptions of an automatic train arrester invented by Jesse Frysinger, Hanover, Pa. The purpose of the invention is to stop trains when block signals are at danger, no matter whether the engineer sees the necessity for stopping or not. Four different patents are required to cover the details of this invention, which are exceedingly elaborate, and are evidently well worked out.

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The J. A. Fay & Egan Co., of Cincinnati, have sent out a general invitation to all machine users to visit their exhibit in Machinery Hall at the World's Fair.

## ?A. What You Want to Know. ?A.

**Don't ask questions that simply require a little figuring to determine, make each question separate. No notice taken of anonymous questions.**

(52) W. R., Washington, D. C., asks

Will you kindly tell me, through the columns of your paper, what causes the peculiar groaning noise the air-pump makes when first started, and a remedy? *A.*—Groaning is usually caused by water in the cylinder; dry or cut seats or cylinder walls. Drain the cylinder before starting, start slowly, lubricate carefully; if cutting has taken place to any extent it can only be cured in the shop.

(53) E. S., Brookline, Mass., asks

I want to know whether in England or on the Continent there is in use any brake that will apply its power to every wheel in the train, or, if there is not, please explain the kind of brake in common use? *A.*—Passenger trains in Europe are generally equipped with automatic air-brakes or automatic vacuum-brakes, there being much more of the latter than the former in use. Freight trains are not so equipped.

(54) H. L. H., Boston, Mass., asks

Can you tell when the steam whistle was first used on locomotives, or when it was first invented? *A.*—A steam whistle made in the form of a letter-carrier's whistle was in use about the beginning of this century, but the cup whistle was not invented till about 1830. It was first used at the Dowlais Iron Works in Wales, and is supposed to have been invented by a workman named William Stephens. It was first applied to a locomotive in 1835 by Bury, an English builder.

(55) C. A. H., Brainerd, Minn., writes:

In a recent number of LOCOMOTIVE ENGINEERING mention is made of a "Hudson" locomotive. Please let several interested readers know what kind of an engine it is. *A.*—The Hudson engine is a double-ender with a pony truck in front, two pairs of driving-wheels coupled and a four-wheeled truck carrying the tender, which rests on an extension of the engine frames. The Illinois Central use this engine largely for suburban service. It was originally designed by William S. Hudson, superintendent of the Rogers Locomotive Works.

(56) I. A. M., Des Moines, Ia., says

1. I have been reading books about the steam engine, and have met with the expression "coal per horse-power." I am puzzled to know how long the horse-power is to be used. Is it a minute, an hour, or a day? *A.*—An hour. 2. What is considered the amount of coal required to produce a horse-power? *A.*—It varies from 2 pounds in good engines to 10 pounds in poor ones. Some Corliss compound engines are reported to be producing a horse-power on as low as 1¼ pounds of coal.

(57) A subscriber, Collinwood, O., asks

1. Why is the pin of the link not put in the center of the block? *A.*—Because putting it back of the center helps to provide the means of equalizing the cut-off of the valve. This question has been answered a great many times and more particulars given. 2.—Why will a lubricator sometimes nearly empty itself when left standing? *A.*—A common mistake is made in asking this question. Sufficient information is not given to enable us to judge what the defect might be. In the first place, the kind of lubricator ought to be mentioned, and then particulars as to how the instrument acts.

(58) H. E. S., Alexandria, Va., writes

1. If the valves of an engine are set properly and the reverse-lever is placed in the center "out of gear-notch," will the engine move if the throttle is open? If so, how far? *A.*—The engine will have an amount of valve opening equal to the extent of lead which increases as the reverse-lever is drawn toward the center. Most of the locomotives will pull a light train with the reverse-lever in the center notch. 2. Give a rule for finding the proper length of the link. *A.*—There is no rule. The link in locomotive practice, where its use was developed, was made so that it would be short enough to clear the boiler and keep away from the ground. A very common size is 14 inches between eccentric rod pins.

(59) S. A. U., Ashland, Mo., writes

1. Will you please state what is meant by decapod, consolidation and bogie locomotive? *A.*—A decapod has five pairs of drivers coupled and a pony truck; a consolidation has one pair of drivers less; a bogie is the English name for a truck. Mason bogie engines, for instance, have the drivers secured in a truck. 2. Is it good practice to build 8-wheel locomotives with one-third of the weight on the truck? *A.*—Yes. 3. I have seen a statement to the effect that a train could be stopped quicker when the wheels were not slid than it could be when the wheels were sliding. Why is that? *A.*—Because the friction is greater between the brake-shoe surface and the wheel than it is between the small point of the wheel that comes in contact with the rail in sliding.

(60) L. on J., New Windsor, Col., asks

1. What sized exhaust nozzles should a 22 x 26 soft coal burning decapod locomotive have; what sized nozzles should a 9 x 14 locomotive have? *A.*—The size of cylinder has very little to do with the size of the nozzle. They should be designed to make the boiler steam freely and as economically as possible. 2. If an accident happened to a shifting engine that it would have to be towed in and only had one-half or three-fourths of a mile to go to get to the shops, would it be necessary to disconnect? *A.*—Not unless the moving of engine without disconnecting would break something or risk breaking something. 3. What is the difference between first, second and third class certificates for engineers, and how large an engine is a third-class engineer allowed to have charge of? *A.*—The first-class man is the more experienced and educated than the third class. In marine work where classification is used the license specifies the tonnage of the boat the engineer is authorized to have charge of. No such classification is used on railroads.

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Even the children know a good thing when they see it. In one home where LOCOMOTIVE ENGINEERING is eagerly read and much enjoyed by the parents, the little ones are quite as interested in the pictures as anybody, and must see them as soon as the paper arrives. The observations made and the questions asked are sometimes amusing. A six-year-old girl was looking at the picture of one of the English engines recently shown in LOCOMOTIVE ENGINEERING, and was telling wherein it differed from our own engines. Soon she looked up and asked "Mumma, don't they have cows in England?" Her mother answered "Yes, certainly, why do you ask such a question?" And the six-year-old said "I thought they didn't, 'cause the engine has no cow-catcher on it."

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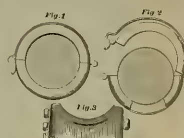
Part of the fireproof (?) building (Temple Court) in which we are located was burned on April 2, but the elect of earth are always cared for—more or less—and we were not smoked or wet down. For all of which we are truly thankful, and, in the language of the *Podunk Podanger*, this is the time to subscribe.

### A Piston Swab Holder.

The engraving will show at a glance the details of a metallic swab holder for air-pump and other pistons, recently patented by a railroad machinist, James N. Elliott, of Battle Creek, Mich.

The hinged shell is hollowed out and contains a strip of thick felt that is pressed against the rod when the two halves of the holder are snapped together.

A swab of this kind not only lubricates




the piston rod of an air-pump, but it prevents a great deal of water from being drawn down into the air cylinder when the gland on the steam cylinder is leaking.

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The Baltimore & Ohio Railroad company require that specimen bars shall be furnished of all the principal castings that are made in contract shops for use in rolling stock. This company has promulgated a good many foolish rules at one time or another, but requiring cast-iron specimens is as foolish as anything we have heard of, and certainly was not approved by a man familiar with foundry work. A good foreman molder can by selecting the period of pouring provide a specimen that will give any kind of test desired.

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"Globe Special Castings" is the title of an illustrated catalogue published by the Builders' Iron Foundry, of Providence, R. I. The specials handled are unusually numerous, more than 250 varieties being listed, while more common sizes are kept in stock. The Builders' Iron Foundry has a motto which is a good one. It says "We make specials as compact as we can, as light as we can; we utilize every pound of metal. Our business is to sell Globe specials."

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A correspondent in Fargo, N. D., sends us the following scientific explanation (?) of the air-brakes: "The air-brakes of railroad cars work by air pressure. Pipes connected with the brakes are carried to an air-pump fitted on the side of the engine and keep up a vacuum in the brakes; when the brakes are to be applied, the air-pump is thrown out of gear, air is admitted to the pipes, and the springs of the brakes immediately press on them and bring them in contact with the wheels."

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One of the most attractive and interesting machinery catalogues we have ever seen has lately been published by J. A. Fay & Co., Cincinnati. Besides giving admirable engravings and descriptions of the wood-working machinery, the catalogue gives a great deal of useful information about wood-working machinery.

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We are informed by Howe, Brown & Co., Pittsburgh, that in addition to their offices and warehouse in North Jefferson street, Chicago, they have decided to open a branch office in the Monadnock building, where Mr. Jackman will have his headquarters. Customers and friends are invited to call.

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A patent has recently been granted to H. H. Westinghouse, Pittsburgh, Pa., for improvements on an air-pump. It covers the new style of pump, which has the reversing mechanism entirely in the top head.

# Railway Liars' Association

Dr. MUNCHAUSEN, Sec'y.

References as to experience and ability required of all candidates.

### The Best Thief of the Two.

"When I werer running a 'yard-wide' on the Rio Grande," said the old-timer reflectively, "we had a cool sorter cuss runnin' freight train by the name of Gunnip—Bob Gunnip.

"Well, the art of car-robbin' never blossoms and gits ripe any place quite so good as it does out to the front.

"Almost every crew had a car-tapper that would get behind a seal, somehow or other, and tap kegs and barrels and touch candy-pails and fruit-cases, to say nothin' of shirt and sock boxes.

"The detectives were everywhere on the lookout, a half-dozen clerks were kept busy startin' out tracers, and readin' 'em as they got back.

"They mostly all told the same story namely, to wit. 'Car 4,944, on train 21, January 14th, received in good condit. all seals intact and turned over in same shape, Seals L. S., 1921.'

"Everything and nothin'.

"Well, one of these tracers dropped into Division Superintendent Bancroft's office at Pueblo one day, and he took and set down and put an appendix to it hisself.

"He went on to say that there was twenty ways to 'touch' a car without defacing the seal, an' 'en he detailed just how to do it. He explained how to take the cast door-clip off the back corner of the side door with a wrench and then spring the door up far enough for a man to slip in.

"How to cut open a lead seal without destroying the sealing letters, then take out the wire.

"How to put it back and scrape its edge to cover up the cut.

"How to cut the wire inside the seal.

"How to re-eyelet tin seals.

"How to pick locks.

"How to 'fish' oranges through fruit car ventilators.

"How to open a barrel of bottled beer, remove three bottle and replace the head.

"And forty other schemes to get at the contents of a car—no doubt the old man was mad and trying to jack up and give the detectives pointers at the same time—and 'en the tracer was sent to Gunnip; there bein' a strongish suspicion in the old man's mind that Bob and his two brakemen knew suthin' about car-touchin'.

"Bob writ a leaf for their tracer that prevented any more from ever goin' out. He said: 'My train-book shows this car taken from 120 to 217 with seals intact. But I should like to call attention to the astonishing revelations made in the confession of the man making the last report. No one but an expert could describe with such detail a score of sharp tricks in car burglary that I have never even heard of in ten years' experience. I don't know much about stealin', but if I were a detective I'd have the yard where this man lives watched at night.

"They put Bob on passenger shortly after that, the old man went to the Western division about the same time, and the car stealin' suddenly dropped off about 50 per cent., so the boys never could tell which was which."

### A Variable Exhaust Experience.

"Talking of variable exhausts," said Hank Collins, "reminds me of a little trick on the D., L. & W. way back in the fifties.

"We got some new Cooke engines with a variable exhaust; these things had a taper plug, not unlike many now in use and yearly 'invented' over again, exceptin' that the plug in these was as big as the nozzle, and went up into the exhaust stand from underneath the saddle. It was raised and lowered by a bell-crank and rod

"Well, Mike Flynn had one of 'em and had a certain place to run it—but the pesky things would get lots of lost motion in 'em—well, one night when everything was clear, Mike told his fireman to come over and run a few miles while he took a snooze.

"Well, you know how a new fireman will experiment when he gets his fingers onto the keys; this one wasn't any exception.

"He changed the lazy-cock just a hair, hooked her up a notch, gave her a thirty-second more throttle, tried her water forty times, and then went for the variable nozzle—it worked with a lever held on a sector with a set screw—he moved it a little and in setting up the thumbscrew did not get it very tight, it worked loose directly and the steam shut it up kerslam!

"Of course she commenced to choke right down and stopped. The fireman shook Mike and said she was broke down. Mike told him to take the torch and look her over just as if he was alone—so as he could learn to run and take care of an engine.

"The fireman got down and looked her over from end to end, and Mike, who hadn't been asleep at all, reached over and put the 'variable' where she belonged."

"'I can't find nothin' the mather wid her, Moike,' reported the fireman.

"'Did you look her all over?'

"'From ind to ind.'

"'And nothin' the matter?'

"'Divel the thing can Oi see.'

"'Well, an engine with nothin' the matter of her will go—try her.'

"But, man, she broke and stopped hersel'.'

"'Try her, my boy, try her.'

"Fireman tried her, and she went off just as if she never had had a fainting fit in her life.

"That fireman's pullin' passenger there now, but I don't believe to this day he knows what did ail that engine; he was one of them superstitious cusses as believes engines has 'queer spells' anyhow."

### Presumably from Boston.

"We had a feller named Bean come out to the front onct," said the old-timer, resting his foot in the spittoon, "one of them edicated, 'cientific engineers, and I'm here to tell you fellers that the way he could sling the king's English would jest make old Dan Webster sick o' the dickshunary bizness.

"If he wanted the fireman to douse the front glim (railroad for putting out a headlight), why, he'd bow, perlitely like, and say

"'Horace, preambulate your jaded anatomy along the by-way of the locomotive and extinguish the nocturnal illuminator.'

"We was burnin' wood at the front then, and when this 'cientific cuss wanted the firesey to drop in a few more chunks of tie, he'd bow again and say

"'Horace, deposit in the furnace of the locomotive a diminutive number of the curtailed excrescencies of the defunct tree!'

"Well, he went 'cientifically to sleep one night, with the injector layin' off, and the crown-sheet wilted, he reported on the book

"'Owing to a temporary deficiency of dampness on the roof of the furnace of engine 76, the active combustion of carbon produced caloric intensity sufficient to permanently derange the contour of the sheet, suspend active participation of this locomotive in the transportation department, and require the employment of skilled artisans and mechanical appliances, unattainable at the time and place of such unsolicited and unexpected derangement of crown-sheet and schedule, caused by procrastination in the application of appliances for the introduction of water to the interior of the boiler.'"

### "Couldn't Pass the Examination."

The man from the Missouri Pacific lit his pipe after Rogers' lie put it out, stretched himself in true Missouri style, and said

"Our old man—Frank Reardon, you all know Frank—has recently had a severe stroke of rigid economy in oil. The Galena Oil Co. are furnishing the oils—good stuff, too—but the old man is putting the nippers on the boys. Valve oil is at a premium.

"Since we commenced using the Galena company's oils on this the Arkansas division of the Iron Mountain, we have double the oil mileage. The oil company have a man here to keep cases on us.

"Not long since he was present when the old man was examining a fireman for promotion. The boy got through with about all the questions put to him, and finally the old man gave him this

"'What would you do if you were out on the road with an engine and train and you saw another train coming against you with no possible show for you to avoid colliding with it?'

"The boy said he would reverse his engine, whistle down brakes, *grab the valve oil can* and jump off.

"The old man was just saying 'all right, you will pass,' when the oil man interrupted and said

"'No, no, Mr. Reardon, that man ain't safe; he never ought to be let run. Why, sir, he should never jump in this world till he had *shut off his lubricator*.'"

### Slow to Get Under Way.

Col. T. H. Long, one of our most famous civil engineers at the beginning of the railroad era, was the man who induced William Norris to engage in the business of locomotive building. Col. Long, like all the civil engineers of early days, took a hand in designing the machinery for railroads, and he made drawings for the first locomotive built by Norris. The engine was not a success. It was tried first on the Columbia Railroad. Col. Long, describing the events of the trial trip years afterwards in a public speech, said "Gentlemen, I can on my honor assure you that we ran four miles and a half in seven hours and a quarter, running all the time at that.'

This was something like the evidence given by Napier, a famous Scotch civil engineer, about a trial of one of the pioneer locomotives experimented with in Scotland. All sorts of odd engines were tried as locomotives at first, many of them being utter failures. This engineer was present at the trial of one of these, and he was questioned about the engine's performance, with the expectation that he would say something favorable. But he was carefully non-committal. When a man having stock in the invention had tried his best to get Napier to commend the engine, and got nothing but grunts, he exclaimed impatiently "You saw the engine running, at any rate." "Well," said Napier, "you may call it running. I saw you fellows shoving the engine."

### A Handy Accident.

"You know Hank Small, don't you?" asked the Jersey Central engineer: "Well, Small had a queer accident a few years ago that for slick good luck takes the cake. He was coming down from Easton with a coal train and didn't notice anything wrong—'cause he was drifting along, the boys holding him with the train, all he had to do was help 'em out on the sags here and there.

"Well, sir, they stopped for water and Small got down to oil around and found that his engine was disconnected and on one side

"The key had come out of the valve-stem and dropped the valve just in the center of the seat; this caused the piston to break and it took the front head out. The crosshead was riding back and forth all right.

"Small was considerably worried and looked her all over but it was no use to do anything—she was disconnected just right—he brought her in that way.

"That's the kind of an accident to have I always have to jack the engine up if anything happens to me."

### The Cowboy's Story.

Speaking of excitement, I tell you nothing so stirs up all the latent depths of one's imagination as the prospect of seeing yourself a millionaire in a week's time, and you can't stay long in a gold country before the fire gets into your brains and you watch the ground at your feet and the rock cliffs at your side, expecting any minute to pick up the nugget that will be the foundation of your fortune. I was up in the Black Hills not long ago and ran across a little incident in this line. The railroads hadn't been there very long and some of the boys were just in the state of mind I've been speaking about—watching to "strike it rich." Abe Bowers was roundhouse foreman and he had listened to the mining talk till he was sure there was luck for anybody who kept his eyes open, and so one of his machinists laid for him. He saved up his brass filings till he had about a quart and one day when the coast was clear, he raked them well into the sand on the bank of the creek out behind the shop, and then watched for developments. He didn't have long to wait, for Abe's prying eyes soon caught the glitter of the yellow particles, and he picked up a handful of the dirt to examine it. His eyes opened! The sand was full of minute grains of free gold! The find was fabulous, for old miners had said free gold never showed to the naked eye unless it was immensely rich. His wildest imaginings were to be realized! He trembled in his eagerness to store away his glittering find, but not till dusk could he begin his willing task; and then just as he was beginning to sack up his fortune, along sauntered the passenger conductor, who asked him what he was doing. It was hard, but he must share his secret, so he told the conductor of his find, and by the light of a match showed him the glistening dirt. The conductor was electrified, and offered to help him sack and hide it for half. Abe was compelled to acquiesce, and together they filled half a dozen sacks, which they carried across the creek to a deserted log cabin for safe keeping. This was no light task and they were two pretty tired men when it was finished, but nevertheless they sat up late planning and making arrangements to be relieved of their railroad duties, so as to give all their time to the development of their fortune, and not until they had washed out a quantity of the filings and taken them to a bank for sale, did they fully realize what "tenderfeet" they were.

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During an examination of engineers and firemen on a Western road, one of those ultra-practical engineers who scorns "book larnin'" to the extent that the book of rules is to him a delusion and a snare, was asked by the examining committee "When the train is running, what do three taps of the signal-bell signify?" The man colored, squirmed, scratched his head and answered "If I was on my engine I'd know!"

---

"Say, Rogers, wheredidger git the black eye?" asked Pomeroy

"Why, that's a birthmark!"

"Birthmark birthmark? Well, it's funny I never noticed it—funny-looking birthmark. What-de-ee think caused it?"

"I got into the wrong berth on the B. & O. last week."

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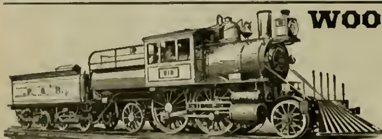


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## A Practical Journal of Railway Motive Power and Rolling Stock



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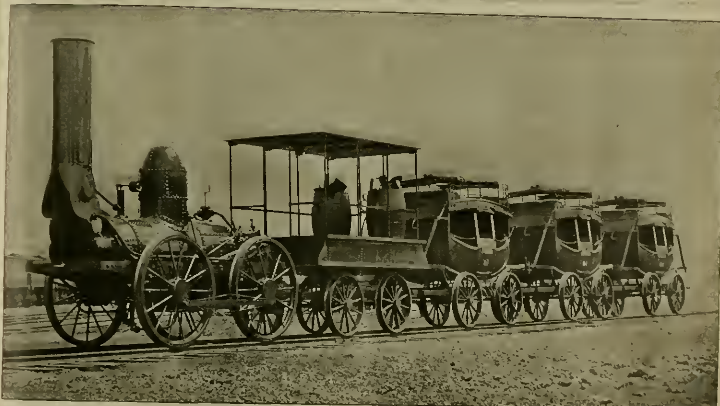
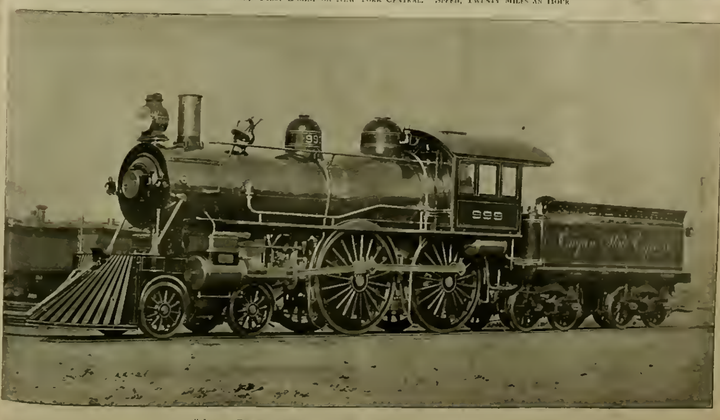


"De Witt Clinton," First Engine on New York Central. Speed, Twenty Miles an Hour




"999," Latest Engine on New York Central. Speed, One Hundred Miles an Hour

### The Fastest Locomotive in the World.

In our last issue we gave an illustration of the New York Central's engine "999," built for exhibition at the Columbian World's Fair. In presenting the picture of the engine we spoke of her as a splendid specimen of excellent workmanship that we consider the highest development of a fast and powerful locomotive; a machine combining power and speed that could be pushed to a velocity of 100 miles an hour, if such velocity was not beyond the capacity of a steam locomotive. We illustrate the engine again in larger form, so that our readers may form an idea of how the locomotive looks that has made the highest speed of any engine that there is a record of, and did it pulling a regular train.

For a week or two before being sent to the Fair, engine "999" was run on various trains to demonstrate her power and speed. On May 9th she took the Empire State Express clear through from New York to Buffalo, a distance of 440 miles, on time. The train was 28 minutes late on leaving Rochester and it is claimed the run of 69 miles from there to Buffalo was made in 68 minutes, and one mile was made in 35 seconds, being at the rate of 102.8 miles per hour. The train consisted of four cars, the weight being 362,000 pounds. On another run, passengers in the train claimed that one mile was made in 32 seconds, which is over 112 miles an hour. These claims of terrific speed are not official and we do not believe that the engine ran 100 miles an hour, but has probably made the highest speed of any locomotive in the world.

Engine "999," as will be seen by the engraving, is an eight-wheel engine, standing remarkably high on her wheels, and of plain, though extremely handsome, appearance. The cylinders are 19 x 24 inches, the valves are Richardson balanced, and the driving-wheels 86 inches diameter, the tires being 3½ inches thick and 5½ inches wide, secured to cast-iron centers by Mansell retaining rings. The rigid wheel base is 8 feet 6 inches, the total wheel base being 23 feet 11 inches. The engine truck wheels are 40 inches diameter, with cast-iron spoke centers, and tires also secured by the Mansell retaining rings. The weight on the four driving-wheels loaded is 84,000 pounds, and on engine truck 40,000 pounds. The boiler is of the wagon top style, 58 inches diameter at the smallest ring, and has 268 two-inch flues 12 feet long. The firebox is 108 inches long by 40⅛ inches wide, set above the frames, and has the Buchanan water-arch. The grate area is 30.7 square feet and the total heating surface of the boiler is 1,930 square feet, 232.92 square feet of that being in the firebox. The boiler has an extended smokebox, and is fitted up with a deflector and perforated steel plate spark arrester. The exhaust nozzles are double 1½ inches diameter. Steel is used throughout for boiler and firebox, and a pressure of 190 pounds per square inch is carried. Remarkably large bearing surfaces are used throughout, the driving-boxes being 9 x 12½ inches, the engine truck-boxes 6¼ x 10 inches, and the tender-boxes 4½ x 8 inches. Ajax metal is employed for all bearings and has given remarkably good satisfaction, the engine having started and run cool from the beginning. After making the unparalleled run of 440 miles without a break, the bearings were all perfectly cool, no water having been used upon them.

The tender has a coal capacity of 6⅞ tons and carries 3,587 gallons of water and is fitted with a water scoop. It is carried on two four-wheeled trucks, each with 4 feet 5 inches wheel base and cast-iron wheel centers, and steel tires secured by Mansell retaining rings. The weight loaded is 80,000 pounds, making the total weight of engine and tender 204,000 pounds. The engine and tender are fitted with the Westinghouse quick-action automatic air-brake and signal. Monitor injectors are employed and Nathan sight-feed lubricators. The engine rides like a drawing-room coach and steams remarkably well.

### Southern Relics at the World's Fair.

The Illinois Central Railroad Co. exhibit at the World's Fair a curious old locomotive called the "Mississippi." The engine was built in 1834, and looks like a class built by the Stephensons at that time, many of which were sent to this country. After a careful study of the engine, we came to the conclusion that she was like the boy's knife which had several times got new blades and new handles. The boiler looks modern, the cylinders were certainly made in this country and she has a link motion. The cylinders are 9½ x 16, and the wheels about 40 inches diameter. She was for three years on the Natchez & Hamburg Railway, from 1836–38. The last service she did was on the Meridian, Brookhaven & Natchez, which is now controlled by the Illinois Central. Some time in the year 1868, the engine was carried away by a flood and was buried in the debris, where she lay for ten years, and was then resurrected to go into service. She is a curious looking relic and well worthy of inspection.

Some other kindred relics are shown beside the engine in the form of strap rails, that were used on the road where the "Mississippi" first ran. They were rolled in England and were of the usual form of rail used at that time.

The Western & Atlantic Railway of Georgia have sent their famous historical engine "General" to the Fair. She looks quite modern beside many of the antiquities to be found in her neighborhood.

In our last issue the types made us say that C. S. Hull was superintendent of the Cumberland Valley road, when we knew perfectly well that Mr. Hull was the draughtsman, and not the superintendent.

John Hickey,
President American Railway Master Mechanics Association. Supt. M. P., No. Pacific Ry.

E. W. Grieves,
President Master Car Builders' Association.
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### More Anent the "Utility."

The sight of the old war engine "Utility" in the pages of LOCOMOTIVE ENGINEERING brought up memories of the days of his youth to Mr. George W. Cushing, well known for years as the chief of the motive power departments of one or another of our largest railroads.

Mr. Cushing was an apprentice boy at Seth Wilmarth's shop in Boston before the "Utility" was built; he was then nineteen years old, and far enough along with his trade at the time she came out to be entrusted with the job of setting her up.

When she was ready for service Mr. Cushing was sent out to run her at her trial trips. It was the first time he had ever run an engine, but those were the days when "machinist runners" were about all the kind there were.

Mr. Cushing afterwards earned his bread by running a locomotive, and slowly, step by step, went up to the top of his profession.

He supposed the "Utility" long ago dead, but seeing her picture and being assured of her present healthy and useful old age, was like finding an old schoolmate in a soldiers' home.

### A Griggs Engine.

The New York, New Haven & Hartford Railway Co. exhibit at the World's Fair one of the best of the Old Colony locomotives and a handsome day coach, both designed and built by the superintendent of machinery, J. N. Lauder. They have also an historical engine built by G. S. Griggs, in 1858. This engine was as much noted in her time for the progressive ideas embraced and for the remarkable work done as the New York Central's "999" is to-day. Beside her, there is one of the first form of coaches used on the road, the body being the same as the old style stage coach.

We have received from the Standard Steel Works of Philadelphia, a very handsome illustrated catalogue giving various views of the works and showing specimens of the steel tires, wrought iron wheel centers and other castings made by the company. The views are mostly half-tone engravings and are as fine specimens of this art as we have ever seen. Persons interested in wheels and tires will find valuable information in this catalogue and the artistic work to be found in the book will make it an attractive addition to the desks of railroad men.

### Some Frauds in the Watch Business—How Railroad Men are often Imposed upon.

BY JOHN J. MCGRANE.

When a man is sick he usually sends for another man who is said to be a physician, and puts his liver, or his lungs or his larynx into his hands—in fact, leaves it to the other fellow to take his choice and to try and get his disarranged anatomy into working order again. The sick man does this because he knows more about something else than he does about livers, lights or gizzards and their ailments. Man at this age is a specialist; he knows considerable about one or two things, and a little about other things. He leaves law to the lawyer, physic to the doctor, sewers to the plumber and hash to the boarding-house. He makes a specialty of, well, say firing and running locomotives.

When the road wants engineers it don't hunt for shoemakers and cotton pickers (except in case of a strike). There is no doubt that an unscrupulous lawyer, doctor or shoemaker can and does deceive his customers—he knows how to do it. When an engineer who, maybe knows ever so much about locomotives, takes his hundred-dollar watch to the jeweler, he puts himself and the watch at the mercy of that jeweler. If the watch has stopped and the watchmaker (?) screws a magnifying glass into his eye, looks into the bowels of the movement, shakes his head seriously, and says "You must have given this watch a hard jar—the staff is broken."

There is nothing for the owner to do but say:

"Is that so? Well, you put it in running order and give me something to carry and, mind, I want a good one, for my life depends on its being right."

Oh, yes, there *is* something else to do. There is $3.50 to pay for a *new staff*—made by cleaning the watch.

Two railroad engineers known to the writer once took a new watch to four different jewelers to examine. The watch was all right except that the hands crossed and caught, and it was run down, and they knew it. The three first men were the jewelers who did the largest railroad trade in town. The first one pronounced the staff broken. The second one said a jewel was cracked. The third said the watch was simply so dirty that it couldn't run. The fourth was an old man, a Hebrew, very much distrusted by "the boys." He was a splendid watch repairer, but there had been stories told about his taking jewels out of watches and substituting glass, the boys took the watch to him. He screwed his glass in his eye, looked in the works, shook the watch, wound it up, shut the case, looked at the face, opened it and bent one of the hands up, set them right, and said: "Poys, maypee she vould co badder if you wind him oupp." He was an honest man—the others were rogues.

All this is small potatoes, however, it's when the engineer goes to *buy* a watch that they lay for him and do him up. The average engineer and fireman knows nothing about watches, but he knows that the Compound or Express Train or some other movement has given the very best of satisfaction to some friend of his, so he says he guesses maybe he'll take one of them. Perhaps he has seen the advertisement of some watch firm's pet movement and determines to have one. The jeweler may not have the one he wants in stock, or may not make so much on one of these as he would on another make, so he says

"I should think you'd want a better watch than that, you know things have improved. What was a first-class watch ten years ago, is no good now; why, ten years ago I got $40 for that movement, it's worth $18 now. Now, here is something fine, there ain't no finer. That's full jeweled; patent regulator, dust proof; safety pinion, adjusted to heat, cold and position, etc., etc." He goes on to point out alleged points of superiority and ends by selling the watch. If he can't soak the victim on the movement he gets even on the case.

"Full jeweled," may mean several things, there must be at least 15 jewels to come under the head. Some full jeweled watches (so called) have 15 jewels, some 16, 17. The three general grades are 7 jewel, 11 jewel and full jeweled. The 7 jewel movements are of the cheapest class. The most important points are jeweled. Generally but one jewel is visible, and that is on the bridge—the one over the balance. Any movement of this class should never retail at more than $7. The 11 jewel movements are a better grade and all the essential points are jeweled; it is hard for a novice to tell this movement from a better one. Most of them have jewels on top while the other end of the shafts run in brass holes—even a watchmaker has to take a movement down to be sure of this. In an 11-jewel movement there are generally four jewels in sight; these are in a row around and under the balance and one on bridge. No 11-jewel movement is worth more than $9 at retail. Full jeweled movements all have five jewels in sight on the back or top plate, four on plate and one on bridge.

There are two kinds of jewel settings; one where the jewel is set in the plate, and one where a separate setting holds the jewel while itself is held in the plate by two screws.

While on this subject I might add that the idea that a watchmaker would have any incentive to rob a watch movement of its jewels is folly. Jewels are usually garnets and each one costs less than the cost of setting it.

There are very few watches of any grade worth considering that do not have the safety pinion, a simple device to prevent the ruin of the movement incident to the breaking of the main spring.

The word "adjusted" as applied to most watches nowadays means very little. Any watch that is regulated may be called adjusted. When the balance is poised by adjusting screws it may be called adjusted. A watch adjusted to heat and cold generally means a balance wheel cut open at two points; one-half of it composed of steel, the other half of brass, so put together that the contraction and expansion from the changes in temperature do not change the size of the wheel—one of the metals expands more than the other; one offsets the error the other would make. The position of the screws in the rim of balance also plays an important part in the adjustment. Adjusted to position means considerable. It means the regulation of the watch in several different positions for days and weeks at a time; great care and close regulation. Adjusted to heat, cold and position, means considerable, and if properly done is expensive. Adjusted for isochronism means a great deal and is a subject that even the makers of fine watches let alone as much as possible. Isochronism means that the long and short arcs of vibration made by the balance wheel are of the same duration of time so that a watch runs the same when wound up or nearly run down.

Perhaps the intricate looking patent regulator has cost the boys more than any other one thing. There are dozens of these of all kinds and shapes. The argument that in jumping off an engine, etc., you can't move the regulator accidentally, generally clinches the sale of a watch with one on. They are a good thing, but add nothing to the time keeping qualities of a watch. The highest priced watch in the world—the *Jurgensen*, has a plain regulator and it is a good one.

The magnetism of watches was thought very little of and caused very little trouble until the advent of the modern dynamo and introduction of heavily charged currents of electricity. Many thousands of dollars have been paid by railroad men for non-magnetic shields, guards, charms and liver-pads; and, as far as real protection from magnetizing a watch by a strong current of electricity is concerned, the owner might as well have said a charm or put a drop of witch-hazel on the back case. A practical demonstration can easily be made with any of these things. Ninety per cent. of our best watches can be stopped dead with a three-inch magnet outside the case. There is only one really non-magnetic watch and that is one having in it the Paillard spring and balance. These are made of a metal entirely non-magnetic, and, strangely enough, the inventor was not hunting for that when he experimented with the different metals.

Paillard was a watchmaker at Rio Janeiro, Brazil, who made a specialty of marine chronometers. In the damp and hot climate of the tropics, steel springs will rust in a week so as to be useless. Paillard was hunting for a metal that he could use in place of steel for springs, balances and other parts of chronometers and when he had found the alloy desired, it was discovered accidentally that it was also non magnetic. Watches and clocks made by him seventeen years ago are still running and giving satisfaction. Many a watch with Paillard's balance and spring have been condemned by ignorant jewelers, because they did not understand what they were—didn't want to make an effort to find out, and didn't want to have anything new around, anyway—just as some old-timers want a pump instead of an injector. When anything is wrong with a Paillard watch, it is more liable to be in the works than in the metal the spring and balance are made of. A watch with this improvement is as cheap as any other, grade for grade, with the added advantage of absolute protection from magnetic influence.

Good watches should be kept away from dynamos or heavy currents of electricity, yet it is hard to tell when and what caused a watch to get magnetized. The usual symptoms of a light case is the gaining of time. The fine hairspring becoming magnetized, the coils stick together, thus shortening the spring, causing the watch to run faster.

Watches can be de-magnetized—but it's like inflammatory rheumatism—you're always afraid it will come back.

Don't let anybody take the gold cap, or inside case, out of your watch and put an iron "preventer" in its place, keep the cap, and charge you $5 beside. It will be just as liable to prevent small-pox or catarrh and no more so.

Another catchpenny improvement (?) is the stem-set. This scheme is handy, as it admits of the setting of the hands without opening the case, but it is a dangerous thing for railroad men, as one is very liable to get hold of the crown of the stem in taking the watch out of the pocket and pull out the "set," letting the hands stand still or fall out of place. The lever set, where you have to pull out a stop and replace it before you can close the case, is simple, safe and sure. Don't take any other, or if you do, watch it close, it's a loop-hole for a calamity.

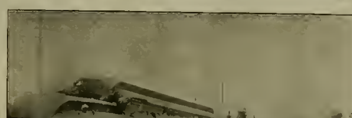
A man running a locomotive cannot afford to be without a first-class watch. A fifty-dollar movement is cheap enough. Require that any watch you buy must run within three-quarters of a minute per month of correct time. Most roads require a less variation than half a minute per week. Get a guarantee for this service. Don't attempt to regulate the watch at all, don't even open the case. Wind it regularly and let the jeweler do the regulating, and once right don't change it for a slight lapse—maybe you forgot to wind it for some hours, and be sure what you set your watch by.

Have your watch cleaned and oiled once every year-and-a-half or oftener. Think of the thousands of thousands of revolutions the shafts make at one oiling. If you could do as well with your engine the road would pay a dividend next Thursday.

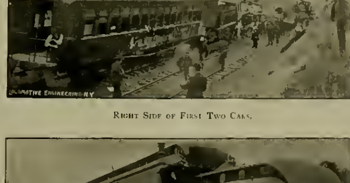
One of the latest improvements in fine watches is the double roller escapement. This is a safety device to save the fraction of a second—just as the emergency valve in the air-brake is for saving a fraction of time in an emergency case. The fork of the lever goes over a very fine ruby pin on a flange under the balance wheel, this moves the lever back and forth as the balance oscillates and regulates the running down of the main spring. Should a very quick jar be given the watch just at the right time and in just the right direction, the balance may be made to momentarily stop or move a little too far. Here is where the double roller comes in, counteracting the effect and keeping the watch to its regular rate.

The above is not written for the eyes of watchmakers, if it was I should have had to go more carefully into details and address my readers in technical terms. This is written with a view to giving the railroad men of the country a few straight pointers, and perhaps put them right when buying a watch. If it shall save one from being imposed upon, or imposing on himself, its object will have been attained.


THE SILVER CREEK WRECK AND ITS LESSON IN CAR CONSTRUCTION. THE HEAD END.




RIGHT SIDE OF FIRST TWO CARS.



LEFT SIDE. TWENTY-THREE KILLED.

Those attending the World's Fair will do well to examine the exhibit of the Ashcroft Manufacturing Co., which will be found in the Machinery Building, section 25, column K, 24-25, main center aisle. It is the largest and most complete exhibit in this line to be seen in the Columbian exhibition. It contains a great variety of pressure and vacuum gauges, beautiful specimens of the Tabor indicator, pipe and gas fitters' tools and other specialties well worthy of examination.

We are under obligations to Eugene V. Debs for a bound volume of the *Locomotive Fireman's Magazine* for 1892. This publication stands at the head of all the "official organs." The new dress for 1893 puts the *Magazine* on a level, typographically, with the best of the magazines.

### Locomotive "Director-General."

The annexed illustration shows the locomotive "Director-General," built by the Baldwin Locomotive Works for the Baltimore & Ohio, and exhibited in the World's Fair at the head of the "Royal Blue" train. The engine is painted to harmonize with the train and has a very handsome appearance. She is compound, with two high-pressure cylinders, 13½ inches, and two low-pressure cylinders, 23 inches diameter and 24 inches stroke. The driving wheels are 78 inches diameter. The boiler is straight, 60⅝ inches diameter at smallest ring and has a firebox 107 x 34 inches. The grate area is 24¾ square feet and there is a total heating surface of 1,693 square feet.

BALDWIN COMPOUND FOR B. & O. RAILWAY. NOW AT WORLD'S FAIR.

### Brazilian Compound Locomotive.

The locomotive shown is a narrow-gauge compound built by the Baldwin Locomotive Works for a railway in Brazil and exhibited at the World's Fair. The principal dimensions are: Cylinders—H. P. 9 inches, L. P. 15 inches diameter, stroke 20 inches. Driving wheels, 49¾ inches outside diameter. Boiler, 45½ inches diameter, with a total heating surface of 861 square feet. The total weight of the engine is 58,320 pounds.

BRAZILIAN GOVERNMENT METER-GAUGE PASSENGER ENGINE. NOW AT WORLD'S FAIR.

The Pennsylvania R. R. Co. appear to be in an unusually fortunate condition this spring as far as the track is concerned, for the management have issued orders reducing the expense of track work. Nearly all other railroads are increasing their force to repair the ravages of a peculiarly hard winter. The heavy locomotives and cars that are becoming the rule make sad havoc of the soft railroad beds that most of our railroads have. How the trains are run safely over some roads is a mystery. There is a growing demand for stone ballast, and it is becoming apparent that nothing else will keep the track out of the mud.

Mr. Frank Hedley, for several years master mechanic of the Kings County Elevated Railroad of Brooklyn, has been appointed superintendent of machinery of the Lake Street Elevated Railroad of Chicago. Mr. Hedley rose to be general foreman of the Manhattan Elevated Railroad shops and is an excellent mechanic and executive officer.

### Wanted—A Jag Cure for Chronic Inventors.

BY JOHN ALEXANDER.

I once asked my friend Hank Colvin if he had ever drank whisky or used opium to excess.

"No," said he, "but I've invented a balanced valve."

Sitting last night, as I am prone to do, on the very masthead of fame (Selah), and dropping the sounding-line of remembrance in the wake of my long voyage of experience, I evolved a scheme for making myself famous. I'm going to ask the government to establish life-saving stations to prevent inventors (?) from imposing upon themselves—and others.

I am going to ask my Uncle Samuel to do something *for* the real inventor and do something *to* the imitator—the man who makes something *different* and then puts on a medal, calling himself an inventor.

Now, I am not a pure, white soul, standing on a virgin cloud, pointing out the straight and narrow way. Like the widow, "I've been there, many times before"—I'm an awful example myself.

I used to think I was an inventor, but, bless you, my children, that was ever so long ago.

I'm cured now, and, like the man who had the catarrh, I am willing to publish my picture just to show what a really *awful* example I am.

But, talking seriously now, this inventing (?) fever has got to be isolated—it's as catching as fleas.

Railroads suffer a great deal from the disease. Many a man—engineer, machinist, fireman, or master mechanic—has cost his company thousands of dollars in experimenting on a patent. If, say, the man is an engineer, and don't use an ounce of the company's material, he takes from the company his intelligent services, which they pay for and he should deliver. A man can't think about his orders when his head is so full of his own valve motion that the wimble-rods and gill-cranks are sticking out of his hair.

Some roads breed this kind of inventor—imitator—by encouraging their master mechanic or superintendent of motive power to make something that will "get around" some patent of merit that they want to use—and ought to pay for.

Most of us go at it of ourselves. It's like prospecting—some one digs a hole in the ground (because he has studied the locality and the indications) and strikes pay-dirt; then every mother's son in sight or hearing goes out and imitates the digger—they make a hole in the ground, and, as a rule, that's all.

The piston-valve craze is the small-pox of inventive diseases. It's as common as dirt and always pits the pocketbook If the ark had motive power controlled by a piston-valve she would have hit bottom long before she did. Just as quick as a fireman is told what a load the slide valve carries, he commences to scheme up a contraption to carry it. All at once the piston idea suggests itself, and he goes off by himself and plans it out—there's been 900 invented, all just alike. Piston valves come, work awhile, then crawl into their holes and die, while the wasteful slide keeps sawing wood at the old stand. It may not be balanced or have a port longer than the moral law, but, at the same time, it didn't inherit scrofula and quick consumption.

The balanced-valve fever—putting hats, caps, or overcoats on plain valves—is in the nature of chicken-pox; the rash breaks out early, sees that it is nothing more than a second-hand, common sort of rash, anyway—and sneaks back.

The gauge-cock fever is local, severe, but not dangerous.

Spark-arrester invention is usually accompanied by chills—to the boiler.

Air-brake inventors are always sanguine, even in the worst cases. Their mania is to get something *different*—and they always get it During convalescence patient has fits of generosity—usually wants to become a benefactor to mankind in general and the Westinghouse Company in particular. Only want a mere pittance of a few hundred thousand for their particular deformity—want the world to have the rest. Usually leaves patient morose, and may lead to settled melancholy or hallucination, cases have been known where patient imagined himself a saviour out of a job Nobody wanted him to save life and limb with a brake-gear that could "stop a train instantly." It's funny how the mechanical world, after years of experience, have become conservative and want to stop slow.

I won't dwell on the car-coupler man seeking for a new device. He is a poor unfortunate for whom nothing can be done He should be placed in the incurable ward, treated kindly, but firmly, bathed frequently, and allowed to exhibit a model of his device and explain its merits —to some other inmate of the ward.

Valve motion is the cholera of inventive diseases. It strikes quick, and a large per cent. of the cases are fatal. Little or nothing can be done, except to dispose of the remains. In this disease prevention is everything—there is no cure. The very best preventative is knowledge of the merits and demerits of the very efficient valve motion that is condemned.

A few kindergarten lessons illustrating in some simple way the fact that a desirable Corliss engine card is not a desirable locomotive card; that the link motion admits of the use of large cylinders necessary to the starting of trains, and then, in effect, makes them smaller when the links are hooked up. Explain that this is done by compression, which takes the heel off the card at the expense of power, but gives this back again in filling clearance spaces, keeping up heat in the walls of the cylinder and in a higher initial pressure. Thoroughly impress upon the patient's mind that all of this is a good thing, and that a substitute for the link *that won't do just what the link does* will be a bad thing for the locomotive.

If railroad companies would chip in and pay for the making of good engravings of all the still-born thing-im-bobs ever designed to take the place of the link and post up a copy in each roundhouse in the land, with a line of large, plain, red letters reading, "Is yours like any of these?" it might save the company money and would certainly let some inventors (?) sleep

Doing something with the heat in the front end is a favorite disease. It has several stages. one of them is where they are going to heat the feed water; in another they are going to heat cars, and in both they are sure to give the boiler the ague.

The independent water arch and circulator is a Baptist invention—it does more than sprinkle.

The diseases are legion and the cures simple, but hard for the patient to take.

One of the evils of the invention mania is the ease with which one may get a patent. A patent means nothing—I will bet my reputation against the pension roll that I can get a patent on the complexion of a hot pin—if they won't grant it on the color of the pin they will on the combination of the pin with the complexion or application to this form or that "herein as substantially set forth, etc., etc." There are patent agencies that will get *some kind* of a patent on anything If this is not stealing from the poor I wouldn't know a charity if I found one dead in the street. Between the shark who gets a patent for a fee in advance and the one who proposes to sell one on the same terms, the inventor is held up and robbed to a queen's taste.

There are one or two fundamental principles—I wish they were laws—in inventing, that once understood and heeded keep a man from committing homicide, parricide, suicide or foolicide in this particular way.

One of these is the difference between invention and imitation. A man who first thinks of a thing and makes one is an inventor, a man who sees that thing and at once makes one a little different is not—he may be an improver, but he is not the inventor. Gutenberg wouldn't know the font of type this article is set in from a peck of shoe-pegs, but he is the inventor of movable types just the same. He's the old, original inventor; all others come after.

Babbit was the inventor of the anti-friction alloy that bears his name. "Smith's" babbit metal, and the "Original," the "Eureka" and "Genuine" babbits are not inventions.

If Jones invents an injector that throws water by using smoke, and Smith changes the pattern and design so as to cheapen the cost of producing the injector, it don't change the fact that it's Jones' injector, and all Smith can claim is improvements. Yet both may have done good.

When Timpkins invents a tire fastener that holds the tire on with glue and four bolts it's an invention, perhaps, and Timpkins deserves the credit, but when the general manager of the G. R. A. & B. road sees it and fastens his tire with mucilage and four rivets there is mighty little invention to it. If it isn't Timpkin's fastener it's nobody's—preferably the latter.

I don't believe that 10 per cent. of the men who are wracking their brains to-day trying to invent something to sell to railroads, know what has already been done in the same line or can tell the *advantages* as well as the disadvantages of the device they want to supplant.

A good many of these railroad inventions are made at the wrong end to be real improvements. I suppose that the amputation of the old, plain slide feet of the Esquimaux and the substitution of wooden shanks would prevent cold feet—but the Esquimaux aforesaid would rather wear fur boots any day.

When you think you have thought of something new and useful *don't* write to a patent agency. Write to some newspaper in that line, get reports of societies, consult railroad men and hunt up all the *facts*; see what has been done, what is wanted and what not wanted—you will probably find your invention (?) properly labeled in the Patent Office as of the vintage of '57. Invent something before you patent it.

If I can only get an institute established where they will give unfortunates addicted to the patenting habit a few jabs of bichloride of information, I think that posterity would give me credit for making one blade of inventor grass grow where formerly there were two—to say nothing of sprouts and suckers


Taking Indicator Diagrams on a Swedish Locomotive.

### Exhibit of the London & Northwestern Railway.

[EDITORIAL CORRESPONDENCE.]

The London & Northwestern Railway's exhibit at the World's Fair attracts extraordinary attention, not only on account of the novelty in appearance of engine and cars, but on account of the elaborate finish put upon every part. Nothing in the Fair compares in finish with the compound locomotive "Queen Empress." All the iron and steel parts exposed are highly polished and the painted parts are polished in a style equal to the finest cabinet work to be seen anywhere, even the inside of smokebox has the pipes painted and varnished, and the tube-plate and the sides of the box are a snowy whiteness. The engine is by no means ornate, being painted a dark blue, with very few red stripings, and edgings of light green.

The engine has two pairs of driving-wheels, the front pair being driven by the low-pressure cylinder through a crank-axle, the hind pair being driven by high-pressure cylinders In this engine there is a novelty of construction, as regards other compounds, in the fact that the high-pressure cylinders are set ahead of the front pair of drivers, the reach to the hind drivers being made by means of unusually long piston-rods. Another novelty about the engine is that a link motion is used for the high-pressure cylinders, the low-pressure cylinder having the steam distributed by a shifting eccentric. The high-pressure cylinders are 15 inches in diameter with a 24-inch stroke, while the low-pressure cylinder is 30 inches in diameter with the same stroke. Both pairs of driving-wheels are seven (7) feet and one (1) inch in diameter. Fixed wheel base of engine is eight (8) feet and three (3) inches. Total wheel-base, 23 feet and 8 inches, total weight in working order, 52 tons and 200 pounds.

LONDON AND NORTHWESTERN CARS.

The sleeping car is 42 feet long, carried on two four-wheeled trucks, the wheels having wooden centers and steel tires. The composite day carriage is of the well-known English type, with running boards on the outside, but has only two entrance doors. The upper part of the cars is painted white relieved with gold and brown moldings, the lower part is painted white relieved in gold, the whole being beautifully polished. The under frame is of iron.

The sleeping car consists of four staterooms, two containing two, and the other two containing four berths each Each compartment is provided with its own lavatory accommodations, and each compartment is also fitted up with electric communication. The panels are finished in walnut with sycamore centers and satin wood, and the lavatory compartments are finished in bird's-eye maple. Underneath the berths there is a long wardrobe adapted for holding the clothes of the occupants. The upholstering is dark-figured plush, and the carriage is heated by gas. In the center of the carriage is a smoking compartment, fitted with folding tables and easy chairs, this room is finished in walnut and satin wood, and presents a very striking appearance. Connection between the two ends of the car is obtained by means of a side aisle.

The composite carriage, in exterior, finish and build, is very much the same as the sleeping car, only less elaborate. It contains two third, one second and one first-class compartment, with lavatory accommodations to each. The difference in the different compartments is entirely in the finish, all being cushioned and well upholstered. This car represents the ordinary day coach of the London & Northwestern. It has one compartment for the storage of baggage. The coaches are fitted up with the vacuum and Westinghouse brake. The other parts of this interesting exhibit we will describe elsewhere in the paper. A. S.

### Good and Bad Views of the World's Fair.

A great many people have gone to visit the World's Fair with the idea of scoffing at what they saw, and returned to give unstinted praise. No person with common sense can walk around the magnificent "White City," as the people of Chicago delight to call the Fair buildings, without being impressed with the wonderful character of the exhibit. After spending ten days in the place, which was shorn of many of its attractions owing to its unfinished condition, we have nothing to say but words of unqualified commendation for the Exposition in itself. It is a place that every intelligent man, woman and child in the country ought to see, for they will have small likelihood of ever being able to witness such a spectacle again, and it is certain that no one has ever seen such an affair before.

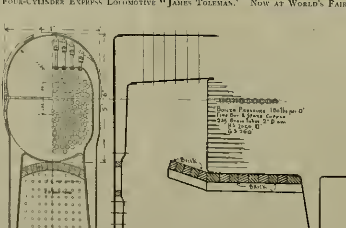
While feeling enthusiastic over the wonderful exhibition, we found many things about the place and about the city of Chicago to dampen our ardor. The exhibition would be likely to give a greater amount of pleasure to a greater number if it were not for the drawback that so many people in the Fair and in Chicago look upon it as an opportunity for making their fortune. We have never been in a city where special attraction drew great crowds of people without finding more or less extortion going on; but Chicago people and privileged persons in the Fair are showing examples of unscrupulous dealings such as the world has never seen before, not even at a political convention. Chicago and the Fair appear to have a great deal of human genius of a certain order—of the order that excels in inventing new and original methods for taking advantage of visitors under the guise of legal exactions. The people of Chicago display much sensitiveness to criticisms of the charges going on inside and outside the Fair, yet their own journals make the evil a continual object of denunciation. Unfortunately this does not seem to mend matters any.

It would take too much space for us to enumerate the large and small exactions that visitors will encounter in the Fair and the city of Chicago, but we would like to say a word about the hotel and restaurant charges. We should advise railroad men visiting the Fair to follow the practice which was so common in the Paris Exposition, of taking their lunches with them. Those who are able to do this will be likely to save themselves from annoyance. Not that there is any deficiency of eating places in the Fair grounds. We were in the Fair nine days and went to a different restaurant every time. This gave us considerable experience. When railroading in frontier regions we have often had worse meals than we found in the Fair, but then we did not look for places to be run like Delmonico's out on the plains. One can get a very satisfactory meal in most of the Fair restaurants, but the charges cannot be called moderate when they are considered in the light of the victuals eaten. Travelers do not generally object to paying seventy-five cents for a lunch; but when a lunch which can be bought ordinarily for twenty cents, is charged at the higher sum, there is cause for complaint, not to say protest, in more or less picturesque language.

The hotels and boarding-houses of Chicago appear to be following a very near-sighted policy in their charges. It was natural that the prices should be a little high, because there was the opportunity for exaction. There is no fairness or justice in raising prices because there is an unusual rush of business. It would be just as fair for railroads to raise their rates at this time as it is for hotel people to do so. There are howlings already to be heard because railroad companies are not cutting the rates in two, while everybody else is increasing charges. We will cite an instance to show how hotel charges have been raised. We have been in the habit of staying at the Great Northern Hotel, and have a right to be considered a regular customer. That hotel had been for months becoming a resort for railroad men. When we went to secure a room there during our last visit we found that the rates were just doubled. The effect of this was the driving away of all the railroad men who were in the habit of going to that hotel, and we heard a great deal of indignation expressed at what was justly considered unfair treatment. If this does not cease to be a resort of railroad men we greatly mistake the temper of those concerned. We understand that the Grand Pacific did not alter their rates for old customers, and that several of the more respectable hotels adopted the same policy, although there were exceptions, the Auditorium being one that ignored all past connections.

There are two things that we would advise our readers to do when going to Chicago. They should take a well-filled purse along, and ascertain carefully the charges at the hotel or boarding house where they propose to stay. The supply of accommodations for visitors appears to be beyond what the demand will be likely to reach, and we are greatly mistaken if the natural law of supply and demand does not cause a bad break in prices before the season is far advanced. Then people a little short of being millionaires will be able to go to Chicago and return without being utterly fleeced.


Four-Cylinder Express Locomotive "James Toleman." Now at World's Fair.



Details of Boiler, "James Toleman."

### A Curious Accident.

One of the great decapods on the Erie met with a curious accident the other night. She went out to push a train up the hill from Port Jervis. One of her forward sand-boxes was filled and the other neglected. This caused her to catch on sand on one side only, and broke the side-rod between the two front pairs of wheels; one side letting go broke the other, and the first revolution the stub end of one rod flopped over against the saddle and chest and blocked that pair of wheels. The engineer could see or hear nothing wrong after the first noise, and went on pushing the train some ten or fifteen miles. When he let go the train and started to back up she made racket enough to call for an emergency stop—she had flat spots 14 inches long on her forward tires.

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Business is so active with L. S. Starrett, of Athol, Mass., that he is building an addition of 160 x 40 feet for the manufacturing of milling cutters.

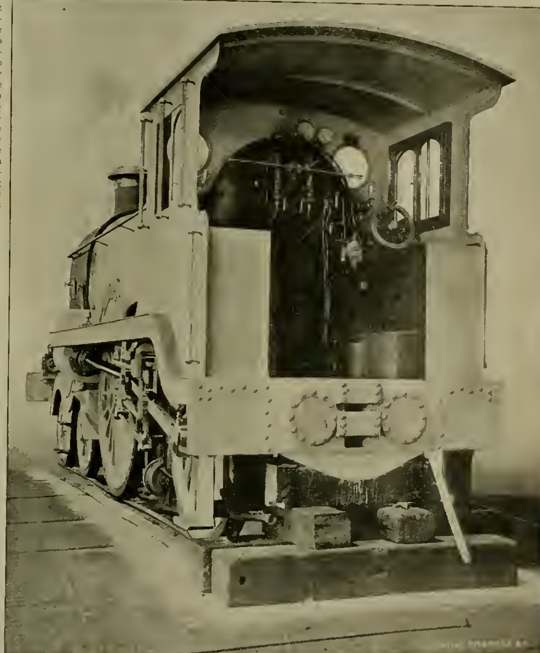
### The Locomotive "James Toleman."

The annexed illustrations show the locomotive "James Toleman," exhibited in the English section of the World's Fair. The engine is a very great novelty and attracts as much attention as anything found in the Transportation Building. The engine represents the ideas of an English mechanical engineer as to the best form of locomotive for handling fast heavy trains. She was designed by Mr. Winby, of London, and was built by Messrs. Hawthorn, Leslie & Co., the well-known locomotive builders of Newcastle, England. That the engine is very much different from ordinary locomotives is apparent to the most casual observer; but there are many novelties about the machine which can only be seen after a laborious examination. To obtain high speed and great power combined, two pairs of driving-wheels 90 inches diameter are employed, and they are each driven by two pairs of separate cylinders, the front drivers being driven by inside cylinders set under the smoke-box, and the back drivers by outside cylinders set back of the leading truck. The inside cylinders are 17 x 22 inches, and the outside cylinders 12½ x 24 inches. The valve gear for the inside cylinder is a shafting link motion, and that for the outside cylinders is Joy's motion. A striking point about the outside connection is the very long piston-rod employed to transmit the power from the cylinder to the main rod. The arrangement of cylinders and their connection obviates the use of parallel rods, which, in our opinion, is the principal real merit possessed by the engine.

To supply steam for four cylinders of the size used by this engine, a very large boiler was required and a peculiar plan was adopted to make the boiler narrow enough to go between the driving wheels and yet give room for a large number of the tubes. The boiler, as may be seen by the engraving, is narrowed at the middle of the horizontal diameter, and crossed stays are employed to bind the shell into this shape. The firebox is also of a peculiar shape, to provide a large grate area and not to unduly lengthen the boiler. The tube plate is extended back into the firebox, the lower part of the boiler shell being protected from the direct action of the fire gases by a lining of brick. The total grate area obtained by this means is 28 square feet. There are 235 two-inch tubes 14 feet 9¼ inches long, which provide 1,817.4 square feet of heating surface, while the firebox provides 182.6 square feet. This gives a total heating surface of 2,000 feet.

The engine is admirably equipped with apparatus for handling. She has a very simple form of steam reversing gear, which works simultaneously with a hand wheel. The Westinghouse quick-action brake is employed, and brake shoes are applied to all the driving wheels. These have also steam sanding devices.

The designer and English engineers generally agree that the engine has unparalleled tractive force, having 143.2 pounds per pound of steam pressure. This is high for an engine with 90-inch driving-wheels, but we have plenty of ten-wheel passenger engines with cylinders 20 x 24 inches and drivers 66 inches in diameter that have the same tractive force as the "John Toleman." The engine has about the same heating surface as Buchanan's large passenger engines, and we feel satisfied would be beaten by any of them in a race with a heavy train. The two pairs of cylinders represent a single pair of about 20½ x 24 inches, while the Buchanan engine has cylinders 19 x 24 inches. We believe that the extra friction due to the additional cylinders and their connections will take away the advantage that might be obtained from the greater cylinder capacity. After all, the measure of the capacity of a locomotive is the boiler, and Buchanan's boiler will be likely to make steam more freely than the odd arrangement of the "Toleman" boiler. The most fatal objection to the engine, however, is the complication of ports, and the difficulty is certain to be encountered in keeping the machine in good working order. The designer appears to have had no consideration whatever of the fact that repairs would have to be done very frequently to a locomotive pulling fast heavy trains. The engine is very handsome and displays admirable workmanship. She has large bearings and strong connections, and is a curiosity to examine; but we wouldn't like to have the duty of keeping a number of them in working order.



Looking into the Cab of the Locomotive "James Toleman."

### Curious Cause for Thinning of Firebox Sheets.

At the last meeting of the New York Railroad Club, Mr. Sampson Fox, the celebrated steel-maker, of Leeds, England, related a curious incident in the talk which he gave on steel plates.

He said that in the furnaces of some torpedo boats, where a very strong force draft was used, considerable trouble was experienced with the sheets failing by becoming thinned at local points. At first it was supposed that the intensely hot flame impinging on the plate, burned out the surface. On careful inspection being made, it was found, however, that the thinning took place on the water side of the sheet. Careful observation led to the knowledge that the damaged spots were at points where free access of air at the sides of the grates caused intensely hot jets of flame to strike. It was at first a mystery why the unusually hot flame should cause thinning to the inside of the plate instead of the outside. A careful investigation was made, and the conclusion arrived at that the flame was sufficiently hot to drive the water away from the sheet, and dissociate the steam into its original gases, which, of course, are hydrogen and oxygen. The hydrogen mixed with the steam, but the oxygen found a better affinity, and combined with the hot sheet, forming oxide of iron, and, of course, wearing away the material.

It would be interesting to find if failures of locomotive fireboxes have not been due to a similar cause. Some of our fireboxes certainly produce as energetic combustion as anything that can be found with forced upward draft. It may be, however, that the pull of the exhaust in the locomotive has not such a tendency to cause jets of flame to strike the side sheets. The remedy found for the trouble with the torpedo boat furnaces, was to put a bar around the grate, with a joint made air-tight inside, which prevented jets of air from passing up close to the side sheets.

### A Matter of Justice.

The Supreme Court of the United States has rendered a decision to the effect that a railroad employé cannot collect damages for an accident due to the carelessness of a fellow servant. This is a far-reaching decision, and is based on one of the most unjust laws in the statute book. The law originated at a time when every workman was familiar with the habits of his fellow workman, and could guard against careless and reckless habits. It is no more adapted to modern conditions of industry than any of the laws relating to obsolete institutions. Railroad men and everyone else engaged in dangerous occupations ought to combine to have the law changed. It was very much to the credit of one member of the Supreme Court that he not only differed from the judgment given, but wrote a very strong opinion on the other side.

The Tryon Investment Co., of this city, are putting out a sight-feed device for introducing kerosene oil into the feed-water of a locomotive, for the purpose of preventing scale. Their device is well known in stationary practice, where its success is unquestioned. Kerosene is absolutely safe and will not produce foaming.

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*The editors reserve the right to use or discard matter for the reading columns entirely on its merits. The reading columns will not be sold.*

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## The New York Central Brake Trials.

The report of the tests made last September of freight train brakes at Karner, on the New York Central road, by P. H. Dudley, C. E., has been published.

This work is composed of sixty-seven large pages containing many tables and diagrams and overflows with details, that, to the ordinary railroad reader, covers up all the essential points that he wants to get at the worst.

We do not believe the report contains a single misstatement, but there are so many entirely superfluous ones, and they are so general—no comparisons drawn, no difference pointed out and no general summing up done—that, to say the least, the report is vague, unsatisfactory and disappointing. Still, it's a report "that will be liked by people who like that sort of thing."

The main object of the test was to determine the relative merits of the Westinghouse and the New York automatic brakes. Two trains of fifty cars each, all alike, all of one make and all of one age, were equipped with the two brake apparatus. The foundation brake, the main air-pipe, hose and fitting were alike on each train, and the engines were just alike except the numbers.

In emergency stopping tests the trains were run side by side at one speed, the brakes applied by a tripping device on the track and results noted. The engineers got their fifty cars each into good control, in all instances running at the same speed and in one instance passing the signal at exactly the speed asked for (thirty miles per hour) and this without instruments on engines to record speed.

Each train made four emergency stops, and among the mass of information we find that the average length traveled by the Westinghouse train before stopping was 360 feet and the average stops of the New York Brake train was 418¼ feet. This is in favor of the Westinghouse train of 58¼ feet or over 16 per cent. It is only fair to say, however, that there were break-in-twos in two of these tests, and that there was a difference in train-pipe pressure in one test, if corrections were made for these differences a still better showing would be made for the Westinghouse brake.

The shock at the rear end of a fifty-car train is a matter of great importance, and all railroad men who know anything about brakes, are aware that shocks are caused by slow application of brakes, the one next to engine going on first, then the next and so on, allowing the rear cars to strike those ahead.

In these emergency stops, the average shock recorded by the slideometer on the Westinghouse train was 2¾ inches, that of New York 28¼ inches. The reason of this was told by record of the standing tests.

In this test each train was divided in half and the two halves placed side by side, on parallel tracks, a pipe connected the 25th and 26th cars, thus bringing the 50th car beside the engine, and this last car was attached to Mr. Dudley's dynagraph car where delicate instruments recorded results.

From the time the brake went on to the first car on the Westinghouse train until it applied on the 50th car was 2.58 seconds, while on the New York train it was 3.07 seconds in doing the same work. This is a difference of but half a second, which seems awfully small, yet it is 20 per cent. of the time required, and enough, so brake experts say, to account for the difference in shock.

Another interesting and important test was made. It was the same as the above except that three consecutive brakes were cut out on each train. Under these conditions the fiftieth car on the Westinghouse train applied in 2.47 seconds, average time for three trials. The New York brake had five trials in this test; in the first and last the brakes behind those cut out did not apply at all, and in the other three trials the brake went on the fiftieth car in 3.75 seconds.

Trains where the two brakes were mixed up showed that slower stops and heavier shocks were had than when a full train of either brake was used.

The service stop tests were as exhaustive as the report, but they showed something of importance—especially to mountain roads.

In one of these tests a moderate reduction was made through the service application port and repeated until full application was had. In this test some of the New York brakes did not go on, and in a second test others stayed off and the old offenders worked.

In one test the brakes were fully applied by emergency and left on. In thirty minutes none of the Westinghouse brakes had leaked off except one that had a ruptured jacket. On the New York train fifteen had leaked off in thirty minutes.

Tests were made to determine leakage; this was done by admitting air to release the brakes through a $\frac{1}{16}$-inch hole in a diaphragm, all conditions being the same. It was found that in five minutes the pressure in the train-pipe of the Westinghouse train was 10.50 pounds, and in the train-pipe of the New York train it was 22 pounds. In 15 minutes the first-named train line had a pressure of 53.55 pounds, while the second train had a pressure of but 47 pounds, showing that there was a heavy leak at first.

There were quite a number of other trials running and standing, and there is something to be learned in each of them, but space forbids our summarizing them here. Mr. Dudley makes some interesting statements, as, for instance, the following:

"* * * A loaded grain train, of a total gross weight of 3,000,000 pounds, running at 25 miles per hour—not uncommon on your line—(N. Y. Central) would require and have stored in the train an amount of energy greater than can be imparted to a projectile by the largest of modern guns, 3,000,000 pounds multiplied by 20,896, velocity head, equals 62,688,000 foot-pounds, the same amount which would be required to lift the entire train 20,896 feet above the track. This vast amount of energy must be supplied by the locomotive besides overcoming all other train resistance of friction, air, grades and curves, and requires a long run to do it, and it then requires distance and very efficient brakes to destroy the energy in a harmless way and stop the train."

Again: "The present time of application from the first to the fiftieth car is so near the velocity of sound waves, that it is more difficult to shorten the time one-tenth of a second now than it was to shorten it ten seconds in 1886 or two in 1887."

To the average observer watching these tests there was little difference in the stops; the two trains running neck-and-neck when the brakes went on and stopping about an engine length from even *seemed* pretty evenly handled by their brakes. The average observer was comparing the difference between the engines' pilots with the great length of train. The brake sharps were comparing it with the length of the stop—it was about 2 per cent of the first, but 16 per cent. or more of the latter.

A report of a comparative test, that does not compare, is in the nature of a certain good book—contains many true things but furnishes such a variety of good, bad and indifferent, leaving each to pick out what suits him best, that the lay reader needs a pilot to steer him aright.

The Westinghouse people have every reason to be satisfied with the report, their brake having done the best on the vital points—why should it not? They have been through this all before, and have years the start of all competitors in experience—many a new brake concern are spending their good money to-day experimenting with something that Westinghouse took up and abandoned years ago. If a new brake concern had put on the market, on the very start, a better brake than the Westinghouse, it would have been more than a wonder—it would have been a miracle.

## Reduce Delay at Stations.

One of our correspondents, who has watched with interested attention the numerous improvements effected on rolling stock and railroad machinery generally for the purpose of making train running time on reduced expense, suggests a novel improvement.

He appears to think that compounding locomotives is in the line of progress, but he thinks that considerable saving could be effected if a little more attention was given to the conductor of the train. We believe the position taken to be perfectly sound, and have no doubt whatever that the practice of neglecting to see that the men on the hind part of the train perform their duties properly is responsible for a great deal of waste and annoying delays. A conductor who is of a social disposition and likes to make brief visits to his friends at stations, is likely to be very expensive to his company.

We can give an illustration of how this thing worked on a Western road that we are familiar with. The locomotives in use pulling a particularly fast train were considered unequal to the work, and larger engines were bought for the purpose of hauling that train. After the engines had been in service for a few weeks it was found that they did not make the time any better than the other engines, and the traveling engineer was instructed to ride on the new engines and find out the source of trouble. He did so, and the experience of a trip or two convinced him that the engines did very rapid running, and he could not make out why the trains were not taken through on time. To supply a graphic record for the use of the manager, he applied a speed recorder to the engine without saying anything to the train men, and took a record of several trips. This showed that the engines ran at a speed over sixty miles an hour part of the time, when the average speed was about thirty-five miles an hour.

It was seen that the loss of time was at stations. The conductors would go into the telegraph office and have a few minutes' social talk with the operator; at other places a few minutes would be spent talking to other trainmen, and dependence was put on the engines for making up the lost time. After the manager examined the record of two or three runs, he entirely exonerated the mechanical department from all blame for the loss of time in running the trains, but he gave the conductors talk of a very impressive and picturesque character. There has been a great decrease of sociality on that road since then, but the trains go through on time. Not a few railroad managers might with advantage get a useful hint from this experience.

## The Mechanical Conventions.

The conventions of the two railroad mechanical associations will be held in the middle of next month, and the business laid out for the meetings indicates that very interesting and profitable sessions will be held. There appears to be considerable apprehension that these conventions will be thinly attended this year on account of the counter attractions of the World's Fair being likely to keep many of the members absent. It seems to us that there ought to be as many present as there usually are, for the World's Fair will offer an inducement to members at a distance to go to Chicago, and the journey from there to Lakewood is so short that few would hesitate to undertake it. We understand that in the immediate neighborhood of Chicago some of the members of both associations are likely to be kept at home, owing to the large extra business that will be performed by their roads in the middle of June. The decrease of numbers due to this cause promises to be made up by a larger attendance from the distant States. We have heard some fears expressed that the accommodations furnished by the hotels are likely to be too limited for the comfort of the visitors. We have made careful inquiries into this matter, and have been assured that nothing will be spared to make the conventions as comfortable as possible. There are two good hotels that will furnish about five hundred rooms, and twenty cottages that will furnish over a hundred more. Besides this there are a number of other good hotels and boarding-houses in the place, and Jamestown, a city of twenty thousand inhabitants, is only five miles away, and is connected with Lakewood by an electric railroad that has an excellent service of cars.

Complaints have been heard because the hotel keepers propose to put two men in a room, when the applicant has no one with him. This is nothing new, and has been done at all places where the conventions have been held of late years. The difficulty is that the conventions have become so large that it is almost impossible to find a place with hotel accommodations sufficient to provide a room for each person. We know of no place where this can be accomplished except at Saratoga. If the members and their friends are not satisfied with the limited accommodations of the ordinary watering-places, they ought to establish a regular meeting place in some town where the accommodation will be equal to the demand.

In other respects Lakewood is a splendid location, and is certain to be popular with most of the visitors. It is a beautiful place with fine shady drives and a beautiful lake that has excellent fishing and the best of boating accommodations. We feel certain that those who go to the place of meeting without prejudice will come to conclude that the Joint Committee did not make any mistake in deciding on Lakewood. They had a very difficult task to perform in making a selection, for there was no place in the neighborhood of Chicago where reasonable rates could be obtained.

## Merits of Different Engines for Passenger Trains.

Since six-coupled types of locomotives are coming so largely into service for hauling fast heavy passenger trains, great diversity of opinion has been manifested respecting the real value of this kind of engine for the service named. Renewed interest has been thrown on the subject by the decision of the Chicago, Burlington & Quincy to abandon six-coupled engines and return to those of the eight-wheel type. The Mogul type of engine has been in use on the C. B. & Q. for several years for passenger trains. Talking at a Western railway club meeting on the reason why this kind of engine was tried, Mr. G. W Rhodes says "We were having our passenger trains and our heavy freight trains run with double-headers, and every now and then we would have something fail or break down on the engines." He explained that the use of double-headers doubled the chances of breakage and the chances of axles running hot, so his company decided on using Mogul engines, which were fairly satisfactory; but they undertook a series of tests to obtain accurate records of different forms of locomotives pulling the fast train. These tests indicated that at very high speed the pull on the draw-bar is much less than at low speed. This fact led them to the conclusion that on long continuous runs it was not necessary to have the heavy adhesion obtained by six-coupled engines. This being the case, four-coupled engines would be more satisfactory on long runs than six-coupled, since there would be one pair of journals less to heat and fewer connections to give trouble. They had decided to continue using six-wheel connected engines for service where stoppages were frequent.

Mr. Barr, of the Chicago, Milwaukee & St. Paul, said that his company had come to a similar decision to that outlined by Mr. Rhodes in regard to engines for through passenger service.

This seems to be an important movement. In the course of a protracted tour the writer made a great many inquiries respecting this question of eight-wheel against six-wheel connected engines, and was surprised to find how conflicting the views are of men who ought to be thoroughly informed respecting the merits of the two types of engines. One set of men hold that the eight-wheel engine is preferable to the other, because it is easier on the track, while other men who ought to be equally well informed on the subject say that it is quite the reverse, and that a ten-wheel or Mogul engine is much easier on joints, curves and bridges than the heavy eight-wheel engines employed for fast passenger train service. They say that the ponderous weight on the engine truck strikes joints, curves and bridges with blows in proportion to the weight carried, and that the types of engine carrying less weight in front are much easier on the structure. It appears to us that this phase of the question ought to be thoroughly investigated by the engineering department. An engine may be very satisfactory to the mechanical department and yet be very expensive for the service of the company. Before a final decision can be reached respecting the merits of these two types of engines the effects of the different forms on the permanent way ought to be properly understood.

The railroad men who are most in favor of the use of eight-wheel engines assert that the others are more expensive for repairs. On this question there is also diversity of opinion, and we are inclined to think that there is very little difference. Of course, six-wheel connected engines have extra journals, extra tires, and extra rod connections to keep in order, but they do not slip so much as the others, and the lighter weight per journal makes them less liable to suffer from hot boxes

During a discussion at one of the Master Mechanics' Conventions, objections were raised to ten-wheel engines on the ground that the tires of the hind pair of drivers were very liable to wear faster than those of the other drivers. If this fault were inherent to this form of engine it would greatly depreciate its usefulness, and would be liable to cause broken rods, bent pins and excessive wear of journals. The engines that displayed this peculiarity must have been defectively designed, with too much weight on the rear drivers, for our inquiries fail to find any case where there was a decided tendency of the tires of ten-wheel engines to wear irregularly. All the evidence collected pointed to the fact that the tires wear as uniformly as the tires of eight-wheel engines.

### To Abolish Passes for Employes.

There is a report current that the Pennsylvania Railroad Company intend to stop giving passes to its own employés. As this company has always been noted for its generosity towards its employés, especially in the small favors that cost little and generate good feeling, we are inclined to doubt the truth of the report. There is no railroad in the country where the *esprit du corps* and pride in the system is so prevalent as on the Pennsylvania proper, and this spirit is not cultivated by refusing to grant favors that do not belong to the letter of the bond. Any change of policy which would reduce the cordial relations between the company and its employés would be a calamity to the road and a very costly experiment. There are officers high in power on some of the Western Pennsylvania lines who strive to be so intensely just with all classes of workmen that they would not let any person below the dignity of a section boss ride on a handcar if they could help it. This class of officer says that a railroad man has no more right than any other person to ride on a train without paying. This is no doubt abstractly correct, but it is a policy which no railroad company has ever followed, and it will be a sad day for the Pennsylvania Railroad Company should such narrow-minded practices be inaugurated. Any employer who displays solicitude lest an employé should receive anything more than he is entitled to by the agreement between the two is not likely to be very well served. Zeal and personal interest in the way duties are performed are not paid for in money, but it is highly important to a railroad company that the majority of the men should display these attributes. The best way to obliterate the noblest qualities of workers is to give them to understand that no favors will be given.

### Old Inventions Made New.

There is something curious about the persistence with which some old inventions are given new life by the inspiring influence of the Patent Office. There are several patents in active force to-day giving protection to furnaces with downward draft, yet this invention dates back into dim vistas of centuries. We rather suspect it was a favorite plan of burning fuel with the ancient Greeks, yet an ingenious French physician named Papin, in 1680, claimed the invention of the downward draft furnace. It has had a great many admirers since that time, and not a few inventors who could not find any other part about an engine on which to hang a spark-arresting patent have boldly invented downward draft for that purpose. We frequently read over the fascinating pages of the *Patent Office Gazette* and sigh half-forgotten prayers to keep us from being drawn from the paths of truth and rectitude by its romancing and impudent distortions of truth in the interests of inventors who never had an original idea. When claims of novelty are made for devices that are nearly as old as Noah's ark, we wonder if there really is anything new under the sun.

### Cranks' Products Excluded.

Those who visited the Chicago Exposition of Railway Appliances in 1883 will remember how much valuable space was wasted by being occupied by a collection of impracticable car-couplers and other inventions that no sane railroad man would think of applying to railroad machinery. Those who go to the Columbian Exposition will find that the products of the crank are conspicuous by their absence. We understand that Mr. W A. Smith, chief of the Transportation Department, had to display Spartan qualities in refusing absurd car-couplers and impracticable devices, but he has succeeded wonderfully well. In spite of his watchful care a few crank notions have been admitted, but they are scarcely noticeable. There are two or three car-couplers that will excite merely fun and ridicule from railroad men, who are the most vigorous of critics. But the exhibit which will excite most ridicule is the H. B. & L. elevated and electric train, which consists of a model of one immense car carried on a single pair of wheels at each end, which are supposed to be about 15 feet in diameter. There is supposed to be an electric motor for propulsion on each end, and the ends are pointed to cut through the wind. These funny exhibits are not without good uses, for they give visitors a little relaxation and offer good material for small jokes.

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The American Railway Union, the new, non-secret association of railroad employés, of which Eugene V. Debs is president, have issued a pamphlet setting forth their principles and calling for a mass meeting of railroad men in Chicago on June 20th, to perfect the organization and commence the work. The promoters of the new order have made-over nothing. They have built on entirely new foundations, placed on new ground. They propose to afford protection of rights to employés and to employers as well, to keep the cost of membership down to a dollar per year, or less; to do away with secret meetings, conventions, grievance committees, strikes and boycotts. The engineers-in-chief have surveyed off a very large and stony field for operations, but the directors are energetic, able and sanguine of success. It goes without saying that the success of such an order means the eclipsing of the present forms of railway labor orders. An interested public, as well as railroad officers and employés, will watch the progress of this new democratic fraternity with interest. They offer to send their pamphlet free to interested parties who ask for it. The headquarters of the order will be at the Ashland block, in Chicago.

### BOOK REVIEW.

THE RAILWAY PROBLEM By A. B. Stickney. D. D. Merrill Co., St. Paul, Minn. Paper binding. Price, 50 cents.

This book will be a surprise to the reader. The author is president of the Chicago, St Paul & Kansas City road, and one expects from the start to find a defense of railway management against the so-called granger laws, the discussion of which called this work out. But Mr. Stickney shows up some of the iniquities practiced by the railroads and rather takes the side of the granger if anything. He brings to his use inside facts and all the time impresses the reader as one who is arguing for justice for the whole people and not for a class. He exposes the bones of the idol of discrimination and shows why people worship it—because it is called competition. Mr. Stickney believes in a rate made and maintained by Government

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Pedrick & Ayer, of Philadelphia, are very busy on the larger sizes of Richard's open side planers and their milling machines. The open side planer is a whole repair shop on one foundation, and is destined to become a popular railroad shop tool.

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LOCOMOTIVE ENGINEERING may be depended upon to publish more engravings of engines at the World's Fair than all the other papers combined.

### PERSONAL.

Mr. J H. Hamilton has been appointed general manager of the Northern Adirondack Railroad.

Mr. John Bonner has been appointed master mechanic of the San Francisco & Northern Pacific, with headquarters at Tiburon, Cal.

The jurisdiction of Mr. J. J. Ryan, general master mechanic of the Eastern lines of the Southern Pacific, has been extended to Algiers, La.

Mr. E. T. Burnett, assistant purchasing agent of the Norfolk & Western, has been appointed purchasing agent of that road, with headquarters at Philadelphia, Pa.

Mr H. L. Gault has been appointed superintendent of the American Steel Wheel Co.'s Works at Garwood, N J He was formerly with the Midvale Steel Co.

Mr. M J. Drury, formerly gang foreman on the Atchison, Topeka & Santa Fé, at Topeka, Kan., has been appointed general foreman on the same road at La Junta, Col.

Mr Geo. Bailey has been promoted to be master mechanic of the Great Northern, with headquarters at Breckenridge, Minn He was formerly an engineer on the road

The many friends of Mr H. B. La Rue, the well-known railroad supply man, will be sorry to hear that he has lost the law-suit which he brought against some parties for slander

Mr. A J McBlair has been made superintendent of the Chicago South Side Rapid Transit. Mr. Blair has been on the road as assistant to the president since it began operating.

Mr. G. D. Hutchinson has been appointed superintendent of the Chicago, Fort Madison & Des Moines Railroad in place of Mr E. F. Potter, resigned. His headquarters are in Fort Madison, Ia.

Mr. E. H. B. Kopperman, formerly foreman of locomotive repairs at the Buffalo Creek shops of the Buffalo, Rochester & Pittsburgh, has been made master mechanic in charge of the shops at that point

We regret to hear that Mr R B Sutherland, master mechanic of the Boston, Revere Beach & Lynn Railroad, has suffered from a severe attack of pneumonia We are glad to hear that he is able to be about again.

Mr S. R. Tuggle, formerly with the Kentucky Central, has been appointed master mechanic of the Newport News & Mississippi Valley, with headquarters at Paducah, Ky., in place of Mr. Wm. Hassman, resigned.

Mr. Jas. A. Graham has been appointed master mechanic of the Cleveland, Lorain & Wheeling R R, with headquarters at Lorain, O. He was formerly a passenger engineer on the Canada Southern, part of the Michigan Central

We have to acknowledge a pleasant call from Mr Herman Johansson, mechanical engineer in charge of the Swedish State Railways at Stockholm. Of course Mr Johansson came here for the purpose of visiting the World's Fair.

Mr. Charles B. Peck, assistant general manager of the San Antonio & Aransas Pass Railroad, has accepted the position of general manager and chairman of the Texas Car Service Association, with headquarters at Houston, Tex

Mr. James Morrison has been promoted to be train master of the Chicago South Side Rapid Transit. He was trained on the Manhattan Elevated and was considered by Colonel Hain one of the smartest train dispatchers on the system.

Mr. William McPhail, master mechanic of the Ohio Southern, was killed at Springfield, O., last month by the breaking of a pulley which he was using to pull a derailed engine upon the track. He went to that road from the Chicago & Eastern Illinois.

Mr. Charles Froberg has been promoted from roundhouse foreman at Albert Lea, Minn., to a similar position on the M. & St. L. R. R., succeeding Mr. B. Reiley, who has taken charge of the M. P. department of the Des Moines Northern & Western R. R. of Iowa.

Mr. W. H. Truesdale, receiver of the Minneapolis & St. Louis Railway, has been elected president of the company. Mr. Truesdale has been with this company a great many years, rising from a subordinate position, and no one is better acquainted with the needs of the company.

Our correspondent, Mr. L. C. Hitchcock, has been compelled for his health to move away from the harsh climate of Minnesota, and he has found a location in Los Angeles, Cal., where he has linked his fortunes with the Southern Pacific Co. We heartily commend Mr. Hitchcock to the good-will of Master Mechanic Gregg.

Mr. James Farrell, master mechanic of the San Luis division of the Mexican National, has been appointed master mechanic of the Northern and Texas divisions of the same road, with headquarters at Laredo, Tex. Mr. M. J. Schneider has been appointed to succeed Mr. Farrell as master mechanic of the San Luis division, with headquarters at San Luis, Potosi.

Mr. C. E. Nichols, who for the past ten years has been a machinist and shop foreman for the Northern Pacific road, has been appointed master mechanic of the Spanish-American Iron Company's road and shops at Santiago de Cuba, in the West Indies, sailing for the scene of his future labors from this city on May 11th. From a Dakota blizzard to a Cubian box fry is quite a change.

A variety of personal changes have been made by the new management of the Santa Fé. The road has been divided into two parts, with Mr. H. R. Nickerson as general superintendent of the eastern and Mr. H. U. Mudge as general superintendent of the western portion. The jurisdiction of Mr. John Player, superintendent of machinery, has been extended over the Colorado Midland division.

The Order of Railway Conductors, in session during the past week at Toledo, re-elected Grand Chief Conductor Clark, of Cedar Rapids, Iowa, by acclamation. Others elected were: C. H. Wilkins, Chicago, assistant chief; A. B. Garretson, Osceola, Iowa, grand senior conductor; E. W. Purrett, Toledo, grand junior conductor; W. P. Daniels, Cedar Rapids, Iowa, secretary and treasurer.

On May 2d, Mr. M. D. Monserrate, vice-president and general superintendent of the Gulf, Western Texas & Pacific and New York, Texas & Mexican Railways, tendered to the Southern Pacific Company his resignation. He had been in this office for nineteen years. As soon as relieved he went to San Antonio to take the position of vice-president and general manager of the San Antonio & Aransas Pass.

Mr. John C. Mackinnon has been appointed general manager of the Chicago, Fort Madison & Des Moines, with headquarters at Port Madison, Iowa, to succeed Mr. J. P. Tucker, resigned. Mr. Mackinnon has been general freight and passenger agent of the road since February last, and it is understood that he will continue to perform the duties of that position in addition to those of general manager.

Those who were at the last Master Mechanics' Convention will remember the smartness displayed by Mr. E. S. Jackman in advocating the merits of Park Brothers & Co.'s steel. Mr. Jackman appears to have prospered since that time, for a company has just been formed bearing his name, with offices in the Rookery Building, Chicago. We have no doubt that Mr. Jackman is prepared to talk steel to any caller.

Mr. B. M. Brown, one of our club raisers at Covington, Ky., and a remarkably warm friend of the paper, was killed at London, Ind., by a collision with cars blown out of a siding. He was crushed in attempting to get off his engine, which was one of those lately designed for the company with the boiler head coming to back end of frames. There is a feeling among the men that to the awkward style of engine was due the death of Mr. Brown.

Mr. Joseph York, whose portrait appeared in LOCOMOTIVE ENGINEERING last July, has gone to Chicago to be employed in connection with the Baltimore & Ohio's exhibit at the World's Fair. Mr. York now resides in Meadville, Pa., where he is living retired after being long employed, first as an engineer, then as a conductor, on the N. Y. P. & O. His first railroading was done on the B. & O. in 1837, when he went to work firing a grasshopper locomotive. Within a year he was an engineer, and ran grasshopper engines for three or four years. Then he went taking out engines for the Norris Works and from that took a turn as engineer on nearly all the leading roads in the North before the war. He is still a hale and hearty gentleman, seventy-four years old. We expect to fill our note book with reminiscences of old time railroading when we meet him at the Fair.

One of the most regular visitors to this office since it was opened has been Mr. H. L. Leach, of Boston, who could lure the editor from his desk on his busiest day to listen to well-told reminiscences of locomotive building and railroading extending over fifty years. It seems only a few days since Mr. Leach was dilating to us about locomotive construction of the olden time, yet it is sad to reflect that we will listen to his voice no more. He was attacked by pneumonia last month and succumbed within a week. Mr. Henry L. Leach made his mark in the mechanical world as superintendent of the Hinckley Locomotive Works of Boston, and he lost the savings of a life-time when the concern failed. We say it to the credit of Mr. Leach that twenty years ago, when interchangeability of parts had not come into fashion, that he built engines that were the most absolutely interchangeable locomotives we have ever found. How he did the work with the ancient tools the chief proprietors of the works insisted on maintaining in use is a mystery. Of late years Mr. Leach has been in the railway supply business, and devoted his principal attention to pushing a rail-sanding device invented by his son. He was one of the oldest members of the Railway Master Mechanics' Association.

One of the best engineers in the East, Morris Clapp, of the Central R. R. of N. J., has been appointed foreman of the Communipaw shops of that company—the New York terminals. There are very few runners better known than Clapp; he has always taken a deep interest in the Brotherhood, has represented his division for years, has made piece and got an agreement between the road and the men many a time. Morris will now find out what it means to have 400 jobs on 100 engines, with force enough to do about 13. This will call for his best judgment in choosing what 13 jobs shall be done and what 387 shall go undone. He will also find how much kicking is justifiable and how much comes as a matter of course. If there is any one man that the boys ought to help make a record it's Morris, he deserves help at their hands—and we believe he will get it. If "the boys" would only take an interest in the success of one of their own number when a position of responsibility is given him there would be more engineers become master mechanics and superintendents of motive power; but the tendency of the majority seems to be to "rattle" the new incumbent and make him give up. This fact and the other one that the roads pay less for general foremanship (and often master's position) than they do for the best runs, makes many good men tired of the raw-hiding and they go back to the throttle, just as John Ericsson, whom Clapp succeeded, did.

In the death of Mr. John Black, which happened at his home in Lima, O., the Master Mechanics' Association loses one of its oldest honorary members and many railroad men lose a friend. Mr. Black came to this country from Scotland in 1850, and went to work as a machinist with a firm building locomotives. After gaining some experience in Eastern shops, and in running

locomotives, he went West and rapidly rose to be master mechanic of the Dayton & Michigan Railroad. When this road was absorbed by the Cincinnati, Hamilton & Dayton, Mr. Black became superintendent of motive power, and remained there till within a few years. By judicious investment of his savings Mr. Black accumulated considerable property.

A host of railroad men and people connected with the supply interests are touched with sorrow at the sudden death of Mr. George B. Ewing, agent for the Ashcroft Mfg. Co., who was killed last month on the Illinois Central Railroad, near the Fair grounds at Chicago. One of the firm which he represented, writing about Mr. Ewing, says: "He was in our employ ten years and was very highly esteemed by every one connected with us, old and young. Aside from his value to us as a representative, he became greatly endeared to us by his personal qualities. As you know, he was a Scotchman, born in Aberdeen, and was a man of that sturdy character, intelligence and integrity that always makes itself felt among men. The letters we are receiving from the largest houses in the country, written by the principals, are a very touching tribute to his qualities as a man and a business man. He leaves a widow, son and a married daughter at Wilkinsburg, Pa., one of the suburbs of Pittsburgh. He was in charge of our Ashcroft and Consolidated Safety-Valve Co.'s exhibits at the World's Fair, and was very much pleased with the fine location we had and the magnificent exhibit that we sent him, and he anticipated great pleasure in meeting his many friends during the summer while in charge of the exhibit. His loss to us is almost irreparable in the sense of anyone valuable to us in a business point of view and also as a friend. It is one of the severest losses we have ever met in our business family."

Intimation has been given by Park Bros. & Co., of Pittsburg, that Edwin S. Jackman Co., Rookery Building, Chicago, will act as exclusive agents for the sale of their steel and copper.

## Examining Firemen.

The Traveling Engineers' Association, the new educational association recently formed, are getting down to business. At their September meeting in Chicago they will discuss several important questions. One of these, and a very important one it is, as it means the determination of the standard of intelligence of future locomotive engineers, will be the report of the Committee on the Examination of Firemen for Promotion and New Men for Employment. The committee have sent out a circular asking replies to the following questions:

1. Do you examine your firemen on machinery and ability to handle same before promoting them to engineers?

2. Do you use any progressive form of examination?

3. Do you examine them on various kinds of "break downs," and how to get an engine to the shop?

4. Have you any educational test, except ability to read and write English fairly?

5. Do you examine engineers hired from other roads: if so, do you do it as thoroughly as when examining firemen for promotion, or more so?

6. Do you have any set form of questions, or do you ask questions as you see fit?

7. Do you examine applicants for position as fireman; if so, what does it consist of?

8. Do you examine on air-brake practice and how is it done?

9. Do you examine them on colors and vision?

10. Who examines them on time card and rules?

11. Do you have any age limits for new men—youngest and oldest?

12. How are the examinations conducted? Are answers written or verbal?

13. In promoting men, do you consider ability paramount of seniority?

14. How do you determine the comparative standing of men examined?

15. Is the examination conducted by a board, or by yourself only?

16. Do you consider the ability of men to economize in the use of supplies when promoting firemen?

17. Are engineers for whom firemen have fired consulted regarding candidate's ability? If so, has their opinion any weight in the matter?

18. Do you issue any form of certificate to candidate passing a mechanical examination?

19. If a man does not pass his first examination, do you give him one or more trials?

## President Lincoln's Private Car.

Information has been wired over the land that a car built at Alexandria, Va., thirty-five years ago, for the use of President Lincoln, has been taken into the Union Pacific shops to be rebuilt, put in its original condition and sent to the World's Fair. The call for historical appliances to be sent to the World's Fair has been the means of the cleaning and polishing many an old relic that otherwise had fallen upon evil days. Few cars of high degree have ever gone through such ignoble uses as that car built for President Lincoln. By the time the war closed she was already out of date, was sold among other government property and was sent West to decay with the rising country. By degrees the old car descended in the social grade until she reached what railroad men regard as the bottom of the ladder, having been converted into a boarding-house car for a construction gang. The next move was naturally the scrap heap, but it has escaped that place, and will appear in gay array at Chicago, and no doubt after that will go to some museum.

## Canadian Pacific Exhibit.

[EDITORIAL CORRESPONDENCE.]

At the front of the Canadian Pacific's exhibit, at the World's Fair, is a ten-wheeled locomotive, weighing 106½ tons, [illegible],000 pounds being on the drivers. The cylinders are 19 x 24, and the driving-wheels 69 inches in diameter. The valves are balanced with ⅞-inch lap and $\frac{3}{32}$ lead. The front pair of driving-wheels has bald tires. The boiler is of the wagon-top variety, made of steel throughout, and carries a steam pressure of 180 pounds. The wheels of engine and tender truck have wrought-iron centers, with steel tires; the engine is equipped with the Westinghouse driver-brake. It is very plainly finished with Russia iron jacket, black painted wheels and polished rods. The tender is black with a single gold-bordered panel, having red facing. The engine supplies steam for heating the train, which is done on the consolidated system, and engine and train is equipped with the air signal.

The cars are all finished in mahogany outside and have a most striking appearance that attracts much attention.

The baggage car is the standard type of the road, of soft wood, finished in oak graining. Next car is a second-class sleeping car, the only kind of this class used for through travel. It has a very handsome interior, with leather-covered seats and mahogany finish. The seats can be made up into sleeping berths, very similar to the Pullman first-class cars, the upper berths being made in the same manner. The car has sixteen sections. There is a ladies' lavatory in one end and a gentlemen's lavatory in the other. In every respect it seems equal to an ordinary first-class coach, except in the upholstering of the seats.

Next is a first-class day coach, which is one of the most striking triumphs of the car builders' art we have ever seen. It is finished throughout in white Honduras mahogany, elaborately carved, with parcel racks made in the form of extended shelves, supported by beautifully carved brackets of the same wood as the car. It is divided into four parts by small casements supported on double columns that extend half way along the seats, forming a semi-partition; these are open and do not obstruct the view of the car, but they give it a novel and massive appearance. The head-lining is made of the solid wood, beautiful panels being selected for this purpose. There is a smoking-room at each end, with three seats on each side of the main aisle, the seats being upholstered in corded plush. The finish of the smoking-room is oak, beautifully carved like the rest of the car. The arrangement is that the smoking-room towards the rear end of the train is used when train is running. There is a ladies' lavatory in one end, the gentlemen's in the other. The main body of the car is upholstered in wine-colored plush, and the body of the seats are of wood, the same as the rest of the inside.

Next comes the dining-car, containing five tables on one side that hold four persons and five on the other that seat two persons each. This car is also finished in white Honduras mahogany and presents a most striking appearance although less ornate than the day coach. All the train is lighted by electricity, but this dining-car seems to have an unusually large share of light, there being ten incandescent lights in body of car. The seats of this car are very massive in appearance, covered with morocco leather of terra cotta color. The floor of dining-car is very heavily carpeted. At the end of each table there is an elaborately carved bronze alcove, with a smaller recess beneath that looks like a miniature balcony. At the back and end of each seat there is a rounded pillar, terminating in a carved scroll, which seems to support the plate beneath the rounding panel. The head-lining of this car is also of solid mahogany and has a very striking appearance. The sideboard, which in this case faces those looking through the car, is a very elaborate article, rounded at the base, with two massive rounded pillars forming the front support for the top, which is a section of an octagon, beautifully carved, with plate-glass in each panel. The part which leads to the kitchen is finished in dark oak. The kitchen is finished in oak and has tables and wash-sinks covered with copper. There is also a very large hot-water boiler of copper, and very complete arrangements are made for the holding of dishes and cooking utensils.

The last car is a sleeper, finished like the others in white Honduras mahogany. The style of finish has a modest look, yet on close examination is extremely ornate—a great deal of carving being done on the wood work. The seats are covered with yellow raw silk, beautifully flowered. The main body of the car consists of eight sections, and at each end there is a very elaborately carved bulkhead, with an arched door, closed by a silken curtain. There is a tasteful grating of bronze above each door. The head lining consists in this case of four panels with an oblong gilded center. The car bears the traces of high artistic design and exceedingly skillful workmanship. At one end there are two staterooms, with three berths each, a sliding door intervening, which makes each entirely separate. These rooms have raw silk lining, richly flowered, and the seats are finished in dark green plush with raw silk hangings; the window curtains are also of beautiful flowered silk. In connection with these staterooms there is a very large toilet room, which is finished in oak, with handsome plate glass mirrors. The gentlemen's wash-room is square, finished in oak below and white mahogany above. At one end it has a lounge of corded plush, extending across the room, and the other has very finely finished wash basins and mirrors. Beyond the wash-room is a bath-room, and beyond that the water-closet, both being plainly finished in oak. The cars as well as the engine tender are equipped with the Trojan coupler, and the cars with the Barr vestibule. The last two cars are carried on 6-wheeled trucks. The cars are supplied with Pintsch gas for lighting, as well as electricity, heating being done on the consolidated system.

A. S.

## Schenectady Compound.

The consolidation compound locomotive shown belongs to the Schenectady Locomotive Works exhibit at the World's Fair and was built for the Mohawk & Malone Railroad. The engine weighs 149,000 pounds, of which 132,000 are on the drivers. She is of the two-cylinder type of compound, the high-pressure cylinder being 22, the low-pressure 32 inches diameter, the stroke being 26 inches. She has Richardson balanced valves, with 5½ inches travel and ¼-inch outside lap. The engine is notable for the large bearings of all journals and connections, the driving-wheel journals being 8½ x 9 inches. The pony truck has a swing-bolster and Krupp wheels. The boiler is the wagon-top style, 62 inches diameter in front.

SCHENECTADY COMPOUND CONSOLIDATION. NOW AT WORLD'S FAIR.

Engineer E. Beans, better known along the line of the N. Y., O. & W. as "Bootjack," has a mogul all to his lone self on the Ellenville branch. The water could be better, and there was considerable trouble with checks. Grinding them in became a regular Sunday job, and, as they leaked at once, "Bootjack" lived in a perpetual Turkish bath. After all else failed, he writes us he took four big dollars of his own money and bought a 2-inch Jenkins check-valve for straight pipe and put it into the branch pipe between the check and injector and then took comfort for eighteen months. "Bootjack" fails to see why this simple check is not the thing for all engines, and points out the ease with which he put in a new seat instead of grinding in the valve.

The New York offices of the Westinghouse Air-Brake, of the American Brake and of the Union Switch and Signal Companies have been moved to the Havemeyer Building.

The New York offices of the Rhode Island Locomotive Works have been moved to 31-33 Pine street.

Don't miss our July number.

### Many Men, Many Minds.

"It is surprising," remarked the President, "the diversity of opinion that exists among men about things that one would suppose nearly everybody would agree about. It is not altogether surprising that men in the West should have experience with appliances different from men on Eastern roads; but why men on the same road should differ so much as some of them do is hard to understand.

"I remember a case which gives a very good illustration of this at the time when corrugated firebox sheets were popular. At a railroad meeting I came across several of the D. L. & W. master mechanics, and, of course, the subject of corrugated side-sheets naturally came up.

"To Mr. Dawson I remarked 'Well, are you people doing anything about corrugated side-sheets?'

"'Why, yes,' he replied, 'putting them into everything. Best thing ever come out. No more cracked side-sheets since corrugations are used.'

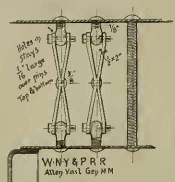
"A few minutes afterwards I happened to meet Jas. Buchanan, who was on the same road but another division. 'Well, Jim,' I inquired, 'are you doing anything with corrugated fireboxes?'

"'Yes,' was the reply, 'we are throwing them all out, they are not worth a *damn*.'"

### Cracked Flue-Sheets in Radial-Stayed Boilers.

The writer, in his various travels about the country, has noticed that not a few roads have experienced trouble from cracking in or about the flange at the top of flue-sheet of radial-stayed boilers, owing, it is thought, to the fact of the crown adjacent being too rigidly stayed. Various expedients have been resorted to, but among the best we have seen is a plan in use by Mr. Allen Vail, Gen. M. M. of the W. N. Y. & P. Railway. (Fig. 1.)

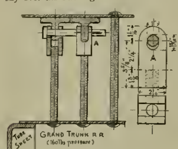
In Mr. Vail's plan the first two rows of stay-bolts are replaced by a flexible sling-stay. Eye-bolts are screwed into the roof and crown-sheets and then riveted over. These are connected by slings ½ x 2 inches, the holes of which, both top and bottom, are 1/16 inch large over pins, admitting of a total movement of ⅛ of an inch, sufficient




to relieve the strain on this part of the boiler, and hence cure the evil. (All of the stay-bolts in Mr. Vail's boilers are drilled.)

Another plan, in use by the Grand Trunk Railway, is shown in Fig. 2. The stay-bolts are screwed into the crown-sheet and headed over the usual way, the upper ends are screwed into a knuckle or clevis, which in turn is pinned to angle irons riveted on to the roof-sheet. The hole in the top of clevis is slotted, being 1 3/16 inches long, permitting a movement of 3/16 inch over the 1-inch pin, or 1/16 inch more than in Mr. Vail's plan.

We do not wish to publish any more articles signed by a *nom de plume*. Articles in a first-class engineering paper ought to be signed by the writer, unless he be the editor. Every correspondent to this paper should be proud of his article; if he is not, it is not good enough for us. Some have said that a man will often say things over a *nom de plume* that he would not say over his own signature. We do not




want articles for this paper that their own fathers are ashamed of. Any man's honest opinion is entitled to respect, and the man who is afraid to own up to his honest opinions is, to say the least, cowardly. The *nom de plume* is a fad; it is continued because it is common—like cutting notches in our coat collars. It has no place in mechanics, and should be discontinued. Please write over your own name for publication—it's right.

Randolph & Clowes, Waterbury, Conn., have issued a pocket price-list of brass and copper tubes and sheets and similar goods. It is a very complete work, giving inside and outside diameter, weght and gauge of different sized tubes, weight, thickness and surface per pound of sheet metals, and a great deal of other information needed by any one buying, ordering or using goods of this class. The work is invaluable to master mechanics, purchasing agents and to copper and tin smiths. It is sent free to those interested. This firm are furnishing 125,000 pounds of copper roof sheets for the Broad street station of the P. R. R. at Philadelphia.

In a recent personal letter to ye junior philosopher, Mr. W. D. Holland, M. M. of the Guatemala Northern Railway, located at Puerto Barrios, Guatemala, says "Please say to all those who write you about coming to this country that if they take my advice they will not come. We are flooded with engineers and machinists now. The only way to come is to secure employment beforehand through some locomotive works sending engines; but many are not sending men now, as there are more here than can find employment. Be sure and tell those who *will* come to bring money enough to get back, for they will want to bad enough, even should they get work. A few months' pay in the depreciated currency of the country will impress upon their minds the size and value of the many blessings they have left at home. I am speaking particularly of that territory that lies between the Rio Grande and the Charges Rivers, but I believe it is as true of the territory between the Charges and the Straits of Magellan."

### Some Facts About the Brake Trials at Karner's.

*Editors :*

The editorial comments which have been made by some of the railroad papers regarding the brake tests on the New York Central Railroad at Karner's, utterly ignored the circumstances which occasioned that test, and their conclusions are decidedly erroneous. The occasion which led to the tests was the issue of a circular by the New York Central Railroad Co., instructing their train men to cut out all brakes but the Westinghouse on their fast freight trains. The New York Air-Brake Co. asked that before such an order was promulgated the railroad company would test a train of fifty of their standard brakes in comparison with the Westinghouse standard brake at that time being applied to the cars of the New York Central Co.

The New York Company claimed that their standard brakes would duplicate every action and function of the Westinghouse brakes then in use. An order was placed with the New York Company for fifty sets of brakes in March, 1892, and these were applied to fifty cars from a lot of 1,000 then being built at the Buffalo Car Works. The Westinghouse Company were not willing to permit a test with any of the thousands of cars then equipped with their standard brake, and they therefore prepared fifty special equipments with triple valves adjusted so delicately that there was less than one pound margin between service and emergency action. The Westinghouse standard then in use required three times as much. The New York brakes were made to meet the Westinghouse standard used on the railroad, and would have been condemned without trial if they had been adjusted to such a narrow margin. There was, therefore, an inequality in the conditions of the two trains that made a comparison impossible.

If the deduction that a fraction of a second difference in time was the cause of the shocks, then it condemns the 200,000 Westinghouse brakes now in service, for they would all require the same time as the New York brakes in the test. How does it happen that the Westinghouse train in the Lehigh Valley tests, which was equipped with the same delicate valves that they used at Karner's, had terrific shocks, while the New York train, at the Lehigh Valley tests, with the same valves as used at Karner's, had no shocks? Here were two pairs of trains equipped with duplicate brake apparatus, yet, at the Lehigh Valley tests, the Westinghouse train had all the shocks, and at Karner's the New York train had all the shocks. This does not seem very conclusive of anything. The practical result of the test was the removal of the embargo off the New York brakes, and a series of orders from the New York Central Co. for brakes manufactured by the New York Air-Brake Co.

The sensitiveness of brakes is only a question of adjustment. The margin between service and emergency can be varied to suit the requirements of the Master Car Builders' Association. The brakes of the New York Air-Brake Co. will be found to equal any other in rapidity of emergency as well as in stability of service, in graduation, in release and in the ability to maintain a uniform and unvarying pressure down a long mountain grade. They may be seen and tested at the World's Fair under the most favorable conditions for observation, and in the most critical manner. We invite investigation.

THE NEW YORK AIR-BRAKE CO.
*May 24, 1893.*

[This communication was received too late to print with regular correspondence, and as it is a matter of importance to the New York Brake Co. we publish here.]

### Science Mysteries.

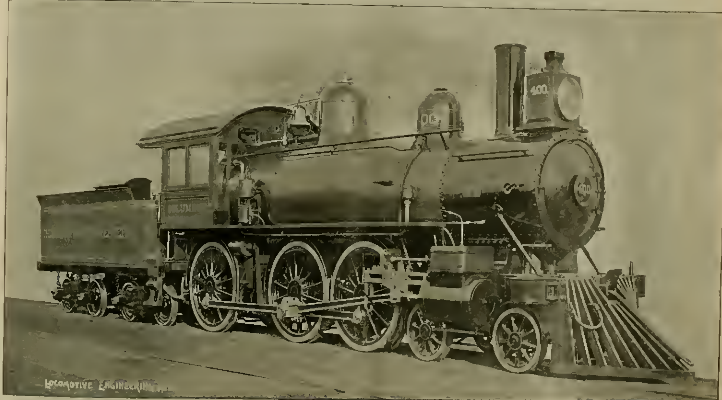
Those who begin to study scientific problems after they are grown up are entitled to as much sympathy in the difficulties they encounter as the heathens who have passed a life in moral darkness and at years of maturity have religious doctrines thrust upon them. When a young man receives scientific instruction as part of his education, the mysteries that are liable to excite heresy and unbelief are gradually made clear and instructors help to explain away obstacles to comprehension. When a grown man, however, becomes a student of science problems he meets at the very portals of the study with unproved statements given as facts, he is in danger of giving up the pursuit of this species of knowledge and saying in his wrath all scientific writers are liars and that Ananias would have had to take a back seat among modern savons.

One of the most trying studies for the faith of a novice is connected with the laws relating to matter. To be informed that all matter is divisible into infinitely small particles called atoms that no human eye will ever be able to see, is to excite the question, How can that be proved? To be told that atoms of different substances are of certain known weight naturally suggests the query, Who was able to weigh an entity so small that no microscope can be made powerful enough to show it? As the student advances in the study these and other difficult problems become more comprehensible, but it would be well for text-books to distinguish a little more clearly between what are established facts and what are theories by what seems good evidence.

There are a great many things believed about matter and forces of nature which never will be conclusively proven; yet those who have studied their phenomena most profoundly are thoroughly convinced of the truth of the theories concerning them. Molecular motion, for instance, as an explanation of heat, is one of the most trying theories to put upon the faith of a novice. Scientists say that heat is caused by the movement of the internal molecules forming the substance. The natural question is How can there be movement in the particles forming a piece of hard steel? Common sense would, at the first blush, call the theory absurd. Yet there are proved facts in connection with metal and other substances that seem equally absurd and can still be proved by experiment to be facts—not theories.

If the objector who considered it absurd that there could be movement in the molecules inside of a piece of dense steel were asked, if he thought it possible that the same steel could absorb any form of gas, he would readily answer that such an idea was as absurd as the other. Yet the power which solids and liquids possess of absorbing many times their own bulk of gases is among the most astonishing phenomena in nature, and is as true as the fact that water becomes steam when heated to a certain temperature. This is spoken of as the occulsion of gases in solids and liquids. Platinum, which is the densest of all solids, absorbs as much as five times its own volume of hydrogen without any increase in bulk, and the metal pallodium absorbs 643 times its own volume of carbonic oxide and remains unchanged in size. Most of our readers are familiar with the operation of converting wrought-iron into steel by the process of cementation. The success of that process is due to the readiness of iron to absorb a foreign substance under favorable conditions. The carbon which converts the iron into steel penetrates to the heart of the metal. Other phenomena of a similar character might be mentioned, but the instances given illustrate how readily one with imperfect knowledge may make a mistake by assuming that things asserted by scientists as facts are contrary to common sense.

In German railway cars there are little iron pockets into which you are requested to deposit your cigar stumps. These are collected by a society, sold to snuff makers and the proceeds used to support some charitable institution.




SCHENECTADY HEAVY PASSENGER TEN-WHEELER. NOW AT WORLD'S FAIR.

### Schenectady, Chicago & Northwestern Engine.

The locomotive shown here is one of the Schenectady exhibit shown at the World's Fair, and is a ten-wheel passenger engine, built for the Chicago & Northwestern. This style of engine has been doing splendid work in hauling the heavy fast passenger trains that are a prominent feature of this Western road. No kind of engine ever tried has done the work sa satisfactorily. The engine is quite heavy for passenger business, weighing 129,000 pounds, 96,000 pounds of this being on the drivers, and 33,000 pounds on the truck. The cylinders are 19 x 24 inches. The slide valves are balanced and have a travel of $5\frac{1}{2}$ inches; the outside lap $\frac{7}{8}$ inch and the inside lap $\frac{1}{16}$ inch. The driving wheels are 67 inches outside diameter; the boiler is of the extended wagon-top style, 60 inches diameter at the front ring, and made of Wellman steel $\frac{9}{16}$ inch thick

## EQUIPMENT NOTES.

The Santa Fé are in the market for a lot of locomotives.

The Beach Creek Railroad is receiving bids for 500 coal cars

The Duluth, South Shore & Atlantic is said to be in the market for 800 box cars.

The Brooks Locomotive Works are building fifteen engines for the Illinois Central.

Jackson & Wooden, of Boswick, Pa., have the B. & O. contract for 300 gondolas.

The Elmira, Cortland & Northern are about placing orders for 100 hopper-bottom gondolas.

The Florida Central & Peninsular have ordered from the Jackson & Sharpe Co. fifteen coaches.

It is reported that the Big Four have let contracts for 50 engines, 30 with Richmond and 20 with Brooks.

The Fall Brook Coal Co. have just received from the Schenectady Locomotive Works two consolidations.

The Pittsburgh Locomotive Works have an order from the Brooklyn & Union Elevated for three compounds.

The Florida Central & Peninsular Railway's order for fifteen engines has gone to Baldwin Locomotive Works.

The Manhattan Elevated Railroad people are in the market for twenty locomotives. They have lately ordered seventy-five passenger cars from the Wason Mfg. Co.

The Cooke Locomotive Works have received orders from the Southern Pacific for fourteen 10-wheel engines, with cylinders 19 x 24 inches and driving wheels 63 inches in diameter.

The Rogers Locomotive Co. have just finished thirteen locomotives for the Wilkesbarre & Eastern, and eight switchers for the government of Chile, these are saddle tank engines with cylinders 13 x 22.

The Wilkesbarre & Eastern Construction Co., which is a portion of the N. Y. S. & W Railway, have placed their order for fifteen coaches with Jackson & Sharpe, two of which are parlor cars.

Within the month the Baldwin Locomotive Works have received orders from the C. N O. & T. P. for eight engines, from the Seaboard & Air Line for eight, and from the Missouri, Kansas & Texas for ten.

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The Hall system of block signals has been applied by the Illinois Central to the tracks between the Chicago terminals and the World's Fair grounds, and works admirably. Within the last few weeks the Lake Shore & Michigan Southern has decided to adopt the same system. For some time the Chicago, Rock Island & Pacific has been engaged putting in a Hall signal plant between Chicago and Joliet.

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The Cardenas & Jucaro road in Cuba is having two moguls, 17 x 22, and one eight-wheel switcher with same size cylinder, built by the Rogers Locomotive Company. The mogul will have a 57½-inch wheel and the switcher 42-inch. The odd size wheel is the "standard" of that road and came about in a strange way. Long years ago, when Rogers built the first engine for this road, a lathe hand made a mistake of ⅛ of an inch in turning up the wheels—they were to be 57½-inch—and the road has used that size ever since. This company are busy on twenty-six 19 x 26-inch moguls with a 56¼-inch wheel, and seven 18 x 24-inch eight-wheelers with 69-inch wheels. They also have in the erecting shop five eight-wheelers, 19 x 24, and seven ten-wheelers, same size, for the Florida, Central & Peninsular, and two moguls 19 x 24-inch, and one eight-wheeler, 18 x 24-inch, for the New York, Susquehanna & Western.

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The Reading Railroad kept up its record of boiler explosions last month, two persons having been killed and five severely injured by a boiler blowing up at Lebanon, Pa We will repeat what we have previously said about occurrences of this kind. A boiler explosion is a crime due to gross carelessness of some person who ought to be readily identified. When these explosions go on week after week and no one is punished, it is plain evidence that the authorities in Pennsylvania, responsible for the suppression and punishment of crime, are grossly neglecting their duties

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From the appearance of the *Patent Office Record* a great many inventors are devoting their time to the designing of compound locomotives and their attachments. It looks as if the compound locomotive promises to become as fertile a source of revenue for patent lawyers as brakes and car couplers have been. At the beginning of this year there had been fifty-seven patents on compound locomotives taken out in this country. England was a little ahead of us with ninety-four patents, but it looks as if our inventors would be ahead before this year is out. Other countries have been well represented by inventors of compound locomotives, for France has 22 patents on this kind of engine, Germany 14, Italy 2, Switzerland 2, Russia 1, and Norway 1.

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We have had the best of reasons to be satisfied with the ready response accorded to our numerous club-raisers, but there is occasionally a road or a place where railroad men appear to have no use for engineering literature. A club-raiser at one of these places, which, by the way, is noted for the number of its liquor saloons and for the audacity of the men interested in them, says "We have one set of men who know everything, and they don't need any paper, think it would imply ignorance to be seen reading papers that give information about their business; then there is another class who do not profess to know anything, don't know anything, and wish to continue always in that happy condition. They think their ignorance is bliss and that it would be the worst kind of folly to try and make themselves wise."

### Kindness Rewarded.

When J. Y. Smith was superintendent of machinery of the Government railways during the war time, Sir Edward Watkin, now a famous railway magnate in England, came to this country with a party of military officers, who were anxious to examine the military railways, and particularly the method of building temporary bridges quickly. Great confusion prevailed at Washington at the time, and it appeared as if the military men would not be able to accomplish the object of their mission. After they had besieged the War Office for days and interviewed no end of secretaries and other officials, some one recommended Sir Edward to see Mr. Smith. He did so, and Mr. Smith took the party to the front on a special engine which he had for his own use, showing them everything of interest to be found on the way.

After the war Mr. Smith invented his vacuum brake, and went to England to try to get it introduced. There was strong prejudice at that time against American inventions, especially brakes, because several electric brakes had been tried and found worthless. Mr. Smith had forgotten the name of the gentleman who came with the officers to look at the military railways, but he received from some one a letter of introduction to Sir Edward Watkin. When he presented the letter he was astonished at the cordiality displayed by the great railway king, who knew him at once and was ready to offer every assistance in his power. The success which Mr. Smith met with in applying the vacuum brake to English railways was due in a great measure to the kind offices of Sir Edward Watkin. There is good reason for believing that the popularity of the vacuum brake on English railways and the large proportion in use there originated in the act of kindness displayed by Mr. Smith to a party of strangers.

### Rhode Island Compound at the Fair.

The accompanying cut was made from a photo of the Rhode Island compound engine for fast, heavy passenger service between Chicago and Milwaukee.

She has cylinders 21 and 31 x 26 inches, 78-inch drivers, with a rigid wheel base of 13 feet 6 inches, and a total wheel base of 29 feet 9¼ inches.

The boiler is of the Sample, or extended wagon-top type, the smallest ring being 62 inches in diameter, the back head is a perfect circle, butt-joints throughout, 272 2-inch tubes; firebox, 120 inches long by 33⅜ inches wide.

The back truck or trailing wheels were put in to distribute the load, as the company limit the load per wheel.

The engine weighs, in working order, 143,000 pounds, 88,500 being on the drivers, 36,500 on the forward truck and 18,000 on the trailing wheels.


Rhode Island Compound Express Engine. Now at World's Fair

This is one of three of the same class built for this road, the other two go into fast service June 1st.

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Breaking the record for fast running can and will be done, but a jump from 91 miles an hour to 112½ is too much of a good thing. The "999" may make 100 miles per hour, but she won't do it with four cars.

### Duty of Injectors.

Exact information about the performance of injectors is not easily found. The *American Machinist* lately applied to all the injector makers in the country to obtain answers to the questions What has been the best performance of the injector in raising or lifting water to any height? What is the greatest volume or weight of water raised relative to height with a given weight of steam?

In reply to this William Sellers & Co. intimated that in one of their tests the injector delivered 25.51 pounds of water into the boiler with 1 pound of steam. The gauge pressure was 65 pounds and the water temperature 64°, flowing to the injector under one foot head.

The Hancock Inspirator Co. said that with one of their instruments R. H. Buell lifted water twenty-seven feet with a steam pressure of 63 pounds, delivering against pressure equal to the steam.

# Practical Letters from Practical Men.

**Facts Wanted. There's a glut of Opinions.**

Write on one side of the paper, state your point plainly and briefly, and then quit. We supply the generalities. No letters noticed unless name and address accompany.

### Cast-Iron Test Pieces.

*Editors:*

Noticing your commentary on B. & O. tests for foundry castings, and having some experience in foundry tests, I wish to make the following suggestions:

You say, "A good foreman molder can, by selecting the period of pouring, provide a specimen that will give any kind of test required."

This is true only within limits. Given a uniform mixture in the cupola for an entire heat and it is true that the forman can get his closest, strongest and hardest iron in the first charge, but so only relatively to the nature of the mixture used.

The B. & O. people should specify that test pieces or specimen castings shall be taken from the cupola (not from the ladle if a large one) at the center of the heat for their cast. That is, if they are getting say 10,000 pounds of castings from a certain stack and it takes 40 minutes to run that amount of iron, their tests should be required taken 20 minutes from the time of first tap for them in the contract shop. The above is provided their work were all poured together — if not, then the test should be taken at the middle of time from first to last in order to secure average iron.

Several different mixtures may be had from the same cupola in one heat if necessary.

Better than any "sample casting" would be to specify certain results by "Keep's Tests," based on good practice, and see these tests properly made.

*Netherwood, N. J.* E. H. M.

### Draft Obstruction.

*Editors:*

At the recent discussion on spark arresters, it was generally admitted that in the matter of fuel economy, even the best of them are objectionable on account of the obstruction which they offer to the draft. To overcome the effect of these obstructions the exhaust nozzle is contracted to sharpen the blast, resulting in a tearing action on the fire, which is pro-

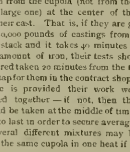


Fig. 1.

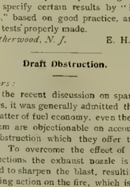


Fig. 2.

ductive of a greater number of cinders being drawn through the flues than with the softer exhaust of a large nozzle, and for this reason some one has said "No spark arrester is the best spark arrester." But it is doubtful whether he would make this "best arrester" his choice were he a participant in the settlement of fire claims due to fire thrown during our dry season. Certainly, the best spark arrester is that which throws least sparks and offers least obstruction to the draft, a point which does not seem to be as clearly borne in mind by some designers as it should.

The diamond stack combination is one of the most objectionable spark arresters, inasmuch as it baffles not only the draft but also the exhaust, thereby increasing the obstruction to the draft and resulting in much black smoke. This form of spark arrester is, however, fast becoming obsolete.

With the open stack combination the diaphragm plate becomes the obstructer, but with this arrangement the obstruction varies according to the location and angle of the plate. The only object of this plate is to deflect the draught to bottom of

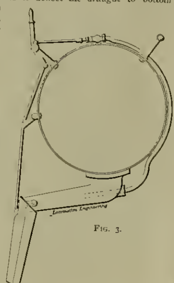


Fig. 3.

smoke-box for the purpose of drifting the sparks to front end, and it should be arranged to do this while impeding the draft as little as possible.

The position which I have found to be most objectionable and in which the plate is least calculated to perform the object for which it is intended, is when it is located within a few inches of the tube sheet, and this is a position still used by some prominent builders.

When engine is working hard and the diaphragm is set as in Fig. 1, the draft recoils from this baffle to an extent that is discernible on the fire, the result being that the cinders are deposited just clear of the plate and there is always a certain amount lying on the netting; to assist this plate to do what it would do alone if properly located, the nozzle is sometimes lowered and a lifting pipe placed above the netting. A plate in this position, therefore, not only fails to do its work, but is a serious obstruction to the draft. I have seen engines which were working unsatisfactorily while handicapped in this manner, converted into good, free-steaming engines by simply changing the plate from the position of a baffle to that of a deflector.

With the plate in the position shown in Fig. 2, there is no trouble whatever in keeping the smoke-box clear of cinders if desired, but they can be collected at the front end by lifting the plate higher, with the advantage of improving the steaming by allowing greater freedom to the draft, and also decreasing the cinder nuisance on passenger trains.

But with the fine dusty coal so commonly used, the cinders soon accumulate, and without some means for rejecting them from time to time as they collect, this advantage is short-lived.

It is a common practice to run with plate low in order to force the draft to front end, thereby keeping the cinders constantly in agitation until they escape through the netting.

Fig 3 is a device the object of which is to permit the plate being kept high by ejecting the cinders at intervals as they collect. This arrangement is operated by a movement of a handle at end of hand-rail in cab, which simultaneously opens the lid of cinder spout and a steam valve placed just behind smokestack, to the lid is fastened a sleeve which comes into position for projecting the cinders clear of engine when the lid is opened.

The important matter of free draft does not seem to receive the close attention to which it is entitled, not only at the smoke-box but also at the fire-grate. Comparisons are now being made between compound and simple engines. Among other information required in order to arrive at correct conclusions, the size of nozzle and grate area is asked for, but the size of the nozzle is regulated to a certain extent by the amount of draft obstruction to be overcome. An engine with deflecting plate in good position will run with a larger nozzle than one with draft throttled at the flue-sheet, therefore the arrangement in smoke-box should be given.

Two engines may have equal grate area, yet one may have 25 per cent. more draft opening than the other; the conditions are not equal, and therefore the percentage of draft opening in grate area should be known.

I have seen the draft opening increased even more than 25 per cent. with beneficial results.

*Stratford, Ont.* A. A. Mayer.

### Mr. Hamer's Brake Questions.

*Editors:*

Referring to the questions submitted by Mr. W. T. Hamer upon the subject of air-brakes in the April number of Locomotive Engineering.

In answer to the third question, permit me to suggest that there should be no difference in the conduct of the black hand, whether the engine is light or working air on a number of cars, although, of course, there would be a marked difference in the action of piston 17. In case of light engine, the reduction of train-pipe pressure *under piston 17* would be quite rapid, and its valve *n* would seat much quicker than would be the case if a number of cars were attached. This, of course, comes about from the difference in quantity of air necessary to escape from the train line in the different cases to equalize pressure above and below piston 17. In making an emergency application, up to a certain point the conditions are the same as in a service application. As the handle is carried around to and beyond service notch, air escapes from above piston 17 until communication between port *h* and preliminary exhaust port *e* is closed, and as it is carried around further, a point is reached about midway between service and emergency notches, where air passes direct from main reservoir to brake-valve reservoir, through port *j* in rotary valve and equalizing port *g* in its seat There being over twenty pounds greater pressure in the main than in the brake-valve reservoir, of course the black hand shows an upward tendency, and if handle is left in this position a few seconds the brake-valve reservoir will be charged to same pressure as main, and black and red hands will register alike That ports *j* and *g* are ever in communication is undoubtedly accidental, as it will be noted that this is avoided in the new model valve. Finally, as the handle is carried around to full emergency position, all escape from brake-valve reservoir is closed and pressure is retained therein, regardless of whether or not all pressure has been exhausted from train line in emergency application. A little confusion in respect of the black hand is introduced by the Westinghouse plates stating that it indicates train line pressure While this is true when the valve is at rest in either running or release position, it is not true while the valve is being manipulated. As a matter of fact, the black hand simply registers the pressure in the brake-valve reservoir, which, as shown above, may be vastly different from train line pressure. Phonetic.

*St. Albans, Vt.*

### Improvements That Will Cause Damp Steam.

*Editors.*

The illustration in the April number of a feed-water delivery, used by Mr. Foster on the Fall Brook R. R. is interesting as it shows originality of design.

The plan of combining the two injector tubes on top of boiler is really a good one, but I doubt the propriety of allowing the trough to feed water of 300 degrees on top of a dry pipe containing steam of probably 350 degrees plus the latent heat of evaporation, all of which it is willing and anxious to part with and would deliver this heat over to the cooler feed-water without objection, and what is the result? Cylinders receive wet steam from a boiler which is making a good article.

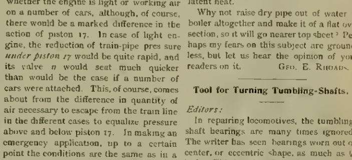
It seems to me that getting steam into dry pipe at a sufficient height above water to insure its dryness does not entail the fact that it will be the same when it reaches the cylinders if pipe is not kept out of the influence of water of a considerably lower temperature, both as regards sensible and latent heat.

Why not raise dry pipe out of water in boiler altogether and make it of a flat oval section, so it will go nearer top sheet? Perhaps my fears on this subject are groundless, but let us hear the opinion of your readers on it. Geo. E. Rhoads.

### Tool for Turning Tumbling-Shafts.

*Editors:*

In repairing locomotives, the tumbling-shaft bearings are many times ignored. The writer has seen bearings worn out of center, or eccentric shape, as much as ⅛ inch. This has the effect of changing the length and position of link-hanger, in which case the valve-setter must of necessity either shorten or lengthen the link-lifter or raise one of the tumbling-shaft boxes in order to equalize the cut-off.




Tool for Turning Tumbling-Shafts.

The accompanying sketch is a tool devised by the late Sylvester Charnley, who for eight years was master mechanic of the C. M. & St. P. shops at Dubuque, Ia.

*A* is an extension with flange and center that screws on to head-stock of a small lathe, *B* is a sleeve with extension that slides on *A*, *C* is a star with six points, fastened on feed-screw *E*, which has a bearing in flange, *D* is a bracket which is fastened on lathe-bed. As the tool revolves with the lathe the star strikes bracket *D*, thereby advancing sleeve *B* to the right. Cutting-tool *E* being set at the

proper depth will carry a cut on tumbling-shaft bearing as shown. The tumbling-shaft being held firmly in lathe-centers, but does not revolve, a small lathe can do the work which otherwise would require a very large lathe in order to swing the long arms on tumbling-shaft. This tool gives excellent satisfaction.

*Dubuque, Ia.* J. C. MILLER.

[This tool is not unlike many others we have seen, but is the simplest of the kind, and a good one to copy.]

### In the Catskills.

*Editors :*

Never having read any items in your magazine about the Catskill Mountains and how to get there, I dropped off one of the New York Central limiteds the other day, crossed over the ferry at Catskill station and found myself at the Alpha of the Catskill Mountain Railway, where I met Mr. John L. Driscoll, the master mechanic and master car builder, whose warm welcome created within me a desire to abide with him forever.

This is one of the daintiest narrow-gauge railroads it was ever my lot to see, and I have seen several. It is 3-foot gauge, sixteen miles, up-grades of 100 and 120 feet to the mile to Palenville, at the foot of the towering mountains, with a branch to Cairo, eighteen miles away, and has a roadbed surpassed only by the New York Central and the Pennsylvania, winding around rocky bluffs, through beautiful hills, over deep gorges with dashing cataracts and deep pools where the finny tribe sport, shaded glens where lovers might murmur the old, old story of bread and butter and an oil-stove, without fear of prying ears, and flitting by sleepy farmhouses suggesting perpetual peace and rest—that is the Catskill Mountain Railway all the way from the mighty Hudson up to the Mountain House station, where the elegant Otis Inclined Plane Railroad with its 3-rail double track, parabolic form and mighty cables winds its safety-grip cars with their passengers a mile high to the mountain's top, above the clouds, and deposits them at the doors of mine host of the Mountain House.

As the Otis Inclined Plane road has been fully described and illustrated before, I need say nothing concerning it unless to state that by it passengers are now elevated from the station to the hotel in ten minutes, whereas by the old hack and stage lines it occupied nearly two hours and about wore the patience of the tourist into shreds. Between the 4th of July and the 15th of August last year it carried over 8,000 passengers. Two cables are used, their speed is about twelve miles per hour, and each car is equipped with an automatic brake-governor somewhat similar to those used on Corliss engines. Should a cable break, the governors instantly apply the powerful rail-grips and stop the car.

But to wander back to the railroad. The motive power consists of three 8-wheeled engines, having cylinders 13 x 18 inches and 48-inch drivers, built by the Dickson Locomotive Works, Scranton, Pa., eleven years ago, and, with the exception of the past two winters, have stood out in the storms and biting frosts with nothing between them and heaven's blue canopy but a coat of slush, and closest examination fails to show a rust or tarnish spot on their bright Russia iron jackets or a patch or other evidence of a calking tool ever having been used on their glossy, black tanks. The cabs have been rebuilt by Mr. Driscoll and made more roomy. I also noted that he had made one large hinged glass window, swinging outward from the top, in the front of them, in place of the usual sliding affairs commonly used. This is the first evidence I have yet seen of the fruits from the missionary efforts of the Rev. John A. Hill, he having described and advocated just such an arrangement in the *American Machinist* a long time ago. It is a good idea, and all cabs should be built that way.

One thing impressed the writer above all others, and that was the absolute cleanliness of those engines. Every night they are thoroughly wiped from pilot point to tender coupler, and their excellent condition can be readily comprehended when I say that their schedule time over the eight een miles up the mountain, around curves of 200 feet radius, with seven coaches and two baggage cars, is only thirty minutes.

Another interesting feature in railroading lies in the fact that this line during its years of existence has been operated by telephone service. In despatching trains and giving orders of all kinds there has never been heard the click of the Morse key. Janney couplers and the vacuum brake are to be found on every coach, baggage, box and flat car, and for the benefit of the Western Railroad Club I will state that the breakages of knuckles are 000 per cent.

The shops where repairs are kept up are at Catskill station and are practically all new buildings, the sand-house and oil-rooms are models of neatness, likewise the storehouse, but the marvel comes when we reach the "shop" proper. A well-constructed building having two tracks and two pits just to fit those engines, and at the extreme end a room fifteen feet wide by twenty-five long, containing a small upright engine and boiler but little larger than a boarding house teapot, a Sebastian twelve-inch engine lathe, a post drill press, two vises and bench and several tool closets and racks—this is the machine shop. Off from this room is a smaller one, probably ten feet square, containing an anvil and small blower—this is the smithy. Over the machine shop is the pattern shop, drawing room and office, while through a door to the attic over the engine stalls is a broad shelf containing patterns for brasses, brake-shoes, nozzles, center-plates and the endless variety of small patterns always required on a well ordered railroad—this is the pattern loft. And I have described the whole plant, but there is one thing I almost forgot, everything was CLEAN. No greasy floors resembling tar pavements, no tools too filthy to be handled, no greasy waste balls being kicked about the floors, but absolute, perfect cleanliness and order existing everywhere. Just think of it ye great big systems with decapods, compounds, testing departments and high-titled officials and go put on clean linen for once in your lives.

Spring switches made by the Pennsylvania Steel Co. are the standard and used everywhere, the points are always thrown to let the trains in sidings, but never opened to main track afterward. I confess to a little nervous feeling coming down to the junction of the Cairo branch at the rate of forty miles an hour and seeing the switch wrong in front of us, and I thought of that old P. R. R. regulation of "ten dollars for running through a switch," next pay day, but we went over it as though it were only a solid rail and that was what it was made for.

While the engine was being turned at Palenville (and here I might remark that every time they turn an engine they have to turn the whole end of the road also), I saw a home-made velocipede car designed and built by the agent of the road here. It was somewhat on the lines of the Sheffield, the wheels under the rider having belonged previously to defunct wheelbarrows. They were flanged with sheet-iron, and the back one was equipped with a 6-inch crank and no gearing, the operating lever being fulcrumed about four to one, thus giving the handles a sweep through the air about equal to the circumference of the wheels. He built it for exercise, I guess, not for speed.

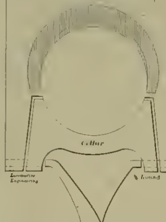
Mr. John L. Driscoll, M. M. and M. C. B., is about fifty years old (although he don't look it), and comes from the solid old New York Central, having been a runner away back in the sixties under the designer of that royal type of American locomotive pulling the Empire State Express. Mr. William Buchanan is superintendent of motive power. His manner, too, is similar, being quiet and unassuming, allowing his work and results to speak his merits and worth. OLD MAN ROGERS.

*Troy, N. Y.*

### A Cellar Remover.

*Editors :*

I send herewith a sketch of a handy pair of cellar tongs that only need to be tried to be appreciated. The chain can be hooked up to any length so as to give the most purchase to a bar, and the harder



you pull the harder the tool takes hold. Any blacksmith can make one from a bar of 1¼-inch iron, and—they are awfully handy. A. J. EDMONDS,

*Mason City, Iowa.* R. H. Foreman.

### No Spark Arresters the Best.

*Editors :*

Reading an article in April's number under the heading, "No Spark Arrester the best Spark Arrester," tempts me to write you on this subject, in the hope that some day spark arresting devices in front ends will be a thing of the past. A fierce exhaust with fire in the smokebox caused by drawing air from below necessitates spark arresters. Remove these causes and the necessity of arresters is gone. A free working engine and economy in fuel follows.

I have run engines six years without any spark arresters in the front end and never to my knowledge have burnt a blade of grass by throwing fire.

I will give you an account from memory of a coal test I was concerned in, in the year 1871, between two six-wheel coupled inside connected engines, 17 x 24, 5-inch single nozzles, no spark arresting devices of any kind in the front end. One engine had a brick cemented arch baffle door, a cast-iron grate frame, 5 x 3-inch, narrow edge bolted to side sheets inside of firebox, level with bottom of mud ring, beveled off next side sheets front and back. The bevel was filled with fireclay to keep out the cold air from coming in contact with side sheets front and back of firebox.

The opposing engine was similarly equipped, with the exception of the air-tight grate frame, the object of which was so well-known to the opposing crew that they imitated it to perfection by forming a cement of fine dross coal, plastering it from time to time around the side sheets back and front. Andrew Young, engineer, ran the opposing engine, with Robert Fairbairn as inspector, and I rode with Mat. Ruddick in the same capacity. It was a fair, sharply contested issue. The coal was weighed on and off the tender at commencement and finish of each trip. The average weight of the train pulled was 310 tons, the test was one way only, from March to Stratford on the Great Eastern Railway, England; distance 86 miles. Some parts of the road the grade was 1 in 100. After weighing coal off tender at end of trip at Stratford the front end was inspected, the cinders, of which there was only one-third of a bushel, averaging the size of pearl barley and so little heat in them that when taken out of front end one could hold them in one's hand, the results of an air-tight front end. The tubes were swept out at end of each trip with a tube-rod and a little hemp.

The test continued for one month, and Mr. S. W. Johnson, locomotive superintendent, now of the Midland, was generally on hand to inspect the contents of the smokebox at end of each trip.

The results of the test were as follows: The engine with the air-tight grate frame consumed thirty pounds of coal to the mile, or sixty-six miles to the ton. The opposing engine consumed thirty-one and a half pounds to the mile, or sixty-three and a half miles to the ton. D. McD.

*Los Angeles, Cal.*

### How a Toolsmith Proposes to Test Steel.

*Editors :*

I see a criticism in the April number of *Sparks* of a letter of mine that was copied from LOCOMOTIVE ENGINEERING, in which the writer says that I take toolsmiths to task when I said, "Test your steel and see that it is pure from phosphorous sulphur, silicon and other impurities of cheap ore."

Now, he says, this would be a job for a Bergmann, Berzelius or Reaumur and would be quite a job for chemists of the present age.

Now, I would like to ask why this is such a great job for toolsmiths. If the writer would go to work and take three or four different makes of steel and also different brands of the same make and harden them at the lowest heat they will harden at, number and break off a piece from each bar, examine them under a microscope and note the difference in color and grain, especially between the high and low price pieces, and then break off another in the same way and have them analyzed, he could, by practicing this, soon be able to tell the steel that contains a large percentage of these impurities from that which contains less.

Again, he says, the next axiom laid down by the writer is "See that your steel will refine."

He asks what steel will not refine. Now we all know, if we know anything about steel, that we very often run across bars of high price tool steel that will not refine.

Again, he says, as regards that sample of drill-rod, if it were to harden in the center it would split. Now, this is a mistake, that drill-rod can very easily be hardened to the center without splitting.

W. G. LOTTIS.

*Madison, Wis.*

### Testing Signal Line.

*Editors :*

Referring to "Nympano's" inquiry in regard to his method of testing for pressure in signal line, I note he states that the pressure frequently runs up to 60 pounds, and that he proves it by reducing pressure in main reservoir to a slightly lower point, and finally asks if there is anything wrong with that method of testing. If he means testing to determine whether or not his reducing valve is defective, I should say it was a very good way, for the conditions he mentions proves that very fact, but if he intends to use his method for determination of pressure in train signal line, when

he has a perfect reducer, then it is fallacious. That the pressure in signal line rises above 25 or 30 pounds, in itself would prove that valve 5 did not seat properly, or when seated allowed air to leak through. The diaphragm being spongy(leaky ?), with no other defect in the valve, would not operate to increase the pressure in signal line, but quite the contrary. The signal sounding when brakes are released would indicate that there was almost a perfect equalization between main reservoir and signal line pressure, and leak enough through reducer to sound the whistle. With a leak of this magnitude, however, I cannot understand why the trouble is not noticed at once, instead of only at the end of a long run. Did "Nympano" ever test more than one valve with same result?

*St. Albans, Vt.* PHONETIC.

### Piston of Triple-Valve Stuck.

*Editors:*

Regarding Thos. Croden's question in May number, permit me to say that if there was no obstruction in the piping, the reason the triple-valve under tender would not work when pressure was reduced at brake-valve, but would when reduced from stop-cock, would appear to be that its piston was so badly "stuck" that it required a severe shock to start it, such as would not be produced by an ordinary application, but would be by the sudden and excessive reduction obtained by opening the stop-cock. Of course, from the very nature of the case the only difference there can be in the methods of reduction named, so far as the triple was concerned, is one of quantity. PHONETIC.

*St. Albans, Vt.*

### Chain Ganging.

*Editors:*

I saw an article in the April number of the LOCOMOTIVE ENGINEERING headed "A Good Word for the Chain Gang System," written by a fireman. He seems to think it is a grand, good thing for the firemen. It may be. But I do not see where there can be a good word spoken for it, and I will venture to say that the majority of the engineers are bitterly opposed to the chain gang system now practiced. It may not be so disagreeable where there is but one class of engines to run; but you take it where we have three classes of them and it is a very disagreeable way of running. I would like to ask some of the readers of the LOCOMOTIVE ENGINEERING where is there any material gain to the company or to the men? The company claim they can get more service out of their power. They may run them steadier for a time, but they are shopped that much sooner, so where is the gain?

The greatest trouble in running engines in the pool is to get the necessary work done on them to keep them in good running order. I will give you a few hints of how we are run and the fruits of pooling. The engines on the West Iowa Division of the C., B. & Q. we run first in and first out. We have three classes of engines to contend with—the class A, and the classes H and D, or Consolidated. We are required to pack a small tool-box of tools, weighing about 40 pounds. This is the fruits of the pool. Not long ago I got an engine out and the gauge-cocks were leaking so we could hardly see anything, and the injector-throttle leaking at the same time, and tank so dirty that we were compelled to take down the hose three or four times and clean out the strainers in getting over the division. At the same time the boiler was so dirty that we could not pull out of a station with more than a gauge of water without throwing it out of the stack. We were mad, to put it mild, and censured the man who had the engine in for not reporting her washed out, but on investigation we found that the man that had her in reported boiler and tank washed out, gauge-cocks and injector-throttle ground in.

Now this was the way the work was done. They filled up the boiler and blew out about two gauges of water, and took down the tank hose and cleaned out the strainers, put up the hose and let her go. This is pool. This last winter and spring we had several engines that did not steam as they should, and after the roundhouse forces exhausted their powers to make them steam properly, the engine foreman had them remove the bottom flues in one of the engines and they found it filled with mud and scales up to the third row of flues. They afterwards removed the flues from four or five others and found them in about the same condition. This is the fruits of blowing off engines instead of washing them out as they should have been. This is another case of expense and trouble that can be attributed to the system of chain ganging engines. Before the chain gang system took effect we ran Consolidated engines from twenty-four to twenty-six months before shopping them. But now if they get eighteen months' service out of them they are doing well. In my way of figuring it is a bigger expense in the long run to the company and a source of trouble and annoyance to the majority of the men.

*Creston, Iowa.* A. W. LONG.

### Running Position—Tender-Brake Rig—Testing Signal Whistle.

*Editors:*

Please note mistakes in my article in May number. Third line, second paragraph, page 211, should read "one and one-sixteenth" instead of "one and one-sixth." Fifth line, same paragraph, "seven-sixteenths" instead of "seven-sixths." In fifth paragraph, ninth line, read "short trains" in place of "short travel."

I wish to raise a question as to running position in brake-valve. There seems to be no question in the discussion lately as to this being at all times the right thing to do. In the Westinghouse Instruction Book, page 23, paragraph 3, it says: "Let the brake-valve handle remain in release position down-hill." I believe on very short passenger trains the Plate D 8 valve will give no trouble if left there, unless the main reservoir on engine was very small. I have tried these trains so when standing still and never had a triple valve stick on an emergency application (unless the valve was out of order or some brakeman had noticed on a passenger train a pressure-retaining valve and closed it), and I have been on these trains up-hill with no reserve pressure, when they broke in two, and I always found engineer had time, after placing brake-valve handle on lap, to get all the pressure needed to release his brakes by the time the train-pipe cock was shut off, and in such cases, where air is in good condition, I fail to see the necessity of making this (in this case) surplus. At any rate, I advocate using weak feed-valve springs, No. 20, Plate D 8, on such trains. We had an experience with the Fig. 5, Plate D 5 brake-valve when it first came on this road. The pumps were of the latest pattern, 9½-inch, and if the brake-valve handle was in running position and an ordinary stop was to be made with from four to six passenger cars, the auxiliary reservoirs would charge to 80 or more pounds in absorbing the air made by this pump, hence the "plugging" business till governor was changed to main reservoir.

Apropos of the tender-brake question, it is my experience that tender-brakes have the worst proportions and are least utilized of anything in the air-brake line. I was once sent out to get measurements of the tender air-brake rigging on all tenders on the roads, and if I had found machinists using corkscrews for straight-edges when I came back I don't think I would have been surprised any. In my opinion there is one defect in the tender-brake that could be easily remedied; on tenders the shoes are usually found setting up to the wheels nicely, but when the top of live lever is pulled back, a man could put his foot between the shoe and wheel. I found it took 18 pounds on a spring scale to pull the top end of lever back, and over 100 pounds to pull back a brake-beam; of course, after the engine starts up, the beams loosen, as the hangers are generally pulling away from the wheel, but is there not some loss of power in starting with over 100 pounds on each brake-beam? I think, for my part, that starting time is the wrong time to have any brakes on at all.

My way to test signal pressure is to put a gauge on signal train-pipe, *and watch it a short time* to see if the reducing-valve leaks up any more pressure after it has cut off; I also instruct engineers to test their signal pressure by stopping pump and opening drain-cock on main reservoir after the trip. Whistle will begin blowing as soon as main reservoir pressure is reduced below that in signal-pipe, and can be seen on air-gauge provided, of course, there are no leaks, but, as there is a likelihood of some fitting coming loose before the trip is ended, this method is not infallible, is only intended for use in absence of test-gauge, and it is to be understood that the whistle blowing at 60 pounds, while signal-pipe only showed 25 or 30 pounds, would indicate leaks or imperfect signal-valve. I once had a signal-valve that would only blow when cut out from train, while on engine it seemed to blow to perfection; when taken down the round portion of spindle in "signal-valve," above three-cornered part, had been filed away till air flowed freely to under side of rubber diaphragm; also should this diaphragm have more tension on one side than the other, or soften only on one side, it is apt to give trouble. GEORGE HOLMES.

*Roanoke, Va.*

### That Gauge-Tester.

*Editors:*

Referring to the hydraulic gauge-tester problem submitted by E. S. Grensel, in May LOCOMOTIVE ENGINEERING, allow me to say that the statement that "the plunger is exactly ¼ of a square inch in diameter" seems to be a little obscure. I assume, however, that Mr. Grensel intended to say that the face of the plunger exposed to pressure had an area equal to one-fourth of a square inch, as the number he gives (.565 inch) is the diameter of a circle having one-fourth the area of a square inch. If I am correct in this, Mr. Grensel's assertion that "the weight ought to represent twenty-four times on the gauge" is erroneous. With the levers shown the ratio between the weight in the balance and the pressure upon the gauge would be 28. Mr. Grensel evidently gets upon the wrong track by figuring from power to load, when he should figure from fulcrum to load, or using 24 inches for the entire length of his lever when it is actually 28 inches. To correct his tester he should either figure the ratio 28 or make the long end of the lever 20 inches and use ratio 24. In either event he should calculate the weight of lever and make proper allowance, or preferably, arrange a counter balance to compensate. CLARK L. PIERCE.

*St. Albans, Vt.*

### A Good Suggestion for Distinguishing Brake-Valves.

*Editors:*

In the May number there is an article by Paul Synnestvedt, wherein he says: "The remarks about the use of the engineer's valve in release position when there is a detect hole in rotary valve, seem to me rather hazy. The valve is not supposed to be left in the release position." Now, in fact, a good many engineers are running with their valves in release position; the excuse they usually give is that when carried in running position the brakes creep on. I have run a number of engines that had the "pinhole" plugged up to prevent it blowing. When an engineer runs with valve in release position he is destroying one of the most important features of the valve. Westinghouse and Phelan tell us that the feed port in running position is ample for any ordinary leaks, to all of which I agree; but here is where the trouble comes in. In starting out on your run or picking up empty cars, you turn handle to release. Now, we will say you have 70 pounds in main reservoir and train pipe; you now turn handle to running position to get excess pressure; now, until pressure in main reservoir runs up to 90 pounds (if you are carrying 20 pounds excess) your valve might as well be on lap, for no more air will come to train pipe until then. Whenever I feel the brakes creeping on I go into release just long enough to "kick" brakes off, and no longer. As soon as excess catches up there will be no more trouble.

I see that the last valve out, which was illustrated in a recent number of LOCOMOTIVE ENGINEERING, has remedied this trouble. There are so many valves now in use that it is difficult to understand which one a writer is alluding to. What's the matter with naming the last one out—the '93 valve? ORANGE POUND.

*Bartow, Fla.*

### A Stolen Air-Brake Article.

*Editors:*

The letter from A. W. Long, which you print in the May number, is almost a verbatim copy of the article over the signature of Paul Sords, published in the technical department of the *Engineers' Journal* for February, this year. Such plagiarisms have occurred several times. Ideas have been taken from the writers to the *Journal* without giving credit, but I never saw anything so near a deliberate steal as the mentioned article seems to be. Better keep an eye on that department of the *Journal*. It contains some good ideas, but they don't look so well when reprinted over the signature of another than the author and in another publication. Trusting that you will accept this as an attempt to prevent imposition on LOCOMOTIVE ENGINEERING,

I am, yours truly,

WILL W. WOOD.

*Terre Haute, Ind.*

[We find our correspondent is correct, and regret to have to acknowledge that an engineer would impose upon us a cribbed article over his own name. We only hope that it may be proven that Paul Sords and A. W. Long are one and the same—this would change the charge from "plagiarism" to "repeating," both of them disgusting to all fair-minded men.]

### What Was the Matter with This Valve?

*Editors:*

I had occasion to inspect a ten-wheel engine recently, equipped with Westinghouse automatic air-brake equipment, equalizing discharge valve. Driver brake of latest design outside equalized lever and operated by separate auxiliary reservoir.

Engineer complained that driver brake would not apply in service notch and only in emergency. Tender brake worked perfectly in service notch. I tried the brake, and, noting conditions, quickly formed an opinion, examined the valve and found where the trouble existed.

Now, what was wrong with this valve?

*Atlanta, Ga.* W. T. HAMAR.

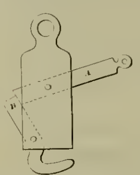
### A Drop-Hammer Trip.

*Editors:*

While in Los Angeles, Cal., May 3d, I spent a couple of hours to good advantage in looking through the Baker Iron Works, situated on Buena Vista street. This is quite an extensive plant, supplying a general contract trade. While strolling through these works, with both eyes open, my attention was drawn to a very simple but neatly working device which was used to trip a heavy weight with which scrap cast-iron car wheels were broken in pieces

to be melted in the foundry. While this subject may not come directly under the head of railroad matters, I thought, perchance, it might come handy to some reader of LOCOMOTIVE ENGINEERING, who might at some time find use for such an appliance. The contrivance consisted of a simple rough fork, or jaw, such as is generally used on the ends of tender-brake rods, and was made of ¾ x 3-inch wrought iron. The top terminated in a strong eye. The bottom was left open. Space between the jaws was about 1 inch near the top, and in the center of the device as it was held in position with the eye up was a ⅝-inch steel pin, upon which worked a lever, *A*, made of ⅞ x 1¼-inch iron, one end of which terminated in an eye, the other end being left square. This lever could be made of any consistent length, the length of this lever would determine the power required to trip the hammer.

Below this lever and to the left of the jaw was another ⅝-inch steel pin, upon which swung another lever, *B*, on the




lower end of which was a hook, left medium straight; the top end of this lever was also straight.

To place this contrivance in position to work, the square end of lever *A* was placed against the edge of lever *B*, near the top end. The hooked end was then placed through the eye in the hammer or weight and the hoisting power applied. When the weight had reached the desired height a slight pull upon a chain or cord attached to the eye of lever *A* caused its square end to slip from the end of lever *B*, whereupon lever *B* instantly flew to a perpendicular position, throwing back the hook, which allowed the weight to slide freely from it and fall.

This device could also be used to advantage, I think, upon a hammer which worked between ways or guides, as a very slight pressure upon the top end of lever *A* against any obstacle which might be placed above it between the guides would cause the hammer to fall, and I believe it would work quicker and surer than the appliance now generally used for this purpose. L. C. HITCHCOCK.

*Los Angeles, Cal.*

### Different Ways of Valve Setting.

*Editors:*

I see that my little dig at Mr. Campbell's pointers has raised a cry from away down in the Cracker State.

If "Young Whiskers" will refer to my article he will see that I asked for information in regard to the method of setting an eccentric with the pin on the quarter; outside of that, my only criticism of Mr. C.'s method was in the amount of time it required. I do not believe that "Whiskers" ever had the pleasure of working on a narrow-gauge engine, for any one who has knows that a machinist cannot get under one of them and loosen the set screws in a back motion—or outside—eccentric in ten minutes.

W—— says that he had an opportunity to try his "pet idea," and he succeeded so well that the engine saved $90 on one month's coal bill. He says, "Will you believe it?" From what I know about the readers of LOCOMOTIVE ENGINEERING, I don't think they will.

I was looking over the fuel expense sheet of a railroad for the year 1892, not long since, and will give a few figures taken from it.

Average miles run per ton of coal, 24½.

Tons of coals used for one month's run of 100 miles per day or 3,000 miles per month, 122.

Cost of coal on engine, $1.65 per ton, $201.30.

Amount saved by "Whiskers" in ten minutes, $90, or nearly 45 per cent.

I have heard of agents who offered to save from 20 to 40 per cent. of the coal bill by putting on their feed-water heater, mud extractor, or some other patent attachment, and I suppose that we may expect to soon hear of an agent going to the general managers and offering to save 45 per cent. of their coal bill if they will only put WHISKERS on their engines.

For the benefit of your readers I will tell how I set valves.

Referring to the January number of LOCOMOTIVE ENGINEERING, will say that I follow the same method as "A Practical Machinist" up to the point of setting the eccentrics, from there I vary a little from his method.

After getting the blades the right length, place reverse lever in front notch of quadrant, move engine forward till right crank-pin is on forward center. *Always get pin on front center when setting eccentrics*, for in that position the throw of the back motion is down and the set-screws can be got at much easier. If forward motion eccentric shows too much lead, move it away from the pin till valve-stem shows BLIND, then move towards the pin till stem shows the required lead and set up the set-screws. Put lever in the back notch and repeat the operation with the back-motion eccentric. It is not necessary to move the engine to take up lost motion in setting eccentrics, when changing from the forward to back motion, as you take up all the lost motion by moving the eccentrics till the stem shows *blind*.

If you have to move the back motion very much it is better to reset the former one, for if you move one eccentric very much it will alter the lead of the other one on same side. Now, go over this and see that it is all right by moving engine off of the center and then back to it with lever in front and back notches. Move the engine forward till left pin is on the forward dead center, and set the eccentrics on that side in the same manner.

Engine is now square at full stroke, but as it is generally worked in about 6 inches, the valves should be squared with the lever in that notch or near there.

Place lever in 6-inch notch, hold tram on valve-stem and move engine till valve just closes the front port on left side. Stop moving engine and measure the distance the cross-head has traveled from the dead-center on the guides, which is 6 inches. Mark it on front end of left guide. Move engine forward and obtain point of cut off for back end of right side, this is 7⅜ inches, mark it on back end of right guide, get point of cut off of back end of left cylinder. This is 7 inches. Get cut off front end of right cylinder 8⅞ inches. Now you have right side front 8⅞ inches, back 7⅜ inches, left front 6 inches, back 7 inches. To make engine cut off equal on both ends of left side, add 6 and 7 inches=13 inches, one-half of 13 inches is 6½ inches, move engine till crosshead travels 6½ inches, the distance on valve-stem from point of tram to point of cut off will be the amount to change the back motion blade. To make right side cut off equal, add 7⅜ and 8⅞ inches=15⅞ inches; one-half is 7¼ inches, move engine till crosshead has traveled 7¼ inches, the distance on valve stem from point of cut off to point of tram will be the amount to change back motion blade on right side.

The engine now cuts off at 7¾ inches on right side and 6½ inches on left side. To make it cut off the same on both sides will lengthen the link hanger on left side or shorten the one on right side. I do not like to raise or lower the tumbling-shaft boxes, for it is apt to cramp the shaft and make the engine handle hard, and besides, if you raise one box, the arm being about 10 inches from the box, you only raise the link about three-quarters what you raise the box and you also raise the other link about one-quarter as much.

With reverse lever still in the 6-inch notch, move engine till the head on left side has touched 7¼ inches. With a scratch awl make a mark on the side of link under plate of link block, then move lever until valve has cut off steam, as shown by tram on valve stem; make another mark on side of link, and the distance between these two marks will be the amount lifter will have to be changed.

By "Practical Machinist's" method find if the reach-rod is the proper length, and if it is not, change it; as a general thing, if it needs changing it will not be enough to affect the lead so as to require the eccentrics to be moved again.

Your engine is now as near square in the forward motion as it can be made without some radical change in the design of the link motion.

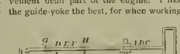
The reasons for changing the back motion blades in equalizing the cut-off in the forward motion are: A road engine uses the back motion very little and so it can be sacrificed for the benefit of the forward motion, also, if you change the forward motion blades you affect the motion more the farther from the center the lever is placed, while you want to change it most the closer to the center the lever is placed.

It is impossible for a person to learn to set valves by reading or studying without he has practice, for no two sets of valves will require the same changes, as different engines have differently proportioned valve motions. One point that must be considered in changing the length of blades, is whether the two arms of the rocker-shaft are of the same length, for if the outside arm is the longer the blades will not require quite as much change as the stem shows.

I will venture to say that if "Whiskers" saved 45% in ten minutes by his method, if he had used this method he would have saved the other 65%.

Now for the benefit of "W——" or any one else who wants a quick method of setting valves, and one that will be found more accurate and, I think, quicker than the ten-minute plan—at least it saves part of the pinching.

When taking the port openings at *A* and *C*, also mark them at *D* and *F* with a tram bent on one end, and the straight end in a center punch mark on any convenient dead part of the engine. I like the guide-yoke the best, for when working



from there you will be out of the way of the steam from the cylinder cocks.

Put a center at *E* between *D* and *F*. Now, when engineer reports valves run over, have the hostler handle engine for you, and with the reverse lever in the forward notch have him move the engine slowly one revolution while you walk by the side of guides, and with end of tram in punch mark at *X* mark the full travel of valve at *G* and *H*; one half the difference between *E G* and *E H* will be the amount the forward motion blade will have to be changed. Rub out the marks at *G* and *H*, and with lever in back notch have hostler move the engine slowly one revolution while you mark the stem again at *G* and *H*, one half the difference between *E G* and *E H* will be what the back motion blade will have to be changed.

Mark the amount on the blades with a piece of chalk and repeat the operation on the opposite side. Be careful to commence marking the valve-rod before valve gets quite to end of travel. Now get under engine and change all blades that require changing, after which you will have to get some one to pinch engine and get one dead center on each side and set the eccentrics if they need setting.

In setting valves this way, all parts of the motion are under the same conditions as when the engine is in service, but the fault that it has is that it tells nothing about the cut-off. I am not the discoverer of this method of setting valves and only recommend it for an emergency, when an engine must be got out in a hurry, or for those who are opposed to a machinist taking the time that is necessary to set valves the way they should be set. F. C. CHARLES.

*Cedar Rapids, Iowa.*

### Conger's Puzzles.

*Editors:*

If I were working on Brother Conger's puzzles, on No. 1 I should examine port in brass bush in triple valve body leading to brake cylinder, and the cavity under the bush. If these were clear, which could be ascertained by filling this port with thin oil, and observing how fast it disappeared; if these were all right I would pour oil in exhaust port outside and see if it came out readily in first hole in seat under slide valve No. 3, plate D 22. Thus, assuming exhaust cavity was clear, Piston No. 4 had its proper travel, and bush, Fig. 9 *b*, plate No. 3, was tight. On puzzle No. 2, would disconnect pipe from brake-cylinder, and by applying brakes or giving straight air, see if the air came through properly. Next, if this failed, would, if piston were free, take off head, and if it were a cape chisel job look for it in bottom of ½-inch pipe hole in cylinder head, taking it for granted that when he speaks of pushing down cams he means push down driving-brakes. No. 3 would depend on piston travel very much. There is a range of 10 pounds on that alone. On a passenger car with 12 x 33-inch reservoir and 10-inch cylinder, with 8-inch piston, the first emergency application should give about 57 pounds, and from 60 to 63 pounds at the second. On service application, should give 50 pounds equalized pressure first time and 53 to 57 second time, depending on how clean the passages were and in what order the brakes were kept. N. B.—With old pressure retaining valve. The only reason friend Croden's tender triple-valve would not work, if nothing but cleaning was done to it, is as far as I can see, there may have been a smaller pipe than usual between tender and brake-valve, and triple-valve been so dirty and dry that it required the larger opening. GEORGE HOLMES.

*Roanoke, Va.*

THE ANSWERS.

First one.—A cinder got in exhaust port, sometimes it turned around so the passage was closed entirely, at other times it let the air escape slowly by it. When triple was taken apart to clean, the cinder got in somehow, after that, when it was taken down, the cinder was not seen. We turned a stream of water into the outside end of exhaust, out came the cinder.

Second.—The driver brake-rod piston struck the top cylinder-head when it released, and finally wore into the head and made an air-tight joint. When brake was set the air only pressed on a surface ⅛ inch in diameter. We cut some grooves in the center of piston to let the air get into the cylinder and brake works O. K. In this case piston-rod came through the spider too far. C. B. CONGER.

*Grand Rapids, Mich.*

### A Dangerous Mistake.

*Editors:*

"Air-brake instructors tell us that when a partial application is on and the emergency is desired, to move the handle to the extreme left for a moment and then to the extreme right, and its action is assured."

This quotation is taken from an article

by Mr. A. W. Long, in the May number of LOCOMOTIVE ENGINEERING. It expresses an idea that, to the certain knowledge of the undersigned, is responsible for more than one disastrous wreck. The origin of this idea is a matter of conjecture only. Possibly it arises from the mistaken belief held by many men that in some mysterious manner the pressure in the main reservoir is of some use in emergency application of the brakes.

When asked how to let the air out of the main reservoir, many engineers will say, "Put the handle in the emergency position." It is of vital importance that all engineers should be impressed with the fact that when the brake is partially applied a release can only be a loss—not only a loss of time but of *pressure* as well.

Even if the handle is thrown to release position so quickly as not to release any of the triple valves, time is lost in the act and nothing gained in the way of pressure. Besides this it is almost impossible, or, in fact, QUITE impossible, to make this movement so quickly as not to cause some of the brakes to come off (supposing, of course, that they are only partially applied).

Of course, to throw the valve handle to the release position increases the pressure in the train pipe, but it must not be forgotten that the brake will not set again or the pressure in the cylinder increase until the train-pipe pressure is again reduced below that in the auxiliary reservoir. This is true of BOTH the service-stop and emergency. Although the emergency does put train-pipe pressure into the cylinder, it is nevertheless dependent on the movement of the main valve for its action.

Under any circumstances, no matter what, it is a great mistake to release brakes or "throw the handle to release position" in case of emergency. Put it immediately to the emergency notch and leave it until the brakes are fully applied.

PAUL SYNNESTVEDT.

*Chicago, Ill.*

## In the Transportation Building of the World's Fair.

[EDITORIAL CORRESPONDENCE.]

The exterior view of the World's Fair buildings presents such an attractive display that a stranger coming within the gates for the first time is at a loss which one to choose. If they wish to see the exhibit likely to be of the greatest interest to them, railroad men would do well to find their way direct to the Transportation Building. On reaching the building it is very well worth an inspection outside. It is a very handsome oblong structure, of what is called the Romanesque style of architecture. In reality it is a huge oblong building with a high monitor roof and a cupola in the middle. The arrangement appears to give very good light and ventilation. The main entrance is an imposing square block, surmounted by a shallow balcony and elaborately ornamented by carving. Four semicircular recesses make a striking border to the gateway. On one side of the entrance is an extract from Bacon, and on the other an extract from Macaulay; both dwelling on the importance to civilization of good facilities for transportation. On entering the main door the first thing seen is a model of one of the caravels of Columbus, flanked by some of the modern massive vessels built by Laird of Birkenhead, England. In close proximity to these are some Fox corrugated steel furnaces.

Glancing around from the doorway so many attractions strike the eye that I decide to take them in a diluted form by a view from the gallery. On climbing up the stairs I find the gallery is in no way behind the main floor in objects of interest. The gallery possesses an advantage in the fact that a visitor can look at the exhibits there and find relaxation from watching the exhibits below, and the moving mass of humanity walking around. One sees among the crowd at this Fair the most picturesque looking people to be seen out of Asia. All the varieties of color, all the diversities of garb and races belonging to the human family, appear to be represented within the Fair grounds.

A very attractive part of the gallery is the offices of Mr. Willard A. Smith, Chief of the Transportation Department. Here there will be offices set apart for the railway press, and the headquarters of LOCOMOTIVE ENGINEERING at the Fair will be here. Around the walls of the offices are hung a great variety of beautiful photographs showing scenes relating to the development of transportation. The pictures give a graphic illustration of the improving methods, from the time men's shoulders were used exclusively for the carrying of burdens, up to the proficiency which built the *Campania* and the "999." One looking over the pictures gets an admirable object lesson of the numerous methods that were tried from the era of the pack saddle with man as the bearer, to our day of luxurious steamers and palatial palace cars.

A curiosity to be seen in Mr. Smith's room is a plant for heating the place by electricity. Railroad men will find this well worthy of examination. It was put in by the Consolidation Car Heating Co.

Starting on a tour of the gallery one is first impressed with the great variety of manual mechanical means of locomotion in the form of velocipedes and their kind. This place is the paradise of wheel riders, and the Mecca of small boys. Next we come to boats of all kinds, from the crudest dugout and bark canoe to models of the finest steamers. The appliances used in all kinds of water transit are very well represented, both in the gallery and below. A railroad man will not find many of the appliances used by himself in the gallery, but it is, nevertheless, a very interesting exhibit, and one well worthy of close examination. There is a great variety of all kinds of road vehicles, from the baby-carriage up to the tally-ho coach.

Descending to the main hall after a turn around the gallery, one of the first sights to arrest attention is a pyramid of railroad rolling stock wheels exhibited by a French firm. The pile has four pairs of driving-wheels six and a half feet diameter as a base, and from this it is tapered up by wheels of decreasing diameter to an apex formed by a single pair of tiny car wheels. The wheels all have steel or wrought iron centers, and some of them are striking specimens of wheel work. This exhibit possesses a melancholy interest from the fact that it fell down while under construction and killed several men.

The Bethlehem Iron Co. have a very striking exhibit in the form of a full size wooden model of their largest steam hammer. It looks so much like iron that visitors believe it to be made of that material, and admire the enterprise that led to the transporting of such a ponderous article. Beside the hammer there are some immensely heavy forgings, one section of a shaft being the heaviest forging that I have ever seen.

An exhibit near here which attracts much attention is the section of an ocean steamer, erected by the International Steamship Co., New York. Thousands of people who have never seen an ocean steamer learn from this exhibit how such ships are arranged.

Towards the other end of the main hall, the most conspicuous object on the floor is the exhibit of the Johnson Signal Co. They have a forty-lever machine which has been in use eighteen months, and a variety of switch and signal apparatus, of which we will give more particulars in a future issue.

The next exhibit presents a variety of apparatus familiar to all train men, being that of the Westinghouse Air-Brake Co. Near this are the exhibits of the New York Air-Brake Co., the Boyden Air-Brake Co., the Mason air-signal, and an air-brake got out by the Crane Co. We will give descriptions of these after they are in working order. The brake exhibits extend into the annex, where we find the principal part of the railroad rolling stock. The space near the brake exhibits is devoted principally to track and construction appliances, among which are the Thatcher dump car and the Rogers ballast car. The former company have two cars, which are shown in operation and attract much attention.

The Rogers ballast cars make a most interesting exhibit, as they are shown distributing ballast. One car putting it down and the other spreading the stones, it is left ready for track raising. The large number of railroad men constantly to be seen watching this exhibit indicates the growing interest in the proper methods of ballasting track.

Another track exhibit which excites much interest is the section of a track fastened with the Greer spike, made by Morris Sellers & Co., Chicago. Sections of ties are shown with the Greer spike and the common spike alternating. It is seen that the common spike bruises its way into the wood and makes a crushed nest, which is ready to fill up with moisture and begin the rotting process that does so much to shorten the life of ties. The Greer spike, on the other hand, cuts its way in cleanly and is grasped closely by the grain of the wood. An onlooker does not need to be told that the Greer spike is twice as hard to pull out as the common one, and makes in that proportion a better fastening.

Near here, and rather out of place, as it appears to us, in this track department, we find Schoen & Co.'s exhibit, consisting of a great variety of pressed steel articles used in car construction. There is in this exhibit an end of a coal car, showing draft timber fastening, body bolster, corner plates, stake pocket, center plates and other parts for which pressed steel is well adapted. There are brake beams and specimens of all the other pressed steel forms made by the company. Among the novelties exhibited are a pressed-steel axlebox and a track tie. The box consists of two pieces, and is of the master car-builders' standard and dimensions. There appears to be a great future for this box. The pressed-steel tie is dished and bent down in the middle and ends. There are 18,000 of these ties in use on the New Central in New York. Mr. Schoen received a contract from the Government lately to supply the Post-Office Department with pressed steel letter-boxes. One of them is shown with its attachment.

Passing a great variety of appliances intended for the construction and maintenance of railroads, such as steam shovels, ballast-plows, and all sorts of switches, we come to the magnificent train exhibited by the Canadian Pacific, which is described elsewhere. Passing this and the fine exhibit of the London & Northwestern, described elsewhere, we find ourselves surrounded by English railway appliances. Among these you notice first the exhibit of the Great Western Railway of England, the principal figure therein being a green-painted locomotive, noticeable for its huge single pair of drivers and wide gauge of seven feet. The engine is the historical "Lord of the Isles." As we expect to illustrate this locomotive soon, there is no use to give particulars of it at present. The rolling stock of the road is represented principally by drawings and photographs. There are some vacuum-brake attachments among them of pressed steel cylinder and piston cut in sections.

Passing the imposing locomotive, "James Toleman," which we illustrate in this issue, we find a succession of booths containing exhibits of the Midland, the Great Eastern, the Great Northern of Ireland, and others that operate under the British flag. As they all consist mostly of pictures, we need not mention the details. One exception to this is found in the booth of one of the Irish railways, and consists of columns of pressed peat, which may be examined with interest. This is used for fuel, and appears to be as hard as coal and looks very much like that article.

On the next track from the British exhibit we find a line of space devoted to exhibits of car heating and lighting. This part was very incomplete when I was there, the Consolidation Car Company's exhibit being the only one in any kind of shape. Passing up towards the main building and inside of the same, we find a New South Wales exhibit. It consists principally of a clay model showing the tortuous course of certain railways in the Colonies in crossing a mountain range. There are a variety of attractive views showing the railway work shops at Eveleigh, the Hawkesbury bridge and a variety of other railway scenes.

Beyond this on the Annex, we find four tracks occupied by the splendid exhibit of the Baltimore & Ohio. The principal part of this collection consists of historical locomotives, and shows in striking form the gradual development of the engine. We expect to devote a great deal of space to illustrating and describing this exhibit. Meanwhile, it is just to mention that the Baltimore & Ohio Railroad Co. have expended nearly $100,000 on this display, which is from a historical standpoint the most valuable ever seen. The modern part of the exhibit consists of a royal blue train with a Baldwin engine in front. We expect to give more particulars about this train in another issue.

Throughout the remainder of the immense annex, there are groups of all sorts of locomotives and cars with every variety of attachments exhibited in separate displays. A visitor here is like a bee in a field of clover—he can only expect to take occasional sips, the luxury of choice being embarrassing. After many days devoted to this exhibit, I failed to digest the identity of the car display, but the various locomotives became quite familiar. Besides a great many foreign locomotives and engines exhibited by railroad companies, the following engines are exhibited by builders: Baldwin, 17; Brooks, 9; Pittsburgh, 5; Schenectady, 4; Rogers, 4; Porter, 4; Rhode Island, 3; Richmond, 1; Lima Machine Works, 1.

A. S.

## A Fancy German Train.

There is a German exhibit in the Fair consisting of a small tank locomotive and two carriages that are well worthy of inspection. The engine is six-wheel connected, with all the motion on the outside. Americans will be struck with the smallness of the working mechanism. The finish is very fine. The cars are built entirely of iron or steel, and are remarkable for the elaborate finish and rich ornamentation. One is a compartment car carried on three pairs of wheels, held in pedestals secured to the bottom of the main frame. The springs are about 80 inches long between pins, and rest on the top of the axle box. The other is a saloon carriage of the American type, with platform and entrance at the ends, and carried on two four-wheeled trucks. Very elaborate drilled brass railings surround the platform. Both cars are very luxuriously finished inside.

The trucks of the saloon car are curiosities, being of pressed steel and made not unlike the pedestal trucks used on the Boston & Albany. The spring arrangement is, however, different—a very long spring being employed which extends from box to box. Persons who like to see curious specimens of railroad rolling stock should not fail to find this train.

In the course of a private letter to one of the editors, Dr. Williams, of the Baldwin Locomotive Works, says that he recollects the "Cork Leg" engine mentioned in the April number of LOCOMOTIVE ENGINEERING. He says that she wore a flat spot on one of her tires. She had a single pair of drivers. As she came limping up to Northfield some wag wrote the words "Cork Leg" on the side of the cab. The name stuck. Dr. Williams has more curious reminiscences about railroads than any other man in the world.

## An Exciting Night on a Confederate Soldier Train.

BY C. S. ANDERSON.

Resuming my war narrative of our hurrying the remainder of Gen. Lee's army from Richmond to reinforce Jackson, who had gone to Gordonsville to meet Gen. Pope, I will tell of one of my trips out from Richmond with a soldier train.

Mr. John M. Kroft, the regular engineer of the "Albemarle," was called home to his family, and the master mechanic detailed a machinist named Dock Galloway to run the "Albemarle."

As I have before said, a machinist is not necessarily an engineer. However expert and competent he may be as a machinist, it requires experience for him to learn to handle successfully, engines and trains in emergencies and under difficulties. Put a healthy twenty-two-year-old boy on an engine and let him *there* learn the thousand-and-one difficulties that necessarily come in the path of a train runner, as, for instance, those that befell Galloway that night of which I tell. It is not down in the books, this knowledge, but it has to be driven in by hard knocks, and once in, cannot be lost. It seems to me that some of our old runners have such a mastery of the machine that they appear only to watch the track ahead. A first-class locomotive is to machinery what the lion is to beasts—the king. Nobody can blame ambitious young men for falling in love with an engine, for she is the picture of life itself. But to my story:

Dock Galloway was a small, nervous gentleman, very polite and quiet, as good and harmless as he could be. I was right glad to see him on the "Albemarle" when it backed down and coupled on to my train. I knew I would have no fuss, even if I did not get on so successfully with Galloway as with some others. We took some officers aboard in Richmond, and got orders to load soldiers between the Chickahominy and Hanover,—the soldiers who had come to the railroad *via* the Cold Harbor road. The cars were soon crammed full of soldiers, of course, inside and out, and we got along very well during the day, keeping pretty well up with our preceding train, which, fortunately, as it turned out, was in charge of Conductor Joshua Finks and Engineer John Davidson.

About 8 P. M. we got safely in Melton's Station, about four miles east of Gordonsville, and having turned over the Summit there rolled along down a 65-foot grade which runs nearly all the way from there to Gordonsville. Feeling that we only had to let her roll on into Gordonsville, and being anxious to reach there and rest, we forgot to tell our new engineer of the wayside wood pile where we usually had to stop and get wood.

Oftentimes during the war we had to stop at out-of-the-way places to get wood from the ricks along the road. It was very dangerous and was the cause of right many accidents. Running into the cut of Cain's old field, Engineer Galloway gave one sharp whistle for down brakes. I listened anxiously for the second blast, which would have meant "Stop," as one blast was often only intended to slacken speed. I was, of course, on the look-out, and saw our rear dash past a red lantern and I also got a glimpse of a mess of folks in the ditch. I did not care to run over the tops of all these freight cars loaded with soldiers, but decided to see why it was that Mr. Galloway did not call for brakes again, reverse his engine and stop the train. I signaled my brakemen and called to them to put on brakes on every car they could get to.

I had gotten up to within a few cars of the engine when I saw just ahead of me the rear of Finks' train, which was just moving off from the wood pile where they had stopped to get wood and had sent the red light back to stop us. I can never forget the scene, made awful by the powerful light which the "Albermarle's" headlight threw on it. The soldiers who were on top of the rear officers' car scampered ahead for the front cars, thinking that we had run into them. Capt. Finks in rear of his train waving his lantern with all his might, the door of the coach open and the headlight of our engine revealing all excitement therein, and all on the rear platform.

But John Davidson made the "Westward Ho" spit fire as she coughed and snatched from the jaws of death two trains full of soldiers. It was certainly a happy disappointment to us all that John kept ahead and prevented the "Albemarle" from smashing into the rear coach of officers. What on earth was the reason that my engineer, Galloway, did not do anything to stop his engine, under such circumstances, I could not imagine, unless possibly he had fallen asleep, not being used to running and being out at night.

I tugged on over the soldiers until I got to the front of the front car and looking down into the cab saw, alas! that it was empty! The soldiers sat in front of the cars with their feet hanging down like boys on a goods box.

"Where are the engineer and fireman?" I quickly asked one of these, who replied, "Pshaw, they both jumped off when they saw that red light yonder, Cap," continued they, as I was getting down into the tender to get over into the cab, "You'd better mind; we heard those officers on the train in front halloo back that they will shoot every railroad man on this train when they reach Gordonsville."

My first impulse was to give the engine steam in her reversed condition and come to a full stop to see what had become of Galloway. But the thought then flashed into my mind that the train following us had by this time gained on us, as we were running very slowly. I leaned out of the cab and heard it coming, evidently having turned the summit. I at once threw her in front gear, whistled "off brakes" and pulled out for Gordonsville, choosing death to myself in front rather than death to my train of soldiers and myself too in the rear.

I fully believed that I would be shot at Gordonsville by the soldiers before I could explain the situation, and show them that I was innocent.

Pulling into Gordonsville, going west, there is, after passing the last county road crossing, a straight line almost a half mile long, which runs up nearly to the east switch at Gordonsville. We were just coming around the curve into this straight line when I saw a red and white lantern coming rapidly towards me and waving us to stop. I, of course, called for brakes reversed and stopped. Good Capt. Finks, pale and trembling as he came up out of breath, seeing me, as I leaned out of the cab to learn of him the trouble, "Carter, you will all be shot! for God's sake run to the woods!" he cried. "Where are Galloway and the fireman?" I quickly told him what had happened. While in this state of excitement we heard the following train coming along around the curve back of us. Instinctively, I must say, for I hardly knew what I was doing, I whistled for "off brakes," and pulled the engine open, intending, certainly, to get far enough into the straight line for the following train to see me in time to stop and let me pull out of their way.

Conductor Finks pulled himself up on the engine, and we got almost in sight of the station yard at Gordonsville, when I concluded to stop and take care of No 1. The soldiers in the front car, seeing and hearing it all, had become very much interested, and said to me:

"Captain, stand your ground, you saved our lives and we will try to save yours," and they began to load their muskets.

"Let's run up to the station and tell the officers all about how it happened."

Capt. Finks said, "That's it, boys, come on." And they ran up the yard to the depot, while I with peace commissioners in front and bayonets and balls in the rear for my defense, sat serenely on the "Albemarle," and was soon assured by Capt Finks and his Confederate officers that it was all right with the soldiers.

I pulled up to the reception room as meekly and mannerly as I possibly could.

What on earth had caused Galloway and the fireman to jump off where they did was the next question. It was a mystery to us all. Capt. Finks and Engineer Davidson agreed to take care of our train, and a great crowd of us got lanterns and went back up the track to see what had become of Galloway and the fireman. Curiosity and anxiety were at their height. The old mountain country road and the railroad run alongside from Louisa Court-House to Gordonsville, a distance of fourteen miles, and never lose sight of each other. It is a curious fact that Contractor Elisha Melton located the railroad, running the levels with three sticks, and built the road, a slab track, the western extension of the Louisa Railroad about 1840. Notwithstanding the fact that it was built without the use of an engineer's instrument, the grades and curves remain just as "Lisha Melton" located them fifty years ago, and it now forms a part of the great C. & O. system of 1,500 miles of track with 500 locomotives and running entirely through three States. But to my story.

I only intended to say that in order for us to go down the railroad we had also to see at the same time all that passed on the county road, and some of our party soon met Galloway and the fireman both nearly dead, laid out in a two-horse wagon, with "rack body" and poles put in to make a bed for the wounded men. The brakeman who had signaled Galloway to stop, and whose nonsense had caused the accident, stuck to them after finding them injured, and secured the wagon which he happened to catch on its way home from the woods.

"Why did you jump?" was, of course, the first question. Galloway, it seems, not being an experienced engineer, and having heard so many exaggerated reports of soldiers bayoneting railroad men who caused collisions, thought that the red light was hung on the rear of Finks' train, and that he was actually into the preceding train filled with soldiers, and so he jumped off after doing all he could to stop. The fireman jumped, he said, because Mr. Galloway jumped.

We used then a square tin lamp, the back tin, the sides white lights, and a red glass in front, but the red glass had a tin door over it to open and shut on a wire hinge. The brakeman said that the tin door would not stay open, so he put it up against his breast and held it open with one hand perfectly still. That was what fooled Galloway.

Doc never pulled another throttle open, but being too disabled for war or railroad life, he assumed the more peaceful occupation of gunsmith, which he successfully carried on until his health failed him, and still following kind-hearted old Joshua Finks he rolled into the Eternal City.

*Richmond, Va*

### An Improvement.

Travelers who have carried along a 20-page folder, with a distorted map of their native land on one side and some Chinook statistics on the other, in the fond delusion that it was a time card, will appreciate a little kink of General Passenger Agent Daniels of the New York Central. This is a four-page folder with the statement about the "shortest" and "greatest" and what-not all condensed onto the first page. The second page tells just where *one* train will get breakfast, luncheon and dinner. The third is advertisements of leaving time and stopping points of seventeen fast trains and the last page is a condensed simple time table of *one* train—tells where it stops, time it passes important towns, etc., and gives instructions about disposal of baggage. These little slips are distributed to each person in the train; you get just what you want for this trip and no extra and you can't make a mistake. The time table of train No. 6 is before us—we got it at Buffalo—and noted more satisfaction in their use by the passengers than we ever saw with the Chinese laundry list usually furnished.


A CONFEDERATE.

### A Confederate.

The picture here shown was made from a photograph of the engine "Aeriel," on the S. C. road, taken at Charleston, S. C., in 1866. This engine was built at their shops in 1851, had a hook motion with independent cut-off and dome boiler. She was employed during the war as a rebel and did good service to the cause of the Confederacy.

Beside her can be seen some cannon, hundreds of them having been made in these shops during the war, many of the tools for which, and same of the jigs and templates are still employed or are laying around the shops yet.

### Another Piston Blows Up.

On the 4th of May an engine on the Queen & Crescent came into Chattanooga with a bent piston rod. The rod and piston were taken out and the rod heated over a blacksmith fire. While the smith was straightening the rod the head exploded, killing the blacksmith and his helper and seriously wounding a man standing near by. Solid heads, so called, those without followers and bull ring but cast in one piece, hollow, with the core-holes plugged up, have exploded several times of late years when heated and one case is reported where one blew up while under a drill press being tapped.

### Making Locomotive Engineers—Two Processes.

BY J. J. CLAIR.

Having noticed an article in LOCOMOTIVE ENGINEERING on the subject, "How to Become a Good Fireman," I will give some experiences on a good or bad fireman, or how to become an engineer.

Jones and Brown were raised in the country and got a pretty good common-school education. When eighteen years old they wished to go firing, for it was seemingly a pleasant occupation, little to do but throw in a few shovels of coal occasionally and spend the rest of their time watching the pretty girls along the road. The excitement, novelty and change of scene prompt them on and through the kindly offices of a friend the wished-for positions are obtained and they go on the road.

Of course they are green and willing to do exactly as instructed, for they want to be good firemen and more, they expect to become locomotive engineers. Things go along all right for a while, the engineer explains how they should handle the scoop; when they pile the coal in the center of firebox and steam goes down to 50 lbs., the engineer will get down and fire and tell them lots of things about the way to keep engines hot. The engineer will fire up the hardest part of the hill a few trips until they can manage to hold the steam up with injector shut off. After a while they can keep enough steam to get along somehow, even if they do waste large quantities of fuel unnecessarily.

After a while the engineer talks about closing the dampers when approaching a stopping place or a down grade and tells them that considerable coal can be saved by following closely the instructions; engineer explains the effect of a heavy fire, about the necessity of air getting through fire, how to guard against getting fire too heavy or too thin, how to fire evenly without using hook or scraper, if possible to get along without them.

At the end of six months Brown has done his work as well as possible and has got into the habit of performing his duties quickly, thoroughly and cheerfully; he has a copy of Forney's Catechism of the Locomotive and has subscribed for LOCOMOTIVE ENGINEERING and during his spare moments studies other literature relating to the occupation he has selected. It's hard work at first trying to understand all he reads about combustion, machinery, etc., but he keeps at it and after a while it gets easier as he gets to understand it better.

Old Billy, the machinist, tells him that he don't go much on reading, that practice is what is needed, and those book-writers have only a lot of theory and guess-work to go by. But Brown remembers hearing the engineer state yesterday about the bad job old Billy did on the engine, and that he must get the work done over again to-day.

Brown has to know many things to be a first-class fireman and engineer, and while he cannot learn all of them out of books, he knows that a careful reading of the literature of his calling will be a great help to him, and will increase his knowledge far faster than can be possible with the most favorable practice without such reading. He not only studies matters relating directly to his calling, but even reads books and papers relating indirectly to it; he knows that should he take up an article relating to bridge construction he will understand more clearly why the superintendent has a slow order on the new bridge.

If he reads about the effects of changes of temperature on iron and steel he will understand why it is necessary to run carefully during extreme cold weather, or why nuts and bolts are more liable to become loose about an engine after a cold spell; he knows something of sudden changes of temperature on firebox and flues, he learns something about a boiler, its material, construction and how to care for it.

Studying something of the chemistry of fuel and feed water, he learns how to fire intelligently, economically, with much comfort to himself, the engineer and passengers. He is aware of the effect of different impurities in the feed water, and appreciates the importance of watching that he does not waste large quantities of pure soft water through the pop needlessly in the form of steam to the discomfort of those within hearing distance and loss to the company, besides increasing the amount of impurities and mud in boiler unnecessarily in a given period.

He cheerfully performs important duties and trifling ones; perhaps he sometimes thinks the master mechanic or engineer never notices all his work. No, he is aware that the officers and his associates are noticing and passing a verdict on his work and conduct daily, and that patience will bring his reward. If he thinks he has discovered a fault in his engineer's work he goes slow about it; he may be mistaken; anyhow, the engineer has probably noticed a dozen faults in his work and has not complained about them. He guards his habits and character, is truthful and sober, he knows it don't require much intelligence to detect a lie, that those who lie forget about it but those who hear do not, and think less of those who deceived them.

Early in his career he gets on with a good engineer, carries out his instructions; keeps his good-will. After a while, in good season he is promoted, and finds the first year pretty hard work, for now he has to take the responsibilities and think for himself, meanwhile, he keeps increasing his knowledge of his work, becomes familiar with the mechanism of engine, studies injectors, brake valves, triples, lubricators, etc.; keeps read up on what is going on in his business, and becomes a successful engineer.

Now, we will go back and follow Jones. At the end of six months he is beginning to think he knows it all, he goes around with the gang that loaf outside the office on the branches, and a Smart Alec, who has had a number of engines to fire and kept none of them, tells him how he does it and how Jones should do things, says he is a fool for cleaning and bothering about the fire. Jones takes in all this, and next time he goes out lets Mr. Engineer know he is firing that engine, and fills firebox with coal to suit himself, leaves the dampers wide open at all times, lets engine blow away steam from one end of road to the other; easiest way is best, say she, this is the way Smart Alec does it and he knows. Jones don't bother putting on blower when steam is shut off, just lets smoke trail back in coach windows when on passenger. When he is told anything by engineer he don't give it any attention, or is ready with some absurd or false excuse, or differs with engineer, or disputes the point with him.

When he gets in he goes up town, meets Smart Alec and more like him; they show him around and post him up. Next trip, when he fills firebox with coal, and engine don't steam well after he has hooked over the fire for the twentieth time, he blames it on engine—not a good steamer, or perhaps engineer works the injector too much. If Jones can find anything about the way engineer performs his duties to kick about, he does it, and tells Smart Alec and the rest what a chump he fires for, what engineer ought to do, and expresses his opinion quite freely about engineer's business.

Pay-day he starts out to have a time, yes, a great time, taking in the town. Smart Alec has a wife and small family. Wife goes over to see the master mechanic on pay-day, makes inquiries about Smart Alec. She needs some money for the little ones, but Smart Alec is out for a time and has Jones along with him. If Jones has some spare moments for reading he studies the *Police News* or some detective stories. They are more exciting than reading about locomotives. When he learns that engineer is about to do some work on engine and he might be in it, he slips off out of sight, and when the work is done comes back innocently, and, of course, the engineer sits down and tells him all about it—Jones is so much interested in learning, you know.

Next day, when he goes over to other end of road, he don't take much trouble about engine; it is clean enough, and if it don't suit engineer he can go out and brighten it himself. Jones goes around back of roundhouse in the shade on the benches and finds the gang, and they criticise engineers in general and Jones' engineer in particular. After a while they notice master mechanic going down to station, and all retire up to old Jake's to play pedro or seven up for the beer.

After firing, or doing some alleged firing for three or four years, he kicks because master mechanic has promoted Sam and Tom and he is not given a show, swears that the master mechanic never did give him a show anyhow. After a while, during a rush of business, he is promoted; but he will be a bum railroad man, a disgrace to the engineers and a stumbling-block to many good people who may think that perhaps all railroad men are like him.

When Brown was promoted he got the 64 regular and Jones got the 65, engines were exactly alike and doing the same work, Jones complained that the No. 8 injector on the 65 was too small, would not keep boiler full, the machinist took the injector down several times, swore it was all right and Jones still complained until he had a No. 9 injector put on instead of No. 8. Afterwards he often used the injector on fireman's side of engine, as he finds it hard frequently to keep boiler full with the No. 9; indeed, he says engine ought to have a No. 10 injector.

Brown has no trouble with the No. 8 on the No. 64, he can easily keep boiler full with a fine feed, and should the injector at any time fail to give good satisfaction he knows at once what is wrong with it and has it fixed.

Jones works the engine pretty much wherever the reverse latch happens to strike the quadrant when he hooks up the links, and fireman performs his duties on the free and easy method that Jones practiced when firing, fill firebox with coal and let engine blow off all along the road.

Brown is particular to work links hooked up as far as engine will do the work and his fireman takes some pride in doing his work as well as possible. Result, Brown's engine is in better condition after a given service, the boiler has not been required to evaporate as much water and there is a saving of 20 per cent. in fuel as compared with the showing made by Jones.

When Brown is leaving roundhouse he opens the throttle a little and reverses engine a few times, then moves engine slowly. Jones starts the engine with a jump and slips it a few times, and, as water continues to comes from stack, slips engine some more.

Jones opens sandpipes with a coal pick and needs new pipes after a few trips. Brown taps pipes gently with a hammer and after two years' service pipes are as good as new.

Jones comes in roundhouse after a trip, meets Old Billy; they have a talk, Jones says engine is slow—has no snap—Old Billy looks wise; tells Jones the No 65 needs more lead, that lead gives engine more snap, and Jones lays for the master mechanic to tell him about the vital defect in engine. Brown don't bother about the lead, but gives attention that valves are gone over once in a while; he knows the eccentrics are set and keyed on, also knows that valves will not stay set always, but need a little attention occasionally.

I was down at roundhouse yesterday, and Old Timer came in mad; had lost fifteen minutes on account of air-brake not working properly last trip, and transportation people were grumbling about delay. I told him that I went over the pipes around engine and tender occasionally and kept them tight; examined, cleaned and oiled the driver and tender brake, triples and drained main reservoir when necessary. Old Timer said he reported brake when he came in, and the man who examined it said there was nothing the matter. Old Timer said further that he never did get to understand much about those new-fangled valves and triples and lubricators, did not think lubricators were much account—did not work good—then as his memory went back to the time when he used to pour a quart of pure tallow into each steam-chest and cylinder per trip, he added with some tinge of regret, "If the old man would only let him have a little taller fur them cylinders the 75 would do a heap better."

While we were talking Jones came along —he is serving ten days for burning a pin off the No 65—and tells Old Timer that the master mechanic wants both of them up at the office at once to explain how they managed to use so much valve and cylinder oil last month.

Being left to my reflections, I mused how we meet engineers every day who never read anything about their business. Ask 'em to take a paper, they don't need it, have not got time for reading, triples, governors, brake-valves, lubricators, combustion, the proper distribution of steam by the slide-valve and link-motion are things they have never studied seriously. Perhaps they might have had some excuse in years past for not working engine hooked up to shortest cut-off that would do the work, as it required considerable pull often to get reverse lever back another notch, for the pressure on valve-seat and strain on valve-gear were considerable, but with balanced valves these difficulties have been obviated, and engineer can easily hold reverse lever in any position with little effort, usually. Experiments and experience have demonstrated the value of good valve oil for keeping valves and cylinders in good condition in preference to pure tallow. The balance has contributed considerably toward saving oil, while keeping valve seats from cutting under the higher steam pressure carried.

How important it is that we should improve our spare moments, cultivate character, have self respect, few of us have learned it all. We should not imagine it requires luck or genius to be successful, from simplest round of duties to highest, work well performed makes success. Luck is, perhaps, but another name for good judgment, and genius often a capacity for nearly superhuman effort.

We should labor, study, think, be sober From the first shovel of coal as a fireman on the old yard engine until you take a regular place on right side of the new compound at front end of the vestibuled day express, put heart and soul into your work. Half-hearted endeavor may not command success, don't be satisfied that you can do as well as others—you ought to excel. Do not go around relating the old chestnut about two engines exactly alike, how one can pull more cars and run faster than the other. Do not be ashamed if you are sometimes called an engineman. Perhaps you have not yet learned the full significance of the word "engineer," but if you study your business, perform your duties well, you will at least be considered an intelligent man and fully deserve the highest pay in your calling in this country.

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We would like to hint gently to "Engineer," Waukesha, that he wants us to do rather a thankless job. If he has ever told his fellow engineers unpleasant truths about themselves he would be likely to receive the same kind of return that we should get for criticising one of our rival papers.

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A patent has been granted to Benjamin Reece, Chicago, and assigned to the Q. & C. Company, for a method of making tie plates.

## The Man Who First Dared Use Cast-Iron Driving-Wheels.

European engineers fail to see how Americans dare risk their big locomotives on cast-iron wheels. Americans fail to see why the foreigner persists in forging


wheels that have always been cast in this country—few of our master mechanics know when we commenced to use them.

It may be interesting to know that they were first placed under the "Best Friend," the very first locomotive built for service in this country, but after she had been put into use.

The engine was built at the West Point Foundry, in this city, in 1829, going into service on the South Carolina Railroad in 1830.

The machinist who set her up and ran her first was Mr. Julius D. Petsch, whose portrait is here given. Mr. Petsch had been in charge of the rolling stock of the road (motive power, mules) since 1828.

Mr. Petsch soon became master mechanic of the road (then the largest in the world), and made many improvements in the engines and the shops.

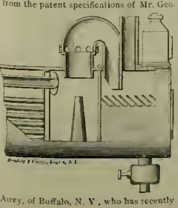
The first weakness developed by the "Best Friend" was in the spokes of her drivers, and Mr. Petsch had a set of cast-iron wheels made for her and put them into use, he used cast wheels from this on under locomotives and cars.

Mr Petsch afterwards became superintendent of the road and at once abolished the running of trains for the halfway posts and issued the first time-card the pioneer road ever had.

Before that, the man who got to the halfway post last had to back up to the first siding.

## Distillery Attachment for a Locomotive.

The accompanying chromo was taken from the patent specifications of Mr. Geo.



Airey, of Buffalo, N. Y., who has recently secured, by patent, the sole right to make all railroads who want to use this combination of distillery architecture and sanitary plumbing pay him a royalty.

He is going to "condense" the smoke, and assures us the front stack will give off steam only, while the cistern in the front end, with the window-blind attachment, will keep itself supplied with water from the condensation

We don't see why he didn't arrange to have the soup tank larger, so as to throw more weight on the trucks and lift it up off the drivers; this would help prevent hot boxes.

Then he ought to have a hand-hole in the side, so that the engineer could cook eggs and coffee.

This worm attachment would be a lovely thing in firing up a cold boiler, it would certainly increase the draft—through the fire-door.

A small machine (operated by condensation) might be placed under the arch, that would take the drowned remains of the cinders and work them up into brick or sewer-pipe that could be dropped at convenient places along the line, or perhaps this device would prefer to lay Easter eggs—we think it could do either as well as it will let an engine steam.

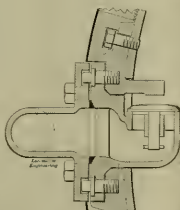
We don't say it won't prevent sparks, for it will—it will prevent them from living in the firebox.

## A New Form of Inside Check.

The check valve shown herewith has recently been patented by Mr. William Wright, general foreman of the P. W. & B. shops at Wilmington, Del. Inside checks are a great safeguard, but there has always been more or less trouble with hinged affairs not seating properly.

A vertical valve, seating fairly by gravity, is the most desirable form of valve, and Mr Wright has got that and on the inside of the boiler

As can be seen, this valve and seat can



be taken out and reground without disturbing the flange joint on the boiler itself. This has been impossible with other forms of this kind of valve.

That the outside check is a murderous thing in a wreck everybody seems to know, that putting the check inside the boiler is a safeguard and desirable is acknowledged. The next thing to do then is to find the best form of inside check. Mr Wright is working on that line.

During November and December last year and January of this year there was conducted a test of the holding power of cut vs wire nails, at the U. S. Arsenal, at Watertown, Mass., under the supervision of Major J W. Riley. 1100 nails were tested; these varied in length from 6 inches to 1¼ inches. The results were somewhat surprising, as in every case the cut nails showed a holding power of from 47.40 per cent up to 135.20 per cent. above wire nails. If the heads didn't pull off we never yet got a wire nail out of anything.

## Fitting Cylinder Saddles to Smoke Arch.

BY J. C. MILLER

A simple method for making the cylinder saddle fit on smoke arch, no fit and try about it, but sure thing every time—is shown herewith. I have never seen it illustrated or explained; have found it to work splendid, and so give it to the readers of LOCOMOTIVE ENGINEERING.

Have boiler level and plumb, put the frames in place on boiler with the back parts level fore and aft and level crosswise The front or tongue frames may be inclined or straight, as the case may be. Put straight edge *I*, Fig. 1, across the frames as at *I*, Fig. 2, at point where

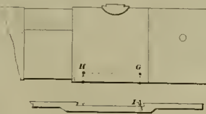



*Fig. 2*

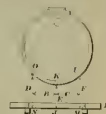



*Fig. 1*

front end of cylinder saddle comes. Get center *J* on line *AA* between frames, Fig. 1, and plumb or square up to smoke arch and put center punch mark at *K*. Then assume a distance a little less than the width of cylinder saddle, say the distance is equal to 30 inches over all. Take half this distance, 15 inches, *B C*, on either side of and parallel to center line *J K*, as shown on lines *D F*, and make center punch marks at *O L*. Now fit a short iron or wood template, *P*, Fig 3 (a little wider than cylinder saddle), to the smoke arch at *G*, Fig. 2. Then transfer the center punch marks, *O K L*, Fig. 1, to template *P* Now make a male template, *R*, Fig. 5, to fit template *P*, Fig 3, and transfer center punch marks from template *P* to template *R*. Next get the distances, *M L*, *N O*, *J K* and *B C*, Fig 1, and transfer to the cylinder saddle, as shown in Fig. 4 Take male template, *R*, and place it so the three center punch marks on template will coincide with the center punch marks on cylinder saddle, then with a scribing awl scribe the segment of circle *S*, Fig. 4. This line represents the chipping line, or line to plane to on cylinder saddle, repeating the operation at the back end of cylinder in the same manner. By trying a straight edge on the smoke arch at *H G*, Fig. 2, any unevenness will be detected and the proper allowances can be made. No matter how uneven the arch or at what incline the frames, this method will keep you correct.

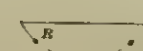



*Fig. 5*


*Fig. 3*

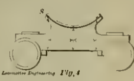



*Fig. 4*

## Some Fast Time with the Old-Time Locomotive, "Brother Jonathan."

Walter McQueen, vice-president of the Schenectady Locomotive Works, was master mechanic of the old Albany & Schenectady Railroad from 1845 to 1849

In 1846 he rebuilt the old locomotive, "Brother Jonathan" (that had been in service since 1832), changing her cylinders from 9 x 14 to 12 x 18, adding a second pair of drivers and reducing the size from five to four feet six inches.

In 1847 Mr. McQueen ran this engine from Albany to Schenectady (part of the road being still strap rail), pulling one car and carrying the Governor's message, in the unprecedented time of twenty-four minutes. The distance is seventeen miles and the grade the heaviest on the New York Central. Twenty-four minutes is just the running time to-day of the Empire State Express.

The Westinghouse Air Brake Co and the American Brake Co announce that their New York office has been removed from 160 Broadway to the Havemeyer Building, corner of Cortlandt street and Church place.

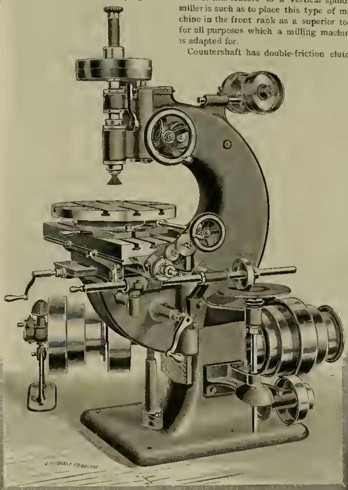

SHOWING ARRANGEMENT OF ROLLING STOCK AFTER FREIGHT TRAIN HITS REAR OF A COAL TRAIN.

LOCOMOTIVE ENGINEERING is one of the forty-two monthly publications in the city whose circulation is guaranteed by a $100 forfeit by the American Newspaper Directory. Last year the actual *average* circulation was 17,853 This year of the Lord 1893 will see the average go over 20,000. Just watch it grow.

### Improved Vertical Milling Machine.

We present with this an engraving of an improved vertical milling machine designed for a wide range of jobbing and manufacturing operations, including die-sinking, surfacing, plain and circular work.

The spindle, which is driven by a belt at speeds suitable for cutters varying in di-



IMPROVED VERTICAL MACHINE.

ameter from 6 inches (for surfacing) down to ½ inch for the finest work, has a vertical adjustment of 4 inches, with means of locking the spindle slide at any point. The mills or arbors are held by a draw-bar, which passes through the spindle, the latter being bored for Morse No. 4 taper shanks. It runs in long composition boxes, which are adjustable for wear, and is driven by a pulley 12-inch diameter, 3-inch face, supported upon a separate bearing, which is independently adjustable, and relieves the spindle of all side pull from the belt. The spindle is thus fitted to run at the very high speeds which make small cutters efficient.

The overhanging arm is carried well back to allow room for work of considerable size, and on the regular platen is mounted a circular one which may be rotated either by hand or automatically. This circular platen has T-slots, and is 20-inch diameter. Work 32-inch diameter can be swung upon this table, so that apertures up to 25 inches may be readily milled inside.

The main platen is 35 inches long, 10¼ inches wide, and as th saddle on which it moves is of the same width, there is always a bearing sufficient for gr at stability.

Centers may be mounted upon the platen in the usual manner, and the machine is then adapted to grooving taps, reamers, cutting gears, etc.

Feed is derived in the manner shown, by means of a friction disk giving feeds from the finest to the coarsest ever required in either direction. The knee has a vertical adjustment of 16 inches, and the greatest distance between platen and end of spindle is 16½ inches.

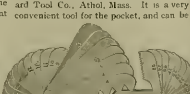
The spindle driving pulley is 12 inches diameter, 3 inches face, independently mounted upon an adjustable anti-friction bearing, by means of which the spindle is kept in alignment with the table, is relieved from the one-sided action of the belt strain, and its bearings prevented from overheating and from wear. The importance of this feature to a vertical spindle miller is such as to place this type of machine in the front rank as a superior tool for all purposes which a milling machine is adapted for.

Countershaft has double-friction clutch pulleys providing for two speeds besides those provided for by the cone pulleys.

The machine may be used for boring and drilling also, and, as will readily be perceived, is adapted to a wide range of machine shop work. It is manufactured by the John Becker Manufacturing Co., Fitchburg, Mass.

### Screw Pitch Gauge.

The screw shown is made by the Standard Tool Co., Athol, Mass. It is a very convenient tool for the pocket, and can be



SCREW PITCH GAUGE.

used for trying the pitch of either inside or outside threads. It takes in the pitches of all threads in common use.

### Crossing-Dangers in Chicago.

There is a great deal of agitation in Chicago, at present, on account of ordinances passed by the City Council to compel the railroad companies to raise their tracks so that street crossings and highways within the city limits may cross under the tracks. There is a dreadful loss of life constantly going on through the dangerous practice of streets crossing tracks on the level, but it is much easier to pass laws requiring a change than it is to make the necessary changes. The ordinance requires that the tracks shall be raised 16 feet above the streets. Throughout the city there are a great many viaducts crossing tracks, rivers and canals that are already raised 16 feet or more. The carrying out of the ordinance would send the steam railroad tracks away over the tops of the houses.

Some years ago the well-known civil engineer, Augustine W Wright, proposed a plan which would have prevented all the evils the city is now suffering from. He proposed completing a belt line that would handle all through freight, preventing the constant blockades that daily occur through the switching of such cars inside the city. Then he proposed to abolish level crossings by depressing the tracks as far as it could be done without interfering with sewers and water pipes, and making low viaducts as street crossings. The numerous high viaducts that have been built of late years would now throw expensive obstacles in the way of Mr. Wright's plan.

### The Biter Bit.

"The conventions are not what they used to be," remarked the bald-headed member. "Nowadays you hear of nothing but business, business at these meetings. In the good old days people who went to the conventions mixed some fun with their business, but nowadays if a man is away from the meetings for an hour some one is liable to tell him that he is neglecting the purpose for which he came.

"At one of the good old meetings some of us got off a very funny joke on Aaron French. Aaron intended to get off a joke at the expense of Jules French, and we turned it into a case of the biter being bit A party of us went into Aaron French's room and there were not enough chairs to accommodate the whole of us. Jules hung up his hat and went out. As soon as he had gone out of the door Aaron took the hat, which was a nice silk one, and put i. under the bed clothes, then went out evidently to wait for Jules. As soon as he went out, some one put Aaron's hat where he had placed that of Jules'. In a minute or two both gentlemen walked in and Aaron took care that Jules should sit down on the spot where the hat was. As soon as he felt the crunching of the hat, he jumped up and Aaron proceeded to show him the condition of his hat. It was great fun to watch the spring-maker's face when he discovered that it was his own hat that had come to grief."

### Something No Feller Can Understand.

We had retired to the smoking-room after dinner, and a ruddy-faced Englishman who had been very social and talkative, settled down into silence and sucked a strong cigar as if it were a long-stemmed pipe.

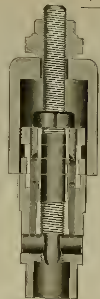
"Don't you think that our dining-car service is a great convenience?" we remarked, over the British practice of rushing to the lunch counter to make the best of a brief stop and parboiling one's mouth with the boiling coffee, in our mind.

"Your dining-car service is great," he grunted. "It gives a man time to fill himself comfortably. But some o' yer ways I cannot hunderstand. Now, when I'm at 'ome I like to 'ave a bite of Hamerican cheese after my dinner. It is fine, tasty cheese. Now, here in yer own country, I hasked for a bit of yer own cheese and they could give me nothink but stinkin' foreign stuff that turned my stomach. I can't make it out."

Neither could his hearers.

A Michigan Central man writes us that the large inset picture in the May number had a peculiar interest to their men, as both the engineer, Robert Brown, and the fireman, Wm. Deyall, shown with No. 433, are now dead.

### A Bushing Remover.



Our attention has been called to a very useful tool for engine-houses. It consists of an appliance for pulling the bushings out of Westinghouse air-pumps. It is very highly spoken of by those who have used it, saving much time and preventing delay when engines are wanted in a hurry. This bushing remover, unlike many of them, removes the bush without injuring it. The illustration makes the details plain.

The device is handled by George P Wilson, Philadelphia.

### The Smith Triple Expansion Exhaust.

The above cut shows this pipe in place on a heavy freight engine on the Reading road, where it has become the standard.

This device takes in and mingles the hot gases of the front end with the steam, re-expanding it and discharging it through an opening, larger in area than the port

The Manhattan Elevated are trying one on a hard steamer, and the Erie have applied one. They intend to give it very thorough tests to find out its effect on the working of the engine. Several other Eastern roads are arranging to try the pipe

The New York Central has got its fine new shops at Depew, near Buffalo, in running order, and about 250 men are at work. About forty engines are in waiting for repairs, and a large assortment are standing on the side track ready to go inside. There is great difficulty in getting mechanics to remain at work in the shops. Few houses have been erected, and those who live in Buffalo lose so much time going to and fro that they prefer to work in the city, where employment is plentiful at present. The companies that have got control of the land in the neighborhood of Depew hold prices so high that there is not likely to be much building of cheap houses until the artificial values now ruling collapse.

# Car Shops and Car Builders.

## Some Recent Car Improvements.

Not much attention is paid to the improvement of the common freight car, though it would save any road more money to gain 10 pounds in dead weight in each car than to compound their engines—there are so many cars.

Saving in repairs of freight cars is a field capable of showing great returns for a small outlay. The trouble has been that practical men did not pay enough attention to the design of cars with a view of repairing.

As every practical man knows, the parts of cars requiring the most repairs have been the draft-rigging and body-bolsters, while truck-bolsters come in for a large share of work.

We have recently noticed some improvements introduced on the cars of the Union Tank Line by the master car builder, Mr. C. A. Smith.

One of the best of these innovations is a composite body-bolster, as shown in Fig. 1. This is composed of a steel I beam 12 inches wide and 5½ inches deep, the sides filled with oak. This bolster is bolted up to froming of car as if it was an all-wood bolster, bolts going through web of beam, no trusses are necessary. This is amply strong to carry the load and its great width stiffens it to bear the buffing strains—the draft timbers being set against it in the usual way.

Mr. Smith's draft timber arrangement is fully shown in Figs. 2, 3 and 4. He uses the Butler draw-bar attachment to carry the springs and puts it up as shown. Three heavy carrying irons, each 1 x 3 inches, are placed each side of the draft timbers, one end of these hooks under the draft timbers and the other end hooks over the center sills; they are let into both the sills and draft timbers so that the two timbers come together solid. These carrying irons are held by 1-inch bolts. The draft timbers rest against the body-bolster, as shown in Fig. 3. Inch rods from the buffer timber run back to the body-bolster, are flattened and bolted to it, the end booking over behind.

This is about the strongest and stanchest draft-rig of the present necessary form that we can think of.

Another improvement has been made on truck-bolsters. Truck-bolsters are always trussed to carry the load, but few car builders have done anything to remedy the real cause of their breaking.

Truck-bolsters are not strong sideways, if turned on their sides they would break with less load or blow than if placed any other way. It is in switching that truck-bolsters are broken.

We will say that a truck weighs 3 or 3½ tons, it is held to the car by the center plate and pin only, when one car is thrown against another it is the *bodies* that are stopped, not the trucks, the latter are stopped by the center pin giving a side blow on the truck-bolster—this is in one direction at one time and next in another until finally the bolster is broken.

Mr. Smith puts a steel channel bar on top of this bolster, as shown in Fig. 5, this being 12 inches wide by ½ inch thick stiffens the bolster, for the shocks it receives protects the timber and strengthens it. This channel bar is long enough to carry the side bearings and ends inside the arch bar just the right length to butt against and support the plate to which the truss rods are bolted. Another lighter channel bar filled with wood is used as a spring plank.

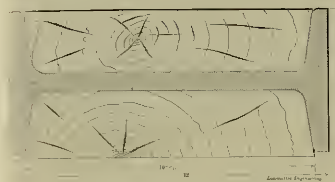


Fig. 1.

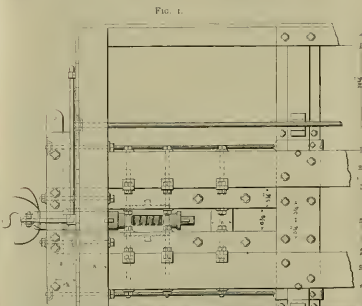


Fig. 2.

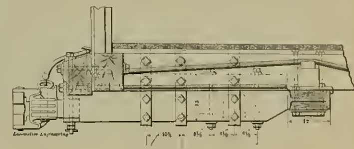


Fig. 3.

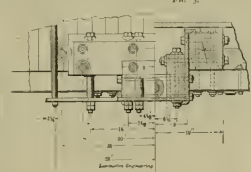


Fig. 4.

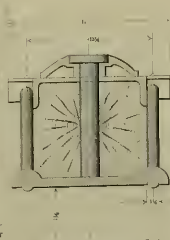


Fig. 5.

## Mount Vernon Car Works.

One of the most prosperous manufacturing concerns in Illinois is the Mount Vernon Car Works. While many old car building concerns have been failing because the competition kept prices so low that a margin of profit could not be obtained out of the business, this young concern has been building up and making the work pay. The reason is obvious. Good business methods make one concern prosperous on the prices that lead poorly managed concerns to bankruptcy. The credit of the success of the Mount Vernon Car Works is due to President Settlemire, Secretary Arthurs and Superintendent Snyder. The following are a few facts mentioned in a statement lately given by Secretary Arthurs:

"Our business has steadily increased from the first day we started, and is still increasing. We now have contracts on hand that will keep the works running to full capacity until August or September. During the year ending April 1, 1892, our total output in finished work amounted to $1,888,149.49 and during the year ending April 1, 1893, our output of finished work amounted to $1,319,565.37, an increase for the year ending April 1, 1893, of $131,415.88.

"During the past year we built about 3,000 new cars, of which 346 were refrigerators and 309 patent stock cars, equal to about two or three ordinary cars, amounting in all to about 4,000 ordinary box cars.

"Our foundry has also become a very important branch of our business. During the year ending April 1, 1892, we made 22,508 car wheels and 8,023,872 pounds of castings, while for the year ending April 1, 1893, we made 32,756 car wheels and 9,595,598 pounds of castings, showing an increase for the year ending April 1, 1893, of 10,248 car wheels and 1,571,726 pounds of castings. We are furnishing a large number of car wheels to railroads besides what we are making for our own use under new cars we are building.

"During the year ending March 1, 1892, we employed an average of 630 men and during the year ending March 1, 1893, we employed an average of 761 men, an increase for the year ending March 1, 1893, of 123 men. Our pay-roll for the year ending March 1, 1892, amounted to $235,648.85, and for the year ending March 1, 1893, amounted to $276,730.40, showing an increase for the year ending March 1, 1893, of $41,081.55."

## Pullman Exhibit.

(EDITORIAL CORRESPONDENCE.)

The Pullman exhibit consists of two trains, with engines, five street cars, two six-wheeled trucks, all iron parts polished, and a model of the town of Pullman, showing all the buildings and dwellings.

The first train which we reach has a Rogers' ten-wheeled engine in front, very striking in appearance. The engine is painted the Pullman standard color, with Pullman standard decorations around cylinders, dome, sandbox, cab and tender.

A novelty about this train is that the tender is vestibuled to the first car, which is a United States mail car. Another novelty about both these trains is that the vestibules have the entrance flush with the side of car, the steps being below. There is also a window at each side facing the front. The postal car is 69 feet and 6 inches in length, and is carried on 6-wheeled trucks of the Pullman standard with Allen paper wheels. This car has a Baker heater on the platform outside of the body of the car, and the platform is closed by doors to the vestibule, the platform in this manner forming a room in itself. The car is fitted out with the most approved mail fixtures, and the postal authorities who have visited the car say it is the best equipped mail car in the world. One novel feature in the construction of this car is that it has a skylight in the roof with eight sections of light. There is a water-closet and lavatory on one platform and clothes closets and cupboards, in which manner every inch of room is utilized. The letter-racks are so arranged

## OUR ENGRAVINGS.

Of late we have had a great many inquiries as to who made the fine half-tone plates shown each month in LOCOMOTIVE ENGINEERING. Credit is due the expert anywhere and we are glad to recommend the engravers of our plates to those wanting good work at reasonable prices. All the half-tones and reproductions we use are made by the STAR ENGRAVING & PRINTING Co., 607 & 609 Sansom St., Philadelphia, Pa. SINCLAIR & HILL.



# SALES OF WESTINGHOUSE ENGINES,

## MARCH AND APRIL, 1893.

### COMPOUND.

("K" signifies "Kodak" or Direct Coupled Generator.)

| | | | | H. P. |
|---|---|---|---|---|
| E. D. Leavitt (for Calumet and Hecla Mines), | 14th | order, | Cambridgeport, Mass., | 600 |
| " " " | 15th | " | " " | 600 |
| Brooklyn City and Newtown Railway (K), | 7th | " | Brooklyn, L. I., | 330 |
| Manufacturers' Electric Co., | | | Philadelphia, Pa., | 330 |
| McMullen & Morris, | | | West Superior, Wis., | 330 |
| Warner's Port'd Cement Co., | 1st | " | Syracuse, N. Y., | 330 |
| Camden, Gloucester and Woodbury Railway (K), | 1st | " | Gloucester, N. J., | 330 |
| " " (K), | 2d | " | " " | 330 |
| " " (K), | 3d | " | " " | 330 |
| Newton & Boston Railway, | 1st | " | Newtonville, Mass., | 260 |
| Riverside Park R'y Co., | 3d | " | Sioux City, Ia., | 260 |
| Detroit Citizens' St. R'y Co., | 5th | " | Detroit, Mich., | 260 |
| " " " " | 6th | " | " " | 260 |
| Westinghouse Electric and Manufacturing Co. (K), | 38th | " | Pittsburgh, Pa., | 260 |
| Olean Street Railway, | | | Olean, N. Y., | 200 |
| Newton and Boston R'y, | 2d | " | Newtonville, Mass., | 160 |
| Warners' Portland Cement Co., | 2d | " | Syracuse, N. Y., | 160 |
| Marion Electric Light and Power Co. (for railway), | | | Marion, Ohio, | 160 |
| Name withheld temporarily, | 22d | order, | | 160 |
| " " " | 23d | " | | 160 |
| " " " | 24th | " | | 160 |
| " " " | | | | 160 |
| Brigantine Transit Co. (for railway), | | | Brigantine, N. J., | 130 |
| Chandler & Price, | 2d | " | Cleveland, Ohio, | 100 |
| Germania Mills, | | | Holyoke, Mass., | 100 |
| Fuel Gas and Mfg. Co., | 4th | " | Pittsburgh, Pa., | 100 |
| Maryland Steel Co., | 13th | " | Baltimore, Md., | 100 |
| Ohio Steel Co., | | | Youngstown, Ohio, | 85 |
| Unknown, | 1st | " | Barcelona, Spain, | 85 |
| " | 2d | " | " " | 85 |
| " | 3d | " | " " | 85 |
| Westinghouse Air Brake Co., | | | Hanover, Germany, | 65 |
| Rosal Hermanos, | | | Berga, Spain, | 65 |
| Elmira Knitting Mills, | | | Elmira, N. Y., | 65 |
| Nichols Chemical Co. (K), | 10th | " | Laurel Hill, N. Y., | 65 |

**35 Compound Engines, 7260**

### STANDARD.

| | | | | H. P. |
|---|---|---|---|---|
| American Sugar Refin'g Co., | 12th | order, | South Boston, Mass., | 150 |
| Chicago Paper Trade Club, | 1st | " | Chicago, Ill., | 125 |
| " " " " | 2d | " | " " | 125 |
| Boone Electric St. R'y Co., | 1st | " | Boone, Ia., | 125 |
| " " " | 2d | " | " " | 125 |
| " " " | 3d | " | " " | 125 |
| Spreckles Sugar Refinery, | 68th | " | Philadelphia, Pa., | 100 |
| Illinois Central R. R., | 2d | " | Chicago, Ill., | 75 |
| Crescent Steel Co., | 12th | " | Pittsburgh, Pa., | 75 |
| Wyman, Flint & Sons, | 2d | " | Bellows Falls, Vt., | 75 |
| G. Amsinck & Co., | | | New York, | 75 |
| Gov't Dep't of Bolivar, | | | Cartagena, S. A., | 60 |
| Warder, Bushnell & Glessner, | 2d | " | Springfield, Ohio, | 60 |
| W. J. McCahan Sug. Ref. Co., | 1st | " | Philadelphia, Pa., | 60 |
| " " | 2d | " | " | 60 |
| " " | 3d | " | " | 60 |
| " " | 4th | " | " | 60 |
| G. Brulay, | | | Brownsville, Texas, | 45 |
| Riverside Iron Works, | 3d | " | Wheeling, W. Va., | 45 |
| Phil. and Reading R. R., | 12th | " | Port Reading, N. J., | 35 |
| Westinghouse Air Brake Co., | 34th | " | Wilmerding, Pa., | 25 |
| Clinton Wire Cloth Co. (K), | 2d | order, | Clinton, Mass., | 25 |
| Girard Iron Co., | | | Girard, Ohio, | 25 |
| W. J. McCahan Sug. Ref. Co., | 5th | " | Philadelphia, Pa., | 25 |
| " " | 6th | " | " | 25 |
| " " | 7th | " | " | 25 |
| " " | 8th | " | " | 25 |
| " " | 9th | " | " | 25 |
| Chicago, Mil. & St. Paul R. R., | 8th | " | Milwaukee, Wis., | 15 |
| " " | 9th | " | " | 15 |
| Cumberland Mfg. Co., | | | Boston, Mass., | 15 |
| Baltimore Electric Refining Co., | 6th | " | Baltimore, Md., | 15 |
| Peoria Gas Light Co., | 3d | " | Peoria, Ill., | 15 |
| Lawrence Machine Co., | 67th | " | Lawrence, Mass., | 10 |
| Chicago City Railway Co., | 6th | " | Chicago, Ill., | 5 |
| So. Bethlehem Gas & Water Co., | 2d | " | So. Bethlehem, Pa., | 5 |
| Unknown, | | | Chicago, Ill., | 5 |
| Boston Electric Light Co., | | | Boston, Mass., | 5 |

**38 Standard Engines, 1965**

### JUNIORS.

| | | | | H. P. |
|---|---|---|---|---|
| F. J. Carey & Co., | | | Gansevoort, N. Y., | 50 |
| Fond du Lac Lt. and R'y Co., | | | Fond du Lac, Wis., | 50 |
| Monroe-Shafer Shoe Mfg. Co., | | | Brockport, N. Y., | 50 |
| J. M. Campbell, | 1st | order, | Kingston, Ont., | 50 |
| Detroit Dry Dock Co., | 15th | " | Detroit, Mich., | 35 |
| Walter S Davis, | | | Contoocook, N. H., | 35 |
| H. C. Durand, | | | Chicago, Ill., | 35 |
| F. Gihlands Sons, | | | Amsterdam, N. Y., | 35 |
| Reidsville Cotton Mill, | | | Reidsville, N. C., | 35 |
| Pittsburgh Reduction Co., | 8th | " | New Kensington, Pa., | 35 |
| Herbert O. Allen, | | | Detroit, Mich., | 25 |
| Shiffler Bridge Co., | | | Pittsburgh, Pa., | 25 |
| Dry Dock Engine Works, | 3d | " | Detroit, Mich., | 25 |
| J. L. O. Vidal & Sons, | | | Elgin, Can., | 25 |
| Pennsylvania R. R., | 64th | " | Camden, N. J., | 25 |
| Pencoyd Iron Works, | 15th | " | Pencoyd, Pa., | 25 |
| Bethlehem Chenille Co., | | | Bethlehem, Pa., | 25 |
| Unknown, | | | Paris, France, | 25 |
| G. Stegmaier & Son, | 1st | " | Philadelphia, Pa., | 25 |
| " " | 2d | " | " | 25 |
| Montana Columbian Club, | | | Chicago, Ill., | 25 |
| Pittsburgh Reduction Co., | 7th | " | New Kensington, Pa., | 15 |
| T. & L. Robert, | | | Liege, Belgium, | 15 |
| H. Ramsdell Trans. Co., | 2d | " | Newburg, N. Y., | 15 |
| J. M. Campbell, | 2d | " | Kingston, Ont., | 15 |
| Lancaster Mills, | | | Clinton, Mass., | 15 |
| Independence Fuel Co., | | | Chicago, Ill., | 15 |
| American Wood Board Co., | | | Schuylerville, N. Y., | 15 |
| Whitall, Tatum & Co., | 11th | order, | Millville, N. J., | 15 |
| George F. Ott, | | | Philadelphia, Pa., | 10 |
| John Shillito Co., | 2d | " | Cincinnati, Ohio, | 10 |
| Detroit Electrical Works, | 4th | " | Detroit, Mich., | 10 |
| Albany & Troy Steamb't Co., | 1st | " | Albany, N. Y., | 10 |
| " " " | 2d | " | " " | 10 |
| Medical & Surg. Sanitarium, | | | Battle Creek, Mich., | 10 |
| New Gaynor Electric Co., | | | Jeffersonville, Ind., | 10 |
| Fontaine Crossing Co., | 9th | " | Detroit, Mich., | 5 |
| Bailey & McKennon, | | | Washington, Pa., | 5 |
| U. S. Government, | 31st | " | St. Louis, Mo., | 5 |
| Edison Span. Col. Lt. & P. Co., | | | New York, | 5 |
| Shelbyville Gas Light Co., | | | Shelbyville, Ind., | 5 |

**41 Junior Engines, 900**

## SUMMARY OF ORDERS FOR 60 DAYS.

| | | | |
|---|---|---|---|
| Compound, | 36 Engines, | 7,260 H. P. |
| Standard, | 38 " | 1,966 " |
| Junior, | 41 " | 900 " |
| TOTAL, - - | 114 ENGINES, - | 10,125 H. P. |

that one of them protects the front door when in use.

One of the Government postal authorities explained some of the advantages of this car over ordinary postal cars, and stated that one of the principal advantages was that the stoves were removed from the body of the car and placed in the vestibule on the platform. The Government not only pays for the amount of mail carried, but also have to pay for the mail car by the lineal foot, and it was to their advantage to have the inside of the car unobstructed by stoves, etc., as nothing could be piled on or near them. In regard to the letter-boxes, he said that in the old style mail cars they formerly had two sets of boxes, one for the trip in one direction, and the other set in the opposite direction, the boxes being marked accordingly. When the reversible letter-case came out it was considered something wonderful, but in this car another new departure has been made. The case consists of double boxes, which can be tipped forward and reversed end for end, and then pushed back in place, and in this manner boxes do not have to be changed, one side being for trip in one direction and the other side for opposite trip. Another good feature of this arrangement is that in reversing the case it throws out any dust that may have accumulated as well as any stray letter that may have lodged inside. Another entirely new feature in the construction of this car is that the paper-boxes can be made to use either single or double as desired. The postal official, talking about the car, ended by saying there never was a car built with such conveniences for handling mail.

The next is a first-class day coach, 68 feet 11 inches in length. The car is finished in vermilion wood that looks like a dark mahogany, with a grain resembling rosewood. The car has twenty-eight Hale and Kilburn double seats, which are notable for the easy way they can be turned and the comfortable seat they afford to the traveler. The upholstering is unusually rich, being an embroidered haircloth with a gold-like hue. Each section of seats is divided by an arched crown, which seems to give the car the appearance of a series of arches, checked at the clear story, but continued around it. The arch panels are three-ply veneer, very richly decorated with floral work. The head-lining is of the same material as the arched sides, beautifully decorated and divided by broad vermilion bands, also artistically carved. On each side of the clear story there are seven half-elliptic windows.

There is nothing unusual in the ends of car, only that it has very handsome lavatories at each end, with toilet-room and white-metal water cooler and trimmings. The ceiling of car is in the shape of an ellipse, with deck sash groined into the ceiling. At the smoking-room end of car there is a family section, with a large space for luggage, making ingress and egress easy at stops. The bulkhead dividing smoking-room from body of car is fitted with plate-glass beveled mirror, with silk plush hangings, forming a very handsome finish, to view it from the body of the car. Passing from body of car through smoking-room passage-way, the gentlemen's vestibule toilet-room is reached. This toilet room is fitted with white-metal wash basins and water cooler. The smoking-room is entered from the vestibule, and is upholstered in olive leather, the wall panels being finished in decorated stamped leather, the ceiling being of same form as that in body of car, decorated to match upholstering and hangings. The windows opening from smoking-room into passage-way are draped with silk plush hangings. The bulkhead, dividing smoking-room from body of car is fitted with circular beveled plate mirror, in a handsome carved frame of vermilion wood, mirror being 3½ feet in diameter. The transoms over bulkhead at ends of smoking-room are fitted with handsome iron grilles.

Passing through vestibule from day coach, the parlor car "Santa Maria" is reached. The parlor of car is finished in vermilion wood, designed in sixteenth century style, trimmed elaborately with gold-plated metal. The ceilings under the side decks are handsomely carved, the whole surface of side decks being carved, with panels supported by enriched medallions. The main windows of parlor are built in triplicate in bay form, and the Gothic sash in all windows is glazed with the most delicate patterns in leaded glass. The main ceiling of this car is built in the same form as that of the day coach, the deck sash having more elaborate designs in glazing. The upholstering of the revolving seats and sofas is a Persian blue with gold-colored pattern, and the frame and design of the chairs is graceful and delicate. The ceiling is colored a natural green, the grainings in the same being gilded. The carpets are of the finest Wilton.

The main bulkheads, forming the ends of the parlor, are pierced by a doorway and a window, the lintel of the same being supported by three beautiful columns, between which heavy silk draperies are hung. Above two small side openings in the bulkheads are placed circular beveled mirrors in carved vermilion wood frames. At the gentlemen's end of the parlor is a private section, consisting of two double seats and a sofa; at each end of the sofa is a small locker, and above the double-seated section is a gold-plated curtain rod, from which hangs heavy silken draperies, which slip forward and may be used to screen section. Passing through passage towards gentlemen's end of car is a library, in which may be found pleasant reading. Next to the library, at the end of the car, is the gentlemen's lavatory and toilet room. The floor and wainscoting of the lavatory and toilet room are constructed of handsome tiling. The wash-basin is beautiful in form, of Mexican onyx, and all the plumbing, fixtures, faucets, etc., are gold-plated.

At the other end of the car is a drawing-room, finished in ivory and gold, of exquisite design and excellent workmanship. The ceiling is colored in Pompeiian pink, the raised carving being decorated with gold. The upholstering of this room is of silk plush, colored to harmonize with the walls and ceiling. The room contains a comfortable sofa and two easy chairs, upholstered in delicate silk plush, colored to match walls and ceiling. The draperies to the drawing-room window are of Pompeiian pink silk, richly flowered in silver, white and gold. The bulkhead at forward end of drawing-room is fitted with large circular beveled mirror, set in a carved and gilded frame, with gilded wreaths looped in upper part of mirror. The entire train is lighted by electricity, the electroliers being of exquisite design and workmanship, harmonizing with the general effect of the cars. The fixtures are all gold-plated, and those in the parlor car being hung with a silk fringe.

Nearly all railroad men are familiar with the appearance of handsomely finished cars, and may not feel inclined to walk through a train in an exhibition. They will make a mistake if they fail to look over the insides of all the trains shown in the World's Fair. A. S.


Iron-Clad Car—General Thomas' Headquarters in War of Rebellion.

### An Iron-Clad Car.

The engraving shown herewith is from a photograph of an iron car built by the Government as headquarters for General Thomas during the family quarrel among the States.

This car is made up of iron plate and panels entirely, strongly backed by wood. It originally had no truss rods whatever and has very slimpsy ones now. But out of many turn-overs the body came out straight and stiff—it was built for war.

In 1866 the South Carolina road bought this car at Government sale, and have had it in use ever since. It is now used to haul laborers from Charleston to the phosphate beds near town. There doesn't seem to be any more indication of the car wearing out now than there was thirty-three years ago.

It bears on its sides a few bullet-marks, scars like any soldier is liable to get, and keep.

### Car for Heating and Lighting.

The car shown in the annexed engraving is part of the exhibit of the Chicago, Milwaukee & St. Paul Railway Co. at the World's Fair. This company found that in the cold Northern regions traversed by the road that locomotives were not equal to supplying steam for the heating of cars when the trains were very heavy. To meet this difficulty the car shown was built. It contains a boiler which supplies steam for heating and also for running a dynamo to light the cars with electricity. The car is particularly well arranged, and is well worthy of examination by those attending the Fair.

The following are the principal dimensions of the car:

Length—Inside, clear, 32 feet 4 inches.

Width—Inside, clear, 8 feet 4 inches.

Engine—6½ x 6 inches, Westinghouse automatic.

Engine—Horse power, 18 at 100 pounds steam pressure.

Boiler—Locomotive type.

Boiler—Heating surface: Tubes, 390.17 sq. ft.; firebox, 55.38 sq. ft.; total, 445.55 sq. ft.

Capacity of coal tank, 2.5 tons.

Capacity of water tank, 300 gallons.

Dynamo—Edison 15 Kilowatts, 110 volts.

Weight, loaded, 76,000 pounds.

Two of these cars are used during the winter season on the vestibuled limited trains, running between Chicago and St. Paul and Minneapolis. Each train consists of ten cars and is lighted throughout by electricity, using 200 16-candle-power incandescent lamps and heated by steam from this car.

The first car was built in 1890, and has run up to date 191,008 miles.

Light and Heat Tender.

We are informed that the American Decorative Company, of Boston, will make a very attractive exhibit at the convention at Lakewood this month. It represents a section of a passenger car roof of the Boston & Albany standard. The head lining is of lignomur, a material made from wood fiber, which is particularly well adapted for car decoration. Mr. Adams, master car builder of the Boston and Albany, has applied this material to about forty cars and the material gives very great satisfaction. Mr. Adams talks very enthusiastically about its merits. When other master car builders have the opportunity of seeing the effect of lignomur in head lining they are certain to become patrons of the material.

The Ajax Metal Company are taking a very warm interest in the fast time the New York Central are making in the race to the World's Fair. Ajax metal is used for the driving-boxes and principal bearings of the fine locomotives pulling the trains, and the motto of the makers is Ajax metal never gets hot. There is a good deal of truth in the claim made by the motto.

# ? A. What You Want to Know. ? A.

**Don't ask questions that simply require a little figuring to determine; make each question separate. No notice taken of anonymous questions.**

(61) S. W. A., Philadelphia, says:

Is there any reason why a compound locomotive should run faster than a simple engine? *A.*—No. There are some reasons why a simple engine ought to exceed a compound on speed.

(62) T. W. H., Holyoke, Col., asks

I have noticed some engines that wear a long hollow spot on their tires at a point just as they pass over the center. Would like to hear from some one as to the cause of this. *A.*—Caused by counter-balance and, perhaps, in some measure by momentary slip when engine takes steam on one side before release on other.

(63) Geo. D., Chicago, Ill., writes.

Will you please inform me through the columns of your paper of the relation the eccentries of a locomotive bear to the main crank-pin? *A.*—This question is very indefinite. If you mean to ask what *position* the eccentrics are in in relation to the crank-pin, the go-ahead eccentric is a little less than a quarter behind the pin, and the back-up the same distance ahead.

(64) G. H., Lunenburg, asks

1. Will you be so kind as to tell me why an engine without rods on being moved, say half a mile, and brought back without slipping driving-wheels, will not come back to the same stroke as she started. *A.*—It is hard to tell. 2. Why will an engine being towed, with main-rods and side-rods off, change her stroke, wheels being same size? *A.*—It is claimed the counter-balance does this, but this is not proven

(65) G. C. J., Gordon, Pa., writes

Is it customary to use lye in tanks and boilers? They have been using it on the Williamsport Division of the P. R. R. for the past two months, and, whatever it has done with the scale, it has opened up all the seams in the boilers and played the deuce with checks and injectors. *A.*—Lye in some form or other is quite commonly used in boilers; many of the patented compounds being little else. Lye is not a bad scale remover, and perhaps your trouble comes from using too much of it or lye that is too strong.

(66) Apprentice, Omaha, writes

I have several times lately met with the expression, "total heat of steam." Why speak of total heat as it it were divided into a number of parts? *A.*—Heat of steam is estimated in two parts, the sensible heat and the latent heat When the water is put into the boiler at, say, 66 Fah., it requires about 146 heat units to raise it to the boiling point. This is called the sensible heat. Then it requires 966.1 units more to convert the water into steam, which will be no hotter than the boiling water. The 966.1 units are called the latent heat of the steam.

(67) G. A. M., Hudson, N. Y., asks

I am using the new engineer's brake-valve, everything pertaining to air-pump train line and air gauges is in good working order, but the brakes will not hold. I can make a service application stop by using 8 or 10 pounds of air, but in about four seconds brakes pop off. Can you tell me what is the matter, and how to overcome the matter. *A.*—There is very likely a leak somewhere that supplies the train-pipe with air Look well to the rotary valve, be sure that the brakes do not leak off, do the pistons travel out beyond the leakage grove?

(68) Mr George Payne, Taylor, Tex., writes

1 I would like you to tell me if a man broke his right go-ahead eccentric strap could he fasten the blade to the other one and pull his train into terminal with it? *A.*—This has been done, but is risky. 2. Mr. Laukes, the traveling engineer of the M. K. & T., is giving the boys some hard nuts to crack on mechanics. He says if he broke a valve-stem or rocker-arm and was pulling an important train that he would not disconnect his engine. Could he run without? *A.*—He would have to take down main rod, but need not take down eccentric rods.

(69) J. C., Amory, Miss., writes

Will you be kind enough to give me some information? 1. If a vacuum brake was adjusted so as to allow the diaphragm to be at half or mid travel, could there be as much power exerted as when the diaphragm is set out to full or in its extreme forward position? *A.*—Yes. 2. Is the weight of the atmosphere exhausted from the diaphragm equal to the pressure upon the exposed area? *A.*—The amount of atmospheric pressure taken out of the vacuum cylinder determines the pressure of air from outside, they are equal. 3. If we had a cylinder 6 feet long and 6 inches in diameter, and exhaust all the air from within, would we obtain the same pressure upon each head as we would with a cylinder 6 inches long and 6 inches in diameter? *A.*—Yes. 4 When atmospheric pressure is forcing against a vacuum piston do we compute by the exposed area regardless of the contents of the vessel? *A.*—Yes.

(70) S., Frankfort, N. Y., writes

In plumbing the rocker-arms on an engine to-day I found the valve rod ⅝ inch too long, both rods exactly the same. I measured two or three others of the same class and found them about this length. The question arose, why was this, or were they so designed to work? The two questions I wish answered are the following 1. Is it always necessary that the rocker-arm should stand plumb when the valve is in central point? *A.*—Not necessarily. 2. Why are some rocker-arms thrown out of line, one arm with the other? What point in the designing of the valve-gear does this overcome? Not long since in the West I laid off a set of arms ½ inch out of line. I asked the foreman why it was done. He said "the engine was so designed." I thanked him, and I have never found any other reason. *A.*—This is done to make the lower arm stand at right angles to the center line of motion (a line drawn through center of axle to lower rocker-pin) when the top arm is at right angles to the valve stem. Rocker-arms are often made with offsets of one kind or another to avoid striking some other parts of the mechanism. An ordinary departure from usual practice makes no perceptible difference in the working of the engine.

(71) C. B S., Coal Gate, I. T., asks:

1 Why does heater-valve of Seller's injector lift and allow the water to run out through overflow? This is injector of 1887, in use about four years. *A.*—The new injector has an open overflow, same as Monitor or Little Giant, when steam fails the excess of water runs out through overflow, in the Seller's of 1876 the overflow is closed and the instrument will regulate and take up water automatically. 2 What kind of metal does the Baldwin Locomotive Works use for cylinder-packing? *A.*—Cast iron. 3. What causes driver-brakes to be applied with handle in running position? *A.*—A leak, in all probability 4. If tires on both back driving-wheels broke off how would I fix engine so as to get in? *A.*—Block up over forward driving boxes, taking weight off back wheels; run very slow; it may be necessary to support back end on a truck. 5. If little reservoir under running board on right side, which is an addition to engineer's brake-valve, should be broken off. Could I fix it so as to handle train with air-brakes and make service stops? *A.*—Yes, the small drum only increases the capacity of the cavity over piston of engineer's valve by exhausting very much smaller amounts of air through preliminary exhaust port; the train could be handled well.

(72) W. M. P., Dennison, Tex., asks.

Suppose I were out on the road with twenty cars of stock, broke left go-ahead eccentric and right link so could not use them, and knocked hole in reservoir on back of tank, so it would not hold air and could not use it, the train has no hand-brakes—all air. Can I bring this train in with engine working on both sides and handle it with air-brakes? Could I do it this way: Make go ahead eccentric out of left back-up one, fasten both blades to the one go-ahead strap, which would be sufficient for left side, take off back-up eccentric on right side and couple forward end of go-ahead blade on to bottom rocker and move that blade ahead enough in strap to give the required valve travel? I only will have two go-ahead eccentrics—no back-up ones; or, in other words, I would have the same as two stationary engines in forward motion or a direct motion. The reservoir on back of tank has hole in it. Can I couple air-pump directly to train pipe and charge train up, and when I go to make a stop, shut pump off, and when I want to release, start pump up and pump them off? *A.*—It is barely possible that this *could* be done, but it would be a slow and risky job, the blade would not fit lower rocker, and the loose link is a thing to be avoided. If this ever happens to you, disconnect your engine and send for assistance If you had the only engine on the road, it would do to repair in this way, but on a road doing business, the thing to do in a breakdown is to get out of the way with the least delay to other trains.

(73) S. D., Chicago, writes.

1. Please give a rule for estimating the number of tons an engine 19 x 26-inch cylinders, and carrying 180 pounds of steam, will take up a grade of 30 feet to the mile at the rate of twenty-five miles an hour. *A.*—An important factor is missing in this question The size of drivers are required to estimate the tractive power of a locomotive. We will assume that the driving wheels are 54 inches in diameter. To find the tractive power we square the diameter of the cylinders, multiply by the stroke in inches, multiply the quotient by 85 per cent. of the boiler pressure and divide by the diameter of the driving-wheels in inches, thus $19^2 = 361 \times 26$ $9,486 \times 153 = 1,451,358 \div 54 = 26,877$ pounds, the tractive force exerted at the rail, less about 10 per cent. for internal friction, leaving 24,190. The total resistance of a common freight train is about 15 pounds to the ton at twenty-five miles an hour, so this engine ought to be able to pull at that speed 1,612 tons on a level. To figure on lifting a train up a grade of 30 feet to the mile, we multiply the pounds in a ton by 30 and divide by 5,280, the number of feet in a mile, thus $2,000 \times 30 = 60,000 \div 5,280$ 11.36 pounds, the power per ton required to overcome the resistance due to the gravity of the train. Then by adding the two resistances we have $15 + 11.36 = 26.36$ pounds of resistance per ton. Dividing the available tractive force of the engine by these figures, thus $24,190 \div 26.36 = 917$ tons, the weight the engine can pull under the conditions given. 2 Why are cylinder heads dished out on some forms of compound locomotives? Is it to hold more steam? *A.*—No, it is to suit the form of piston head used.

(74) V. J B., Waycross, Ga., writes

Please favor an appreciative subscriber by answering the following questions as plainly as possible 1. In disconnecting a locomotive on one side, should the ports be covered with valve before main-rod is disconnected, which is best, to cover ports before disconnecting valve-stem or disconnecting valve-stem first? *A.*—Cover ports first always, steam might be admitted to cylinder and do damage while piston is disconnected from main rod. 2—What is a dutchman on a locomotive and where is it located and what is its use? *A.*—This is a local nickname; means nothing. 3. What is best to do when a driver wedge-bolt is lost? *A.*—A nut or block can be placed under wedge and tied to frame 4. What is best way to get a driver-wedge down that is hard stuck up and cannot be got down with a pinch-bar? *A.*—Running engine over wood block will sometimes bring down stuck wedges, sometimes pedestal brace has to be taken down. 5. Please give illustrations (if possible) and best, easiest and quickest way to put in a spring in back, main and front drivers on a Mogul engine, and what convenient small tools (such as railroads do not furnish on engines) can be bought that will help to expedite the work? *A.*—All depends on design of individual engine. Many little kinks shown in back numbers of this paper none that we know of are for sale. 6 Suppose a locomotive breaks loose from tender and tears hose off so badly that they cannot be screwed back to pipes or goose-necks, what is best plan to adopt? *A.*—Try and make one water connection with remains of both hose 7. What is best and quickest way to put a truck spring in pony truck of a Mogul when spring fits over box and frame? *A.*—Jack weight off truck and the spring will go in easy enough. Ask a shopman, or watch him do the job.

We are in receipt of the large bound catalogue lately issued by the Berry & Orton Co., makers of wood-working machinery at Philadelphia, Pa. It illustrates and describes all the machines made by the firm.

Wm. Sellers & Co., of Philadelphia, Pa., have just issued, in neat leather binding, the able paper on "The Modern Traveling Crane," recently read before the Franklin Institute by Mr. Alexander E. Outerbridge, Jr. This paper tells all one cares to know about the modern crane, illustrating the latest and best Any one interested in shop cranes should send for this work, which is sent free.

Those who are interested in the development of the railroad rail will find a very interesting exhibition in the space occupied by the Great Western Railway of England, in the World's Fair. They show specimens of all the sections of rails which they have used since 1838 up to the present time There are no less than forty-four specimens shown, the weight rising from 45 pounds to the yard up to 120 pounds. Some of the forms are very curious. If some of our inventors who have been striving to improve on rail sections lately, would go and examine that display, they would find a good many of their ideas have already been put into practice.

The works of the Westinghouse Machine Company have been running for a year with a full night force. The shops are crowded with a large amount of heavy work in addition to their regular line of manufacture There are now coming through ten 600-horse power compound engines, of which eight are for the Philadelphia Traction Company, for direct coupling to multipolar generators, and two are to fill an order placed by E. D. Leavitt for the Calumet and Hecla mines, to be used in driving electric pumps for mine drainage The company has just completed the shipment of six 1,000-horse power engines for the Westinghouse Electric Company, to be used in filling its contract for lighting the World's Fair. These engines are also coupled direct to 1,000-light generators They stand eighteen feet high and make 300 revolutions per minute.

LOCOMOTIVE ENGINEERING
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### "David and Goliath."

The picture shown herewith was made from a photograph of two engines exhibited by the Pittsburgh Locomotive Works at the World's Fair—the largest and smallest engines of their exhibit.

The magnificent heavy ten-wheel passenger engine is a model modern engine and the little one about as small as does useful work in this country.

The big engine was built for the Vandalia line; she is 4 foot 9-inch gauge, has 20 x 26-inch cylinders; a total wheel base of 23 feet 8 inches; a driving-wheel base of 13 feet 4 inches; driving-wheel 72 inches in diameter; weighs 139,000 pounds, 110,000 of which rest on her drivers.

The small engine is one to be used about the new shops of the Pittsburgh Locomotive Works. Her track gauge is 24 inches, she has cylinders 6 x 10 inches, a total wheel base of 3 feet 6 inches, all on her drivers; driving-wheels 26½ inches in diameter, and weighs 12,500 pounds.

The large engine is more than eleven times as heavy as the small one. They make a very attractive exhibit, and have been dubbed "David and Goliath."

The railroad companies are continually complaining about the iniquities of ticket scalpers, although no ticket scalpers could live a month but for the aid and comfort given by railroad passenger agents. The howling on this subject has been so persistent in the West of late, that the Federal Grand Jury has decided to investigate the matter and find who are violating the Interstate Commerce Law. If the investigation should be made thorough we are afraid that the railroad companies will come out of the fray more badly wounded than the scalpers.

### Self-Lighted Fires.

In the course of a private letter to the writer, an engineer of high scientific attainments observes that there are many curious phenomena besides those mentioned in our article on the subject last month, connected with the power of certain substances to absorb gases. The faculty which carbon has for absorbing gases is no doubt the cause of many mysterious fires. If people in charge of shops and factories were more thoroughly informed about the behavior of carbon in the presence of gases which it absorbs readily, there would be greater attention devoted to isolating the mixture from other inflammable material and there would be fewer mysterious burnings-down of buildings. When you tell the ordinary practical man about dangers which laboratory experience has proved to exist and which are not readily apparent, he is nearly always inclined to undervalue the information given. When men accustomed to the making of laboratory tests first directed the attention of boiler-makers to the danger of flanging steel at the critical temperature, they were laughed at, and it took years of patient writing and talking on the subject before the men in charge of boiler-making realized that there was something worthy of attention in what the scientific fellows had been saying about the danger of working metal at the blue heat.

No information can be more profitably discussed than that which relates to the science of common things. Among these, the behavior of carbon under different conditions comes home to a large number of the readers of LOCOMOTIVE ENGINEERING. When fresh wood charcoal is allowed to cool down in a closed vessel it has the peculiar property of absorbing gases much greater than its own volume. It has a peculiarly strong thirst for oxygen, which it readily draws from the air, but it also takes in nitrogen and all the inflammable hydrogen and hydro-carbons. On account of this the charcoal is very ready to burst out into flame through the heat generated by the mixture. Charcoal left exposed is less ready to absorb inflammable gases, but it does that freely enough to call for close watching.

When common coal badly slacked is stored in a building it deserves careful watching, for the carbon absorbs oxygen, and under favorable conditions will take fire. When the mass is open enough to permit free circulation of air, the heat of chemical combination is carried off as fast as it is generated, but if the coal heap is dense, the temperature rises steadily. When any part gets higher than 100° Fah. it is getting dangerously near the point where spontaneous ignition becomes an active, all-devouring flame. A little care and watchfulness will frequently prevent a conflagration.

"DAVID AND GOLIATH." NOW AT THE WORLD'S FAIR.

### Peat as Fuel.

Visitors to the World's Fair who are interested in fuel ought to go and examine some pillars of compressed peat that are to be seen in a booth containing exhibits of an Irish railway. The material is compressed till it is as dense as coal, which it strongly resembles. Where coal is dear and peat is abundant the latter material can be used economically as fuel.

When peat is solidified under a powerful hydraulic press the operation which Nature takes ages to accomplish is completed in a few minutes. A peat moss is a coal bed in course of formation. It is a vegetable growth which decays and is pressed down by the accumulations on top till the mass below receives sufficient pressure to convert it into mineral coal. The peat on the surface of a moss contains from 50 to 60 per cent. of carbon and the percentage increases the deeper the explorer goes.

There is not much likelihood of peat being used for fuel on this continent, although there are vast accumulations of it in some regions. But good perfected coal is so abundant that it will not pay to use material that needs compressing. In some quarters of the globe, however, peat is likely to be used largely for steam generating purposes.

The Traveling Engineers' Association have issued a circular asking information about the examination of enginemen for handling air-brakes. These men, on whom devolves the responsibility of determining the efficiency of men handling brakes, can be depended upon to formulate a plan that will insure efficient handling without any unnecessary expert testimony being required of the enginemen.

It sounds comical to the railroad men of this country to hear so many prominent preachers, editors and others advocate boycotting the World's Fair on account of Sunday opening. When the railroad men did a little boycotting a few weeks ago, they were anarchists, etc., etc. It makes all the difference in the world who is boycotting and who is getting boycotted.

During the year 1892, 41,893,220.18 tons of anthracite coal were mined and sent to market. It is easy to estimate the extra profit made by the operators on the raise of 25 cents per ton.

### William Buchanan.

Railroad men are a unit in believing that the splendid locomotive "999," built by the New York Central Railroad Co. for the World's Fair, has attained the highest speed ever reached by a locomotive on any railroad. We have pleasure in submitting to our readers a portrait of Mr William Buchanan, superintendent of machinery of the New York Central, who was the designer of the locomotive. Mr Buchanan was born in Dunbarton, Scotland, in 1830, and came to this country with his parents when a boy. His father was a mechanic, and his son followed in his footsteps and learned the blacksmith and machinist trade, in the Burden Works, at Troy. These two trades were very closely combined in those days When he was about twenty years of age he went to work as a machinist on the Hudson River Railroad Then he ran a locomotive for a year or two, and was from that promoted to be shop foreman His rise to master mechanic came shortly afterwards

The attention which he bestowed to his business soon brought him the confidence of the management, and his responsibilities increased gradually with the growth of the Vanderbilt lines, until in 1881 he was made superintendent of motive power of the whole New York Central system and controlled lines He is a progressive man but intensely conservative, and his vast experience has taught him to avoid making mistakes He appears to remember everything that has been tried with locomotives, and he is careful to avoid the rocks that have sent others to grief. His principal characteristic as a designer is the choice of simple forms and strong parts The fast locomotives that have brought the designer so much honor form the highest development of simple forms. The result is efficiency and durability. The engines can be relied upon to do their hard work every day without failure, and they will match anything on wheels for the miles they will run without repairs.


WILLIAM BUCHANAN,
Supt M. P., N Y C & H R Ry. Designer of the "999."

### Charles Hogan.

Nearly all the phenomenally high speed made by New York Central trains, the runs which have broken all records and set men looking forward to the time when 100 miles an hour will be a schedule speed, have been made with Mr Charles Hogan at the throttle Mr Hogan, whose portrait is shown herewith, is a modest, retiring sort of man, whom none but railroaders would expect to make himself famous for fast running. Nearly all his railroad experience has been on the New York Central. His first railroad work was done here, and he was away from the company only a short time when he was seized with the Go West fever. While that lasted he ran on the Union Pacific, but after a few years' experience there concluded that the effete East was good enough for him, so he returned to the Central. He runs regularly between Buffalo and Syracuse The secret of Mr. Hogan's success in keeping up high speed is his steady manner of working up to it. He evidently makes a careful study of how to work the engine into high velocity with the least possible drain on the boiler. He feeds the water very regularly, and never has the lead high enough to cause priming, no matter how fast the cylinders may be drawing the supply of steam. He runs with a full throttle and regulates the speed by the reverse lever. No accident has ever happened to his engine at the high speeds which put terrific strain upon the mechanism. The exemption from accident is doubtless due to persistent and rigid inspection. Mr. Hogan does his own inspection, and is certain that it is done properly.

In speaking of the "999," Mr. Hogan refrains from all braggadocio, and recently wrote "Mr. Buchanan can well be proud of her, for she is all that a locomotive can be."


C. H. HOGAN,
Engineer of the "999." Made the Fastest Time Ever Recorded.

### The Fox Truck.

The New York Central people are remarkably well pleased with the experience they have had with the Fox pressed-steel truck. It is in use under a large number of freight cars, and some of the trucks have been in service over a year. The men in charge of the car department have good opportunities to judge of the merits of the Fox as compared with the excellent standard diamond truck used by the company, and the conclusion arrived at is that the pressed-steel truck is going to be remarkably light on repairs The New York Central people are reported to favor the making the Fox truck standard for all roads. A rule of the Master Car Builders' Association which prevents the making of a patented device a standard will prevent the association from taking action in favor of the Fox truck, which is much to be regretted. If a general desire were manifested to make the truck a standard of the association, it is probable that the patentees might be induced to enter into a satisfactory agreement.

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A great many high-pressure marine engines are now fitted with a simple device, independent of the other lubricators, to force into the steam-chest a small amount of pure graphite daily. This material, if pure, is an excellent lubricant, prevents corrosion and polishes the walls of the cylinder and other moving parts. Some of our compound locomotives should have something of this kind, for it is found very hard to lubricate the valves and pistons with steam at 180 or 200 pounds pressure.

### Smoke Preventing—Jim Skeevers and the Fourth Vice Try Experiments.

There is going to be a reform on Jim Skeevers' road about smoke making, or smoke preventing We know there is going to be a reform because the fourth vice-president says there is, and he knows.

The fourth vice has read three scientific books on combustion and all by his lone self wrote out a bulletin notice about preventing smoke, that showed he was master of the subject When the boys consulted the bulletin board one morning they read the following

Official Order No. 39.

[The fourth vice was educated at West Point and married the president's daughter.]

Official Order No. 39.

The careless habit of enginemen in allowing black smoke to issue from their engines must be discontinued from this date. By firing in such a way as to distribute the carbon evenly on the grates and admitting about four-fifths of the total volume of air to the ash-pan and one-fifth above the fire, the oxygen and hydrogen will mix and all smoke will be consumed before reaching the flues, thereby abating a nuisance and showing a great economy in fuel. Controllable air jets will be put on all passenger engines at once, but men on freight can prevent smoke by putting their fire door on the first notch of the latch for one-and-a-half minutes after each new supply of fuel, then closing it. When the engine is standing, open fire door and put on the blower slightly.

The penalty for a disregard of this rule will be instant dismissal from the service.

SAM BLANK,
*Gen'l. M. M.*

Approved,
A. VERRY NEWE,
*Fourth Vice-President.*

Of course all the boys knew that "the old man," Sam Blank, was never guilty of writing anything about oxygen or hydrogen, and that he knew too well how heavy the trains were and how much coal they had to burn per hour, then, years ago, "the old man" fired and run, and he would just as soon expect the men to obey an order to hold their left hands on the seats of their pants when passing all mile posts as to half close the fire door for one-and-a-half minutes after each fire.

Skeevers pulls the express freight—it's heavy, the time is lively and the "93" never was known to go over the road without burning coal; never was known to burn much coal without some smoke, never was known to steam any too well with tl [illegible] or shut, and never was known [illegible] it all with it half open

Skeevers determined to work in an object lesson on the man that wrote that bulletin. (Skeevers' specialty is object lessons).

Skeevers went home and put on his store clothes and presented himself at the office of A. Verry Newe, fourth vice-president.

He worked his way past the outside guard, made the grand hailing sign of distress before the altar of the "assistant to" and was permitted to send in his name and business on a little piece of paper. He wrote·

"Skeevers, engineer '93,' come to get help and advice about smoke prevention."

He was admitted to the holy of holies, salaamed before the fourth vice, hung his hat on his left thumb, and said:

"Mr. Newe, I am very much interest in smoke prevention, I think it can be e tirely stopped if the men are instruct right. Now, what I called for is this; think if you can get one engine to run without smoke, you can make the other crews do as her crew does and the job is complete; it would take two years to instruct all the men on the road. Now, I want the honor of having the first smokeless engine. You know my train is considered of the most importance on the road, you sidetrack passenger trains for it every day. Now, I thought I could get you to put on some old clothes and go out with us this afternoon. You know more about smoke prevention than anyone else, because you have made a study of it (the fourth vice smiled here and stroked his mustache approvingly); the signals are so thick and the importance of time so great that I cannot watch the fireman and give him the right instruction, but if you would sit on his seat for half a trip and tell him when to shut the door and when to leave it on the latch and prevent him from using too much coal at a time I think the '93' would throw no smoke and be an example to all the rest."

The fourth vice agreed to Skeevers' plan, and Skeevers went home with a pay-day smile on his phiz.

That afternoon as the "93" backed down on to her train, A. Verry Newe, fourth vice-president, stepped upon her hurricane deck, and Skeevers introduced him to the fireman, Pete Doyle.

"Mr. Newe; my fireman, Mr. Doyle Pete, Mr. Newe is going over the road with us to give us a few pointers on smoke preventing. You fire just as he tells you; I am anxious that the '93' should be the first to run without smoke."

Pete said "All right, sorr," but there was a sneer under the coal dust as he glanced at the "dood collar" and effeminate face of the fourth vice.

The fourth vice got a clean piece of waste to wipe his hands, and looked around nervously. He had never been on an engine before with any responsibility at all.

Skeevers oiled around, and then shut himself up on his side of the boiler—the "93" was a mogul—and said to Mr. Newe·

"I shan't be able to notice you much, as it keeps me pretty busy with the signals and all; but Pete will do just what you tell him, and I am sure we shall learn something before we get over the road.

But here's the orders. Are you all right, Pete? Well, we're off."

The "93" picked up her twenty-four loads and started out of the yard.

"Phwat about the firin', sorr?" asked Pete of the fourth vice.

"Well, fire lightly, and don't close the door at first."

"Shall Oi putt in a foire now?"

"Well, yes, I suppose so; fire about as often as you do regularly."

Pete jumped for the shovel and fired in three or four scoops of fine coal, the black smoke rolled the second the door closed, the fourth vice glanced at the stack and spoke sharply to Pete:

Skeevers was wrestling with the sand-lever, for the "93" was slipping.

"Stop!" shouted the fourth vice, "are you crazy? you put in ten shovels of coal there at once; leave that door on the latch."

"But she jerked a hole in her foire, sorr."

"How's that—a hole in her fire?"

"In course, phwen he slipped her she histed the coal aff the front av her grate, the foire wor too thin."

"She didn't throw smoke until you put in the fourth or fifth shovelful."

"Oi'm onto that, sorr; phwen there wor no smoke I knowed there wor a hole, an' all the draft wor goin' in there."

there's an ordinance against it in this town," said Skeevers.

Skeevers went to the telegraph office for orders, and returned with this message

"Report cause of delay to your train at once. J. E. B."

This he handed to the fourth vice.

"What's this for?"

"Bluff wants to know what has delayed us. We were four minutes late and he has held us six more to ask a useless question; does it every day we get three minutes late."

"Don't pay any attention to him."

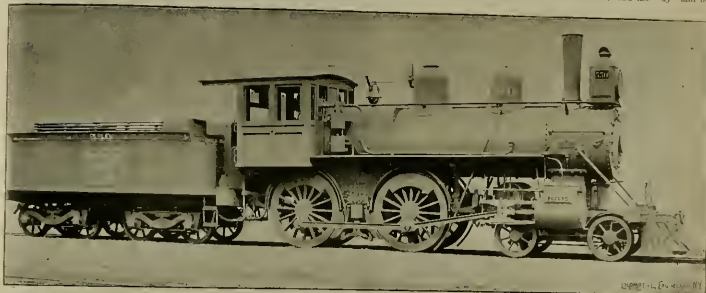
Skeevers jumped onto the engine, glanced at the gauge and said

"Pete, why in the devil didn't you blow wide and then fired in a half-dozen shovels of coal. She smoked, but the finger on the gauge commenced to crawl up toward a hundred and enough.

"Mr. Newe, don't you think that if we could get more oxygen to combine with the hydrogen over the fire that we could complete combustion better?" asked Skeevers.

"Well, I don't know but we could, but what we need is in——"

The Flyer went by here, and the fourth vice didn't finish, for the "93" was tugging at her train when the last sleeper passed. Pete and the fourth vice "fired her for smoke," and the "93" laid down



ROGERS' EIGHT-WHEELED PASSENGER ENGINE. NOW AT WORLD'S FAIR.


ROGERS' TEN-WHEELER PASSENGER ENGINE. NOW AT WORLD'S FAIR.

"Open that door on the latch, sir; don't you see how the smoke is coming out?"

Pete opened it, waited a couple of minutes, then the fourth vice motioned with his hand to have it shut.

"That's the way to do it, my man, do you see there was no smoke at all?"

"Oi do, sorr, but she dropped foive pounds of stheam, do ye moind, an' it's harder to git than to lose."

There was just the trace of a wrinkle on the brow of the fourth vice, as he glanced at the gauge.

"Shall Oi putt in another foire, sorr?"

"Yes, if it's time."

Pete chucked in three shovelfuls, well distributed, and the fourth vice watched the stack with joy—there was no smoke. Pete turned his shovel over and held it in the door for a second, looked up at the stack, and jumped for the tank, commencing to fire coal into the furnace like mad.

Skeevers kept himself busy, and apparently paid no attention to the play on the deck.

The "93" lost another 5 pounds of fog. The fourth vice, Pete and Skeevers each had a wrinkle on his brow now, and Skeevers looked at his watch, then at the steam gauge anxiously, whenever the fourth vice looked his way. This kind of anxiety is catching.

Pete left the door on the latch one-and-a-half minutes by the watch after every fire; fired as he was told, worried to see the steam go down, sweat like a butcher and wished the fourth vice was in Halifax.

Skeevers kept his eagle eye on the rail and looked anxiously at his watch. Steam was down to 105 pounds, ten miles out, and at Peeksboro he was four minutes late and there was a red flag out.

"Please put Pete onto the way to use that blower and door to prevent smoke; her up and get her hot, she ain't gained a pound?"

"The gintlemon said, kape the doure open and the wind-jamber on aisy loike."

It was hard storting with 105 pounds of steam, and when they got back to speed they were fifteen minutes behind time, and had to lay back one station for the Flyer. Skeevers pretended to be mad at Pete and raved about being disgraced; never was so late before. Why in the —— —— couldn't he keep wind on the engine?

"Is it fog yer wantin', Misthur Skeevers?"

"Yes, here's sixteen mile hill ahead of us, thirty minutes late, and no steam."

"Well, sor, Oi can fix ye out if ye will let me foire this kittle fur *stheam*, but Oi am foirin' her now under instructhins fur *schmoke*, and yez can have yer chice"

"Well, get her hot anyway, now."

Pete shut the door, opened the blower half way up sixteen mile hill and had to be "blowed up."

At Hilltop they got another sassy message about delay of train, and at Sumerton they were an hour and five minutes behind the schedule and had delayed most of the other trains on the road—the "93" hadn't done such a thing in years.

The coal dust and sweat mixed with the wrinkles on the brow of the fourth vice. As they were taking water at Springvale he asked Skeevers how much steam he needed to keep the train on time.

"One hundred and sixty."

"Do you generally have it?"

"Always."

"Why won't she keep it up now?"

"Oi can give yez a straight tip on thot," said Pete, sliding into the pit.

"Well?"

"Foire her for stheam."

"Well, fire her for steam, then; we've

got to get this train over the road some time," said the disgusted official.

"But she'll schmoke a little, sorr."

"Damn the smoke."

"That's what Oi say all along, sorr."

The fourth vice slid off and took No. 4 back to town.

Pete, the "93," and Skeevers finished the trip with 160, and, well, she did throw some smoke.

When they got home the next day there was a note for Skeevers to report to the general superintendent at once.

He reported.

"Old Calamity," as the boys called the general superintendent, was in a swearing rage.

"What's the matter with your engine, Skeevers?"

"Nothing at all, sir."

"How came it, then, you lost an hour and forty minutes yesterday, missed your connection, delayed half the trains on the road and raised hell in general?"

"Experimenting to save smoke."

"What right have you got to *experiment* all the trains on the road late, tell me that?"

"I wasn't doing the experimenting."

"Well, who was?"

"The fourth vice-president, sir."

"What in the name of the bald-headed Abraham does he know about smoke?"

"You saw the new bulletin about it, didn't you?"

"No."

"Well, any engineer who can't burn soft coal with a forced draft at the rate of a hundred or two pounds per square foot of grate per hour without smoke is to be discharged."

"Who says so?"

"The fourth vi——"

"The fourth jackass!"

"I asked him to show my fireman how to combine the hydrogen and oxide and the chuloric and the carbolic and the debolic, so as to do away with smoke—and that was what was the matter with the '93' yesterday."

"She didn't steam?"

"Pete says she was fired for 'schmoke.'"

"Well, you make time, smoke or no smoke. I know you fellows make too much smoke around stations and can prevent it some, but you can't burn coal without *some* smoke any more than you can boil water without making steam."

"Well, what about the bulletin? There are already a lot of rules and orders in force that if obeyed would stop every train on the road. You officers know we have to disobey them to do our work, but if anything happens we were disobeying orders. Mr. Newe might just as well have ordered us to have burned no coal at all—it's one or the other, which shall it be: smoke steam and time, or no smoke, no steam and no time?"

"That bulletin will come down *and the man that put it up will take it down.* I'm getting tired of this kindergarten railroading."

"What about stopping a train that is three minutes late to ask what delayed it, and give it five minutes more in the neck?"

"It's bad business, they do that on the G. M. & T."

"They do it right here."

"Who the h——"

"Read that, ask Mr Newe, he was with us," handing him the message received about delay.

"Look here, Skeevers, you knew how this smoke business would come out, didn't you?"

"I could guess fairly well."

"What did you let this new Newe go out to bother you for?"

"To teach him an object lesson."

"Well, what do you suppose he learned?"

"That you can figure out more about smoke preventing on a mahogany desk than you can show in practice and do the work at the same time. That it would be easy enough if all you had to do was to prevent the smoke, and that there was more cry than wool in this smoke nuisance howl, anyway. That what can be done with a big stationary boiler with natural draft, burning twenty pounds of coal per square foot of grate per hour, cannot be done on a locomotive burning more than a hundred, any more than a Corliss valve-gear will do on an express engine."

"Well?"

"You put up a request something like this and you will have little cause for complaint, and take down the old one."

Then Skeevers sat down and wrote out a bulletin.

"Considerable complaint comes from various towns about the throwing of heavy clouds of black smoke. The management of the road recognize the fact that the enginemen cannot burn coal without some smoke, but know that where they try, they can, in a large measure, prevent it in towns and villages by intelligent firing, the use of the door and blower.

"Away from towns smoke is of little consequence. Fire then so as to keep an even and full pressure of steam with the least fuel.

"Those firemen who are the most successful in preventing smoke at stations will be given the best engines to fire and this record will not be forgotten when it becomes necessary to promote men.

"The company has no set rules or pet plans of firing, but leaves this to the judgment of the men on the engines, you will be judged by results, not by methods."

"Try that on 'em and see if you don't have less trouble."

"Old Calamity" put on his specs, read the order over twice and then said

"That's worth trying, young man; it's worth trying, and damme if I don't think you'd make a pretty good railroad official yourself."

"I think so, myself," said Skeevers, "but the president has no other daughters and I'm married, anyway."

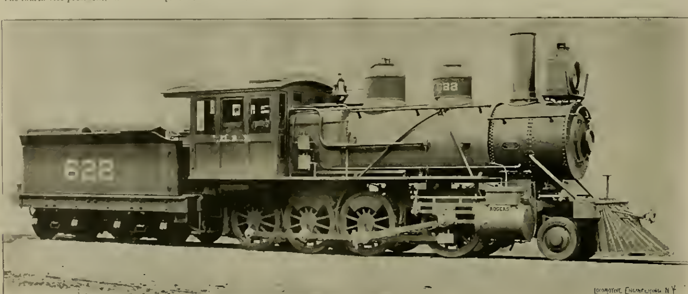
## The Rogers Locomotive Co.'s Exhibition Engines.

On pages 291 and 292 we show some splendid engravings of engines sent to the World's Fair by the Rogers Locomotive Co., of Paterson, N. J.

The first picture is of a standard American engine, with Belpaire boiler, built for the C., B. & Q. She has 18 x 24-inch cylinders, driving-wheels 69 inches in diameter, a rigid wheel base of 8 feet 6 inches and a total wheel base of 22 feet 11½ inches. She weighs, in working order, 102,000 pounds, 65,500 of which is on her drivers.

The second picture is of a heavy ten-wheeled passenger engine, built for Florida passenger service, which is heavy during the winter season. She has cylinders 19 x 24 inches, driving-wheels 72½ inches in diameter, a rigid wheel base of 13 feet 6 inches and a total wheel base of 24 feet 8 inches. She weighs 133,000 pounds, 98,500 of which is on her drivers.

The engine shown on page 292 is a consolidation freighter built for the Illinois Central road. She has cylinders 21 x 24 inches, drivers 56½ inches in diameter, a rigid wheel base of 16 feet 9 inches and a total wheel base of 24 feet 5 inches. Her total weight, in working order, is 137,300 pounds, 118,600 of which is on her drivers.




ROGERS' 21 x 24-INCH CONSOLIDATION. NOW AT WORLD'S FAIR

## Railroads in Georgia.

The Georgia Legislature has acted for the last few years as if railroad property had no right to exist, although the railroads have performed a most important part in dragging the State out of the condition of bankruptcy in which it lay at the close of the War. Capitalists, willing to help in the building up of Southern industries, invested money freely in Georgia railroad securities, and they are getting paid back by Acts that are pure confiscation. There are fifteen railroads insolvent in the State and are being operated by receivers. Three railroads have been sold by the United States Marshal at public auction, and the stocks of all the railroads that have escaped bankruptcy have declined as the values of no other property has ever done.

The outrageous laws that have brought this about have not always confined the inflictions to capitalists in other States. The incomes of hundreds of families in Georgia have been suddenly wiped out and poverty has visited homes where plenty would be found but for the robbery practiced by the law-makers. Many charitable institutions have had to close their doors because their incomes were cut off by the plunderers of railroads.

A curious law was enacted last year by the Georgia General Assembly. They conferred upon the State the monopoly to sell all alcoholic beverages, and made regulations requiring the drinks sold to yield a profit of 100 per cent. Not contented with putting this tax upon the thirsty citizens, the enactment compels railroad companies to transport the drink at a specially low rate. It is generally believed that the working of the new liquor laws and the distress resulting from the adverse railroad legislation will end the sway of the Communists, who form a majority of the Georgia Legislature.

## Call for Meeting of Foreman Blacksmiths.

At a recent meeting of foreman blacksmiths, the subject of forming a national association was discussed, and the undersigned were directed to correspond with foreman blacksmiths throughout the country to ascertain their views on the subject.

It is not intended to form a labor organization, so-called, but an association such as that of the master car builders, for mutual information, improvement and benefit.

The suggestion is made that if the proposition is favorably received, a meeting of those who are able to attend be held in Chicago at some convenient date during the World's Fair. Foreman blacksmiths are requested to write me at earliest convenience how the proposition strikes them, and, if favorable, whether or not they could attend such a meeting. If a sufficient number of favorable responses are received, a meeting will be appointed and notice thereof sent.

J. J. THORNTON,
C. H. WILLIAMS,
W. G. LOTTES,
GEORGE F. HINKENS,
*Committee.*

Address replies to GEO. F. HINKENS, Gladstone, Minn.

An old rule in force fifty years ago on the South Carolina road read: "In cases of dense fogs all freight trains on the road will go into nearest turnouts, and there remain until it clears off. The passenger and night express trains will, in such cases, run strictly within schedules."

## Baltimore & Ohio Railway's Exhibit.

[EDITORIAL CORRESPONDENCE.]

The exhibit of the Baltimore & Ohio Railroad Company in the World's Fair showing the development of the locomotive, forms three rows of machines. If we begin at one end and follow the line to the extremity, then go up the other side taking the next row, and return by the third row, we follow the development of the locomotive from its first germs to its present condition.


THE FIRST ENGINE WITH A LINK MOTION, BUILT BY HENRY T. JAMES, NEW YORK, 1832.

THE PHILOSOPHER'S IDEA OF A LOCOMOTIVE.

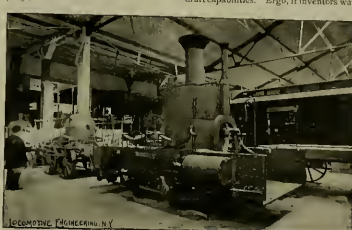
The first apparatus we find is a globular copper ball, with a spout projecting from one end. This was the philosopher's idea of applying steam for the propulsion of vessels, and represented an idea of Sir Isaac Newton's. For more than 2,000 years learned men have been more or less familiar with the power of compressed steam, and they have speculated on the means of applying it to useful purposes. A sort of rotary engine was used as a species of toy in Alexandria some 2,000 years ago, power being developed by the reaction of escaping steam, but learned men failed to design a harness which would transmit the power of steam to machinery. It had made no progress in Sir Isaac Newton's time, when he expressed the idea that is embodied in this machine. The only way that the force of steam could be applied in a machine of this kind, was by the reaction of the escaping steam on the atmosphere; this was the idea of the most accomplished scientific men in the world in 1680.

Philosophers continued their speculations about steam, as the growing industries of the world demanded something better than animal horse-power, but nothing tangible came of their efforts, until a working blacksmith put a piston in a cylinder and used the steam pressure to drive the piston. The first important link in the train of mechanism that forms the locomotive, was thus put into practical shape by Thomas Newcomen, in 1705.

As soon as steam could be applied by this means, even through crude apparatus, military engineers, who have always been looking for new means of increasing their destructive agencies, attempted to make a steam engine that would be useful for military purposes. This desire led to the inventing of the second machine shown in the line; it was designed by Cugnot, a French engineer, in 1769, and his machine is still to be found in a museum in Paris. This was really the first attempt to build a locomotive engine. Two cylinders were employed transmitting the rotative power to a single wheel. The power was applied through ratchets connected with the wheel. Reversing the direction of travel was done by turning the pawls. The fatal weakness of this first locomotive was deficiency of boiler capacity.

MURDOCH'S MODELS.

The next machine is a steam engine invented by Murdoch, one of Watts' assistants, in 1784; it was a small model and worked well enough to demonstrate that the applying of the steam engine to locomotion was practicable. The inventor, who was an accomplished engineer, was, however, too much engaged with other engineering business to follow out this idea, and it fell to others to carry out the work. One upright cylinder was employed, the piston being connected to a long pivoted bar, which in turn moved the connecting-rod. The next machine,




THE FIRST "CRAB." IN FRONT OF HER STANDS THE "HERCULES," THE FIRST ENGINE WITH EQUALIZERS.

NATHAN READ'S TUBULAR BOILER.

which looks like a flat car with a boiler at one end, is not an engine, but it shows something which performed a very important part in the development of steam locomotion. This is the first multi-tubular boiler ever built, and was invented by N. A. Read, of New England. He demonstrated the rapidity in which steam could be generated in a boiler of this sort, and urged its adoption upon the engineering world of his time, but he was in the field too early, having built the first boiler in 1791. His ideas, however, were taken by others and utilized to make the locomotive a success.

The next machine is Trevethick's first engine, and was built about 1800 for the purpose of running on common roads

The next engine, with the big fly-wheel and nest of gear-wheels, was the developed idea of Trevethick's, and was built three years after the first one; it was also intended for common roads.

OLIVER EVANS' AMPHIBIOUS MACHINE.

To Americans, the queer-looking oblong box with four wheels, ought to be one of the most interesting exhibits on the grounds, for it represents the first vehicle ever moved by steam in America. It was a scow, built by Oliver Evans in 1804 Oliver Evans was a great advocate of the use of steam for locomotive purposes, and to demonstrate its practicability he put wheels under a scow which he built, and by means of his high-pressure steam engine ran the scow through the streets of Philadelphia. Evans was the inventor of the high-pressure, high-speed steam engine, which was for half a century distinctly American.

The next machine, with its four large wheels and vertical cylinder, transmitting power through a walking-beam and long rods, is another locomotive of Trevethicks' design, also intended for common roads. It contains all the elements of the first practical locomotives. This engine was built in 1808.

Four years later the next machine was built by Blenkinsop, an English inventor. Like most other early engineers, he believed that smooth wheels could not be used under locomotives, and he accordingly made his engine with geared wheels to secure the necessary adhesion. The engine was not a practical success.

To overcome the difficulties of obtaining adhesion of the driving-wheels, the next engine was built by Brunton. It will be seen that the cylinders transmit power to a pair of levers with shoes trading on the ground. These were to push it along, in the way that a man or an animal steps, giving the required propulsion to the machine. Many engineers believed eighty years ago that the method of Brunton was going to be the line of development of the steam engine to land transport. They argued that Nature was the true mother of invention, and Nature had shown that the horse embodied the highest speed and draft capabilities. Ergo, if inventors want to succeed in making a perfect traveling engine let them imitate the motions of the horse.

One of Brunton's engines was built, and a great eager crowd gathered to see it start on the expected speed that was to rival the pace of the fleetest Arabian steed. The engine started with many jerks and groanings, as is apt to be the case with new machines, but she went without shoving, which is more than could be said of many other early locomotives. As she moved away the engineer became excited and shouted to the fireman to "keep her hot." That person labored with vigor and zeal, and a giddy velocity of three miles an hour was reached. Still the men in charge were not satisfied, and there seemed to be some prospect of adding another mile an hour to the speed if the fireman did his duty. At this point, when breaking the record seemed within the grasp of the inventor, the boiler blew up, killing six or seven persons and ruining the engine. Stock in the Brunton invention dropped to zero and remained there.

HEDLEY'S WORK IN BEHALF OF THE LOCOMOTIVE.

Wm. Hedley, superintendent of one of the coal mines in the north of England, who, like others of his class, was interested in applying the steam engine to locomotive purposes, seems to have been a very keen observer, and did not take for granted that the adhesion of plain wheels was not sufficient for traction; as it was the opinion, however, of the engineering world of the time that plain wheels would not do, Wm. Hedley constructed a machine to test the proportion between the weight and adhesion, that is shown in the four-wheeled vehicle, with gears in the middle and handles outside for turning the wheels. By experimenting with this machine he demonstrated that geared wheels were not necessary for locomotives.

About the time this experiment was tried he had a locomotive almost ready to put in service; this engine is the four-wheeled machine seen next, and it became the model of locomotive builders up to the time that the Liverpool and Manchester Railway was opened in 1829. This locomotive of Hedley's, which was called the "Puffing Billy," was built in 1813. She was the first locomotive to do practical every day work on a railroad, and it was a highly sensible machine considering it was built before high-pressure boilers and high-speed engines had made any progress in England. The boiler was of wrought-iron plate, with a return flue. Two vertical cylinders were employed, the piston-rods being connected to beams from which motion was transmitted by means of gearing to four smooth wheels. The exhaust steam was discharged into a drum, from whence it passed into the smokestack. This engine remained at work till 1862, when it was removed to the South Kensington Museum, London.

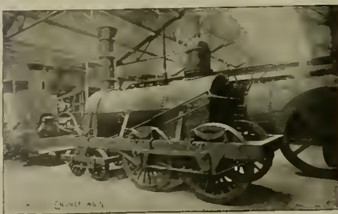
GEORGE STEPHENSON'S FIRST LOCOMOTIVE.

George Stephenson, who was foreman of a coal mine a few miles from where Hedley had his engine at work, went to see Hedley's engine, and on examining it declared he could build a better one. George was never overwhelmed with any sense of native modesty, and he convinced the proprietors of his mine that he could build an engine superior to Hedley's. The result was that they furnished the means and he built the engine next in line; this engine was called the "Blucher."

It gave George a good deal of experience in locomotive construction and maintenance, but it was not much of a success. Nobody but George thought it was a better engine than Hedley's. George made two radical mistakes in the construction of


FIRST EIGHT-WHEEL CONNECTED ENGINE. BUILT BY WINANS'.

the "Blucher" to use a single flue, thereby losing the heating efficiency that Hedley's engine possessed, and he multiplied the gearing that intervened between the connecting-rod and the driving-wheels. The engine had two cylinders, 8 x 24 inches, placed vertically half way within the boiler. The engine did not work long before the cog-wheels wore so badly that radical changes had to be made. This experience with gearing as a means of transmitting power to locomotives taught subsequent builders to make direct connection with the driving-wheels.



The First Eight-Wheeler Patented by Henry R. Campbell, of Philadelphia, in 1836.

While the English were laboring to develop locomotives for hauling coal cars, engineers on the continent in Europe were also engaged in working out the problem of applying the steam engine for land transportation. The next engine, which has two sets of driving-wheels with a cylinder set above each and a tender with an article like a fan on each side, was designed by Seguin, a French inventor. His idea was to use the fans for blowing the fire. The engine has a return flue boiler, ... became a common form in those ... of the development of the locomotive. ... next machine, with the ratchets ... of the wheels, is interesting because it represents the first form of locomotive patented in America, this was done in 1827, but the engine was never built.

The next three engines are interesting, because they are those which competed at Rainhill in 1829 for a prize of £500 offered by the Liverpool & Manchester Railway Company for a locomotive that would come up to certain requirements regarding pulling, weight and speed.

STEPHENSON'S "ROCKET."

The first engine is the "Rocket," built by George and Robert Stephenson, at their works in Newcastle; it took the prize. The model of this engine is well worthy of critical examination. A more correctly built model will be found in the exhibit of the London & Northwestern in the British section. This was the first locomotive that had a firebox and multi-tubular flues. This combination gave the first element of success, since it enabled the boiler to generate steam enough to meet the drain of cylinders having a fast-working piston. The engine is a remarkably compact machine for the time in which she was built. She has all the elements of the modern locomotive, including steam blast and direct-connecting cylinders. In this engine we find the bar-frame, which was afterwards developed by English builders and then abandoned, to be taken up as a regular feature of the American locomotive. This engine attained the speed of twenty-nine miles an hour on a trial trip, which caused a tremendous sensation among the general public, who believed that twenty miles an hour was a speed too great for safety.

The next engine is the "Sanspareil" of Timothy Hackworth. It was a favorite before the race, but did not equal the "Rocket" in performance, although it was said to be a more powerful engine.

The next engine, with the boiler, cylinders and diamond-shaped box on the same frame, was the engine built by the famous engineer, Ericsson, for the competition. The box contained a fan for stimulating the fire, and to its failure to work at a critical moment was due the failure of the engine in the race.

"STOURBRIDGE LION."

The engine at the end of this row is interesting to most Americans, from the fact of it having been the first to turn a wheel on an American railroad. This was the "Stourbridge Lion," built at Stourbridge, England, by Foster, Rastrick & Co., for the Delaware & Hudson Canal Company, and brought to this country under the supervision of the famous engineer, Horatio Allen. The engine made a single trip over a portion of the road, but proved too heavy for the track, and was abandoned in consequence.

The next engine we come to, returning on the next line, which has horizontal boiler, firebox, single pair of driving-wheels and a small pair of leading wheels, was the first of what was known as the "Planet" type, this form of construction was for years followed as a model by English designers.

COOPER'S "TOM THUMB."

The next engine that we come to represents our first native efforts to make locomotives for railroad service. It was a small working model, built by Peter Cooper, and run on the Baltimore & Ohio Railway in the summer of 1829. Its performance demonstrated that working a railroad by locomotives was practicable. The most interesting point about the engine is that it shows the first element of what was afterwards known as the "V" hook motion. This will be apparent to anyone who examines the valve motion. The engine was little more than a working model, having had only one upright cylinder and a small vertical boiler in which gun barrels were used as flues. This engine was built before the "Rocket," and Peter Cooper deserves the credit of first designing a multi-tubular boiler for locomotive purposes. The engine, however, attained a speed of eighteen miles an hour and pulled a car containing thirty-six passengers. The trial of the little engine was made before the famous Rainhill trials in which the "Rocket" obtained the famous laurels. It is probable that the performance of Cooper's "Tom Thumb," as she was called, would have convinced American railroad men that steam locomotives were practicable for high speed, even if the trials in England had never taken place. The cylinder of the engine was $3\frac{1}{4}$ inches in diameter with a stroke of $13\frac{1}{2}$ inches. Power was transmitted to the driving wheels by gearing. The wheels were 30 inches in diameter. The whole engine in working order weighed about 1 ton.

American locomotive men ought to examine this model carefully. The accident of a more conspicuous success alone prevented the "Tom Thumb" from holding the high place in history now occupied by Stephenson's "Rocket."

"THE BEST FRIEND."

The next engine ought also to be of great interest to American railroad men, as it was the first practical locomotive built on this continent. The engine was built at West Point Factory, New York, under the supervision of Mr. David Matthews, one of the pioneer engineers of this country, who is still alive, and will, no doubt, visit the World's Fair. She was built for the South Carolina railway according to designs furnished by Mr. E. L. Miller, president of the railway. As will be seen, she has a vertical boiler, the furnace at the bottom being surrounded with water and filled inside with teats running out from side to top with alternate stays to support the crown of the furnace. The gases of combustion passed through the sides at several points into an outside jacket from which they escaped into the smokestack. The boiler and cylinders were carried upon a frame resting on four coupled wheels. The cylinders were 6x16 inches, wheels $4\frac{1}{2}$ feet diameter, the whole weighing $4\frac{1}{2}$ tons. This engine was shipped to Charleston, S. C., in the fall of 1830, and was put into service at once and did very good work. She afterwards came to grief through the fireman hanging a weight on the safety-valve to prevent the noise of blowing off steam, which exploded the boiler, killing the fireman. She was afterwards rebuilt with a horizontal boiler and worked on the road up to the time of the War.

First Engine Built by Norris Locomotive Works.

BALTIMORE & OHIO PRIZE LOCOMOTIVES.

The next group of models represents a very interesting event in the history of American railroad development. After the successful trial of Cooper's little engine on the Baltimore & Ohio Railroad, the company offered prizes for locomotives that would meet certain requirements, and the models shown represent the engines that were built for the competition. The terms of the competition were rather curious. The engine was required to burn coke or coal and consume its own smoke. The weight was restricted to $3\frac{1}{2}$ tons in working order. The wheel flanges were required to be inside the rail and coned according to a shape submitted. If the engine was four-wheel connected, the wheels were not to exceed 3 feet in diameter, but if a single pair of drivers were used, the diameter might be 4 feet. The pressure of steam was not to exceed 100 pounds to the inch, and a less pressure was preferred. The company took the right to test the boiler with water to four times the steam pressure. The engine was required to be carried on springs, and the height of the smokestack was restricted to 12 feet. The sum of $4,000 was to be paid for the engine that most successfully met the conditions, and $3,500 for the next best. The prize was taken by an engine designed by Phineas Davis, who was afterwards master mechanic of the road, and was killed by one of the engines turning over. The model of his successful engine will be identified from the fact that she had vertical cylinders connecting direct to the middle of the side-rods. This plan of driving was found to be very defective, as it put too many stresses on the side-rods, and the engine was afterwards altered and put into a shape shown further on in this group.

Among this group is an engine built by Milholland for the competition. The most interesting point about Milholland's engine is that it has a distinctly developed form of "V" hook motion. She also seemed to have the germ of the extended smokebox.

"Sandusky," First Engine Turned Out by Rogers Locomotive Works.

One of the engines in this group, which will be identified by two sets of copper pipes leading from the boiler-head to the steam-chest, is a great curiosity. She was designed by Stacey Castello, of Philadelphia, and built for the Baltimore & Ohio competition. There are several curious things about this engine, the most prominent feature being oscillating cylinders that admit and exhaust steam in a peculiar fashion. The steam-pipes lead to a cored disk at the side of the cylinders. When going ahead the forward pipe admits steam and the other acts as the exhaust, while to go backwards, the pipe becomes the steam-pipe and the other the exhaust.

FIRST LINK MOTION ENGINE.

There are two other experimental machines here, one built in Philadelphia by Childs, the other by Henry T. James, of New York.

The James engine is of peculiar interest owing to the fact that a link motion was used upon it. This ingenious inventor understood the merits of the link motion as they are now recognized; knew that by linking up towards the center the steam cut-off was accelerated, and the period of compression advanced. The weak point about his inventions was lightness of the parts. He made neither boiler nor mechanism strong enough for the work to be done. The mechanism was much given to breaking down, and several of his boilers exploded, which was the cause of a very valuable invention being lost to the engineering world at the time. Through the explosion of the boiler of the best engine he built, the whole thing was destroyed, and the link motion dropped out of sight until it was re-invented fifteen years later.

The next engine to claim our notice is the grasshopper "Atlantic." This is merely a development of Davis' first engine, and became the standard of the Baltimore & Ohio for several years. This "Atlantic" was the first of her class, and is a real engine of historical interest. At first a revolving fan was employed for blowing air into the fire; but that was afterwards abandoned and the steam turned into a smokestack.

Among other models near at hand is that of Matthias Baldwin's first locomotive, the "Old Ironsides." Then comes a double-ender, designed by Horatio Allen for the South Carolina Railway. It did not prove much of a success; but another ahead of it, a single connected engine with a four-wheel truck, demands attention, for it was the first locomotive to which a leading truck was applied. This was done by John B. Jervis, the well-known engineer. This improvement was first applied to an English-built engine running on the Mohawk & Hudson Railroad.

Walking along, we come to an eight-wheel engine built by the Baldwin Locomotive Works many years ago. This engine is interesting on account of being the prototype of the modern eight-wheel American engine. She was designed by Henry Campbell, of Philadelphia.

Next we come to an engine with an upright boiler and horizontal cylinders called the "Mazeppa." This was an advance on the rasshopper type of engine and is the first "crab" ever built. The trainmen gave the engine this name because she appeared to move backward, the cylinders being behind. Like the grasshoppers, she transmits the power to a driving-shaft having a gear-wheel, which in turn engages with a cog on the driving-axle.

The next engine is Eastwick & Harrison's "Hercules," and is of historical interest from the fact that she was the first engine built with equalizers. The engine is of a style that was very popular in this country for years, having the dome form of firebox introduced by Bury, of England. This engine had a peculiar form of valve motion, with only one eccentric for each side, a movable plate on the steam-chest having changed the position of the ports to make them suitable for back or forward motion.

The next engine we come to, with a single pair of drivers, dome firebox, engine truck and drop-hook motion, represents the first locomotive built by Norris, of Philadelphia.

THE ENGINE THAT ESTABLISHED THE TRACK-GAUGE OF OHIO.

Across the aisle we find the "Sandusky," an engine of historical interest from several circumstances. The engine was the first built by the Rogers Locomotive Works in 1837. She has a half crank connection and eccentrics set on the driving-axle outside of the frame, actuating a rocking-shaft placed under the deck. The engine has the wagon-top form of boiler, which afterwards became so popular in this country, and to which the splendid boiler work done by the Rogers Locomotive Works contributed in no small degree. A novelty about this engine was the counterbalancing the weight of the crank and its connections by putting lead in the cored rim of the wheel. This plan was patented by Thomas Rogers at a time when few people considered counterbalancing necessary. A bonnet spark-arrester was applied to this engine, and it was considered the most advanced form of spark-arrester at that time.

The "Sandusky" was built for the New Jersey Railroad & Transportation Co., which had a gauge of 4 feet and 10 inches. About the time the engine was finished some capitolists in Ohio were about to begin building a railroad to form connection with the Ohio River, at Cincinnati, and Lake Erie. One of them came to Paterson and bought the engine for the Mad River Railroad Co. She was taken out by canal and lake transport to Sandusky, and was landed before a foot of railroad was built. They built the road to suit the gauge of the engine and the legislature of Ohio afterwards passed an act making 4 feet 10 inches the legal gauge of the State. We believe this is the only case on record where one locomotive led to an act of legislature, or where a locomotive established track-gauge for a State or country.

READING'S FIRST LOCOMOTIVE

The next engine, with the favorite name of "Rocket," is a real engine, and was the first used on the Philadelphia & Reading Railroad. As will be seen by a plate on her side, she was built by Braithwaite & Co., London, in 1838. The engine is of a kind that was very common in those days, and all railroad men can remember when many of them were still in use in Great Britain. This engine is very well worthy of a critical examination; she is inside connected, has the Bury style of boiler, and the eccentric rods extend beneath the smokebox to a rocking-bar under the front end, which is actuated by drop-hooks. This is the most perfect of the old types of locomotives on the grounds. She is in perfect order and is still fit for service after the many years she has been in use. She has what was known as the Bury bar-frame, which was dropped by English builders, but was adopted by Americans and has become an established feature of our locomotive construction. A point about the engine well worthy of examination is the springs, they contain twenty-one plates, of about the same size of those now used in driving-springs of our heavy locomotives.

The next locomotive is the "Samson," which was built by Timothy Hackworth in 1836 for a coal railroad in Nova Scotia, and was kept in service up to within ten years ago. She has a return tubular boiler and vertical cylinders, and was one of the type that was very popular with English builders for heavy service in early railroading.

The next engine is the first of the eight-wheelers built for the Baltimore & Ohio. It has horizontal cylinders, which was a departure from their older form, which transmitted power to driving-wheels in the second motion. She was a favorite engine with Ross Winans, and did useful work.

The next engine is the "Albion," an English engine sent to Nova Scotia early in the railroading era

The next engine shows the progress towards heavy freight engines made by the Baltimore & Ohio Company. She is carried on four pairs of drivers, connected, has cylinders under smokebox and transmits the power through a supplementary shaft and gearing. This was the line in which Ross Winans developed the locomotive towards the camel-back

Greater progress is represented in the next engine, which has horizontal cylinders on the outside and four pairs of driving-wheels, connected, and with a very large dome in the middle of boiler. This is the first of the "camel-backs;" it is also notable in having a magazine chamber beside the stack for a spark-arrester.

The next engine is one of the older form of locomotive, still used by the Baltimore & Ohio, and was taken out of service to come to this Exposition, and will go back into service after Exposition is over. She has been in use longer than any locomotive in this country.

The next engine is the first "camel-back" built by Ross Winans. She is the ordinary form of "camel-back" still in use.

The engines in the remainder of the row will be readily understood by railroad visitors.

## Brooks' Twelve-Wheel Freight Locomotive.

Gauge—4 ft 8½ in.
Fuel—Bituminous coal.
Weight in working order—156,000 lbs.
Weight on drivers in working order—136,000 lbs.
Rigid wheel base—9 ft. 8 in.
Driving-wheel base—15 ft. 6 in.
Total wheel base—25 ft. 3 in.
Diameter and stroke of cylinders—20 x 26.
Diameter of driving-wheels—55 in.
Diameter of boiler—68 in.
Length and width of firebox—114 x 32 in.

TENDER.

Coal capacity—8 tons.
Capacity of tank—4,000 gals.

ENGINE AND TENDER.

Total wheel base—52 ft. ½ in.

This engine was intended to stand on a pedestal at the Fair entrance, another huge engine of Baldwin build to be opposite, but the Fair officials deciding to cut down the pier from 23 to 4 feet, the builders put their engines inside.


BROOKS' HEAVY TWELVE-WHEELER. BUILT FOR ONE OF THE PEDESTALS AT WORLD'S FAIR ENTRANCE.

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A rule in the M. C. B. interchange code has worked iniquity to some people since it was adopted. This is the rule which read "That in case a foreign draw-bar is removed from a car upon a defect card, a credit shall be allowed of the full value new of the material in the bar" The effect of this has been to induce unscrupulous parties to turn old bars upon other roads and make claims for four times their market value. A change has been made allowing only the value of the bar as scrap.

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A patent has been granted to Mr. S. M. Vauclain, of the Baldwin Locomotive Works, for an improvement in injectors. The improvement consists of a method for saving the overflow water by returning it to the feed-pipe.

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The Strong Locomotive Manufacturing Co., of Cincinnati, have dissolved. Only $8,700 of the $1,000,000 capital was ever paid in.

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### Durability of Hollow Bolts.

Claims have repeatedly been made that hollow stay-bolts are more durable than those made of solid iron, but very few mechanical men put any faith in the theory. As broken stay-bolts is a subject of vital importance to every one connected with the care and handling of locomotives, we believe that thorough tests ought to be made to find how far the claims of those who allege that hollow stay-bolts will stand stresses better than solid ones are correct. The practice of drilling stay-bolts to indicate when breakage occurs is becoming very common, and is, we believe, an increased means of safety; but even this practice has its detractors, who assert that the bolt is weakened, without being made a certain means of indicating rupture.

There is too great a tendency to take snap judgment about everything where there is a possibility of difference of opinion. We do not think it is wise for any man to jump to the conclusion that anything which can possibly make a boiler safer is wrong, without painstaking investigation. The incompetent way in which investigations of mechanical subjects are sometimes carried out was strikingly illustrated in a case that came to the knowledge of the writer concerning a test of solid and hollow iron intended for stay-bolts. The iron to be tried was said to be of the same tensile strength. The hollow stay-bolts broke under the same strain per inch of section as the other, and the conclusion jumped at was that it could not be any better in sustaining the strains of service.

The claim made for hollow or drilled bolt is that it has greater elasticity than the solid one, and better withstands the deteriorating action that causes crystallization. Although no satisfactory test has been carried out to demonstrate the truth or fallacy of this theory, analogy indicates that it is well founded. Years ago Mr. Stroudley, locomotive superintendent of the London, Brighton & South Coast Railway, began the practice of using bolts drilled hollow for all important connections, and the failures were greatly reduced thereby.

Lately, the Straight Line Engine Co., of Syracuse, N.Y., have adopted the use of hollow bolts for their main rods because it reduced the chances of breakage. Professor Sweet, talking on this subject lately, said that hollow bolts were not only less given to breakage than solid ones, but they had so much elasticity that a single nut would hold a bolt secure, as the spring of the material obviated the necessity for using a jam nut. They have made a variety of tests to find out how hollow bolts withstood strains and shocks. Under pulling tests the solid bolt began to stretch under the same strain per inch of section as the hollow bolt, but the former broke after stretching one quarter of an inch, while one hollow bolt stretched two inches before it broke. Under the shocks caused by blows the hollow bolt displayed even greater superiority over the other. The solid bolt broke under a certain weight dropping twenty-eight inches, and the hollow bolt did not break until the fall was raised to forty-three inches

Facts of this kind show that there is more in a hollow bolt than the critics, who rely on their "common sense" alone, would lead us to suppose. A form that displays superior power in withstanding blows is likely to endure vibration and cross movement in a similar degree. Marine engineers are in the habit of drilling a hole through the center of propeller shafts under the belief that it lessens the crystallization action due to stress and vibration. If this is a fad, as some ultra practical men pretend to believe, it is a very expensive one not likely to be followed if good cause were not shown to prove its utility. There certainly appears to be sufficient good engineering testimony to justify faith in the improvement embodied in drilled or hollow stay-bolts.

### Is it Saving Money to Save Oil?

A prominent superintendent of machinery of a large road recently remarked to the writer "I'm afraid to ask my boys to be very economical with oil. I could save oil by forcing matters a littl , but the company would lose money by it." Undoubtedly this statement is true. Men forced to it by orders or induced by hope of earning premiums will skimp a bearing of oil close up to the heating point. If heating takes place permanent damage is done the bearing, and it will require far more oil to cool it down than would have been required to keep it cool in the first place. Every bearing of a locomotive or car should have all the oil that can be gotten between the rubbing surfaces; excess that runs off is waste, but there will be less power consumed in overcoming friction, less liability of bearings to heat and cause of delays to trains, and expense in repairs, if the bearings are flooded with oil.

It is mistaken economy to buy cheap, thin oils; they are much poorer lubricants, and being thin and volatile they run away from bearings, allow cutting to take place at a lower temperature, and are themselves fuel to a hot box. Once a bearing becomes heated it can hardly be gotten cool again with the miserable stuff known to the trade as "six-cent oil," and to the men as "purchasing-agents' slop."

Where plenty of reasonably good oil is furnished to enginemen there will always be found an absence of delays from hot pins and cut bearings, less repairs to machinery, *and less money invested in oil per mile run*, than on a road trying to save *oil* when they should try to save *money*.

How many master mechanics are there in the country who absolutely pay no attention to saving coal, who will let one man use, regularly, twice as much fuel as others do, but who will haul him over the coals at once if he runs a few miles below the average to a quart of oil?

Any master mechanic can save his company a dollar on coal with half the effort, and without any of the risks he takes in trying to save a cent on oil.

Coal is the big expense in operating locomotives; if a pound can be saved it is pure gain; it can do no harm in another direction; therefore it is the place to try to save

Oil is one of the small expenses, stinginess in its use or economy (?) in its purchase may cause expense, delays, and annoyance in a dozen ways, each more expensive than it would be to furnish good oil and plenty of it.

### Train Wrecking.

Within the last month the daily papers have recorded several cases of attempted train wrecking, and in only one instance has an arrest been recorded. In this case, the man who attempted to commit wholesale murder upon innocent passengers and trainmen gave as an excuse that he had been badly treated by the railroad company. The man would have been equitably treated had the people whose lives he put in jeopardy strung him up to the nearest telegraph pole. Public sentiment is far too lax in dealing with the crime of train wrecking. It is the worst species of murder, yet it has very rarely been treated as a capital crime. If the criminal has influential friends or money behind him, he is certain to escape the highest penalty of the crime, no matter how many lives he may have sacrificed

We are familiar with several cases where worthless wretches obstructed the track or moved rails, causing the death of enginemen, and in no instance was a punishment of ten years in the penitentiary inflicted. In one case a youth got off with eighteen months in jail, although his diabolical act caused the death of an engineer. This laxity of punishing crimes that are of peculiar atrocity encourages people to commit them. In cases of train wrecking, railroads ought to combine to prosecute the offender There is so much hatred to railroad companies as corporations that a lawyer can generally enlist the sympathy of the jury by pretending that the criminal is vindictively prosecuted by a soulless corporation. If he was prosecuted by the men whose souls he was trying to let loose ahead of time, the sympathy would seldomer be found on the side of the murderer. The way to make ruffians understand that the lives and limbs of railroad men are worthy of respect is for railroad men to show that they demand the kind of protection that prevents crime through wholesome fear of the consequences.

### Obstructing Car Movement.

A discussion arose in the Master Car Builders' Convention, that strongly illustrates how the want of judgment or the illiberal spirit of one railroad official may obstruct the prompt movement of freight cars. It will be remembered that several years ago certain destructive wrecks of freight trains were traced to brake rigging being hung so low that it was torn off by guard rails or other truck attachments, derailing trains and causing loss of life and serious damage to property. As a remedy for this danger the Master Car Builders' Association inserted an article in the Rules of Interchange of Cars, permitting cars to be refused if the brake-beams, levers and attachments were less than 2¼ inches from top of the rail. The rule has worked well, and although there are thousands of cars with their brake attachments lower than that specified by the rule, it caused no inconvenience or dispute till lately. One decided benefit of the rule has been that all new cars and all cars rebuilt have had their brake-rigging set high enough to prevent danger.

The members of the last convention were surprised when the Rules of Interchange were under consideration with a motion to change the rule respecting brake-rigging, making the distance from the rail not less than two inches. The move led to a lively discussion, and several of the New England members insisted that their managements were anxious for the change to be made in order to facilitate the movement of cars.

It appears that the New England railroads were in the habit of accepting cars at interchange points with the brake-rigging lower than the specified limit, and no inconvenience was experienced till a new master car builder was appointed for the New York, New Haven & Hartford lines, who issued a positive rule that all cars should be refused unless the brake-rigging was up to the required height The rule stopped cars by the wholesale, and a sort of panic ensued. The Master Car Builders' Association was appealed to for assistance, and they promptly refused to change their rules.

This evidently was not a case for the master car builders, but for the general managers, whose cars were delayed. If they had represented to the management of the N. Y., N. H. & H. that their M. C. B. was acting without good judgment and was interfering with the movement of freight cars without serving any good or rational purpose, there is no doubt that a change of policy would have been dictated.

Meanwhile the roads whose cars were delayed did not deserve much sympathy. While others have been raising their brake-rigging to prevent accidents, and in compliance with the M. C. B. rule, they have been doing nothing.

### Proposals of Change on the Rules of Interchange of Cars.

We have been urging for years that the Master Car Builders' Association give the car inspectors a little consideration when they undertake to discuss proposed changes on the Rules of Interchange of Cars. Complaints are constantly heard that the inspectors at the numerous interchange points are celebrated mostly for making diverse interpretations of the rules under which they are supposed to work We have attributed much of the confusion of opinion that exists about these rules to the practice of making changes on them every year. Changes have often been made without any real necessity, but it seemed that some members could not let the rules alone. To gratify a little desire to pose as the originator of a new rule, changes have been carried out which led to confusion among the inspectors on every road in the country. It seems that the seed of our arguments against the practice fell on some fertile ground, for the last Master Car Builders' Convention was notable for the firm manner in which the majority of the members opposed changes on the Rules of Interchange. A wholesome, practical sentiment seemed to prevail. When a change was proposed, the questions were immediately considered: How is it going to work? What good will it effect? If there was not very apparent reasons for a change, it was rejected by a large majority We consider that the railroad companies will profit largely by the good sense that ruled the councils of the last convention.

### Advantages of a Stiff Rail.

The New York Central Railroad Company, in all their renewals of track, are using a section of rail designed by Professor Dudley which has a very deep section, making a remarkably stiff track. The rail has several peculiarities which contribute to making it an improvement over all other rail sections in use. The metal is so distributed that it has an unusually wide head, and the fillets between the head and base are so formed that these parts get compressed in the act of rolling This makes strong what are usually weak points.

In the course of a conversation with Mr. A. G. Leonard, assistant to Vice-President Webb, about rail matters, we were surprised and somewhat skeptical about a statement which he made to the effect that their engines were able to haul two more cars on a fifty-foot grade after the Dudley rail was put down. We now believe that the statement correct, extraordinary as it may appear. With a weak rail and heavily loaded cars the wheels are constantly ascending and descending a series of small grades due to the deflection of the rails. A stiff rail gives the wheel a flat surface to roll on, thereby decreasing the resistance. An incidental advantage obtained by use of the wider rail-head is increased durability of tires, the larger bearing surface reducing the tendency to wear.

### A Standard Height of Draw-bar Made Compulsory.

A circular received from the Secretary of the Interstate Commerce Commission intimates that the railroad companies which have so long refused to adopt a standard height for the draw-bar of freight cars will now be required by law to adopt a uniform height of 34½ inches. It was high time that something was done to put an end to the diverse height of draw-bars used by different railroad companies, and in some instances by the same company. There has been for many years a standard of 33 inches for the height of freight car draw-bars, but it has been ignored by many railroad companies, and the actual heights in use vary from 31 to 36 inches. This has been a most dangerous condition of affairs for trainmen and switchmen, and great loss of life and injury to persons has resulted from two connecting draw-bars varying so much in height that one passed over the other.

Those who realized the dangers of this defect have over and again tried to induce railroad companies to adhere to the standard or to agree upon a height that would bring about greater uniformity. All efforts in this direction were futile because a few large railroad companies had adopted a height above the M. C. B. standard, and they would not yield an inch to meet the wishes of those who were inclined to effect a compromise. It is gratifying to know that the strong hand of a United States law will now come into force to end the heartless methods of the companies, which permitted no considerations of humanity to influence their actions on car design.

### Locomotive Tests.

We have heard considerable criticism among members of the Railway Master Mechanics' Association and others about the excessively elaborate method of locomotive tests proposed by the committee on the subject. To subject a locomotive to all the details of the proposed test will certainly involve a great deal of labor, but after the work is done there will be material to form accurate conclusions from that cannot be found after the slip-shod tests in vogue are finished. The report recommends considerable useless and unnecessary work, such as weighing the ashes in smokebox, in the ash pan, etc., but on the whole the work mapped out is of a kind that will bring good results.

The fact is that nearly all master mechanics are inclined to make tests of locomotives with data not sufficient to draw conclusions from. In the last convention speakers described their methods of arriving at conclusions about the relative value of compound and simple locomotives which were simply ridiculous. We heard some of the railroad men making fun of a New England master mechanic for the plan he adopted to find out the relative value of two kinds of coal. It seems the general manager wanted to find out how a new quality of coal would compare with the quality they had been using, so he directed the master mechanic to find out. A few weeks afterwards he called for a report, and the master mechanic went to the general office and said that he had talked to the engineers using the coal, and some of them said it was better than the old kind, while some of them said that it was not as good. This method of reaching conclusions on a measurable quantity was carrying loose practices to such an extreme that it struck most master mechanics as being ridiculous, yet it was not a shade more inaccurate than practices that were gravely described as having been followed by speakers in the discussion on compound locomotives.

### Crude Committee Reports.

One of the most exhaustive reports of committees which we have ever seen was one on freight car trucks submitted to the Master Car Builders' Convention. As a means of drawing out information the committee sent out a circular containing fifty questions, and these appeared to have been exhaustively answered. The report consisted principally of extracts from the replies. While the report was a monument to the industry of the committee, and although it was well received by the association, we consider it one of the worst reports we have ever seen. A report is not a good one unless the information is put in a digested form that can readily be grasped by the reader. The mass of reading which this report contained formed the material for a good one; but in the crude shape submitted to the association, the report had no more claim to be considered good than the collection of wood and iron that go to build a car has the right to be considered a good car when it is heaped together without form or order.

The truth is not palatable, but it needs to be told about this species of report, which is still too common. No sane editor would accept a report of that character as an article on freight car trucks, even if he was extremely desirous of having the subject treated as exhaustively as possible. It is an editor's duty to see that the articles present the desired information in the most intelligible form, and if he does not follow this practice, readers will not be satisfied. We regard the framer of a committee's report as an editor of the report, and he has a very poor conception of his duty if he merely repeats the words of replies to circulars. If a member answering a circular does not give information, his reply is of no value to the association and ought not to be repeated. Mere opinions are of little more value. Facts are what are wanted. These should be arranged under the various headings, and summaries made which would be readily grasped. Then the committee should carefully consider all the facts presented and make out their conclusions concerning the same. These words are applicable to other committees besides that particularly mentioned.

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In the closing hours of last Master Mechanics' Convention, a resolution was passed unanimously giving it as the sense of the association that the president ought not to be elected a second time. This voiced a sentiment which is very strong in both the mechanical associations, although delicacy has prevented it from being publicly expressed. There is a feeling that railroad companies consider it an honor to have their mechanical officers elected to the head of these associations, and that the compliment should be given to as many men as possible. The only way to carry out this idea is to elect a new president each year, and it looks as if the Master Mechanics' Association will follow this course in future. So long as it was customary to elect the same president for two terms, to deviate from the practice appeared to be a reflection on the man who was elected only for one year, but when the rule is established and understood there will be no mortification felt at seeing the compliment passed to the next vice-president.

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A very exhaustive report on a standard method of conducting locomotive tests was presented to the last Master Mechanics' Convention. The great labor of preparing this report was performed principally by Mr. F. W. Dean, Chairman of the Committee, and is similar to one prepared for the American Society of Mechanical Engineers. Mr. Forsyth, who is a member of the committee of the latter society having the subject on hand, submitted to the Master Mechanics' Association a proposal that they join with the Society of Mechanical Engineers in paying the expense necessary to conduct a series of tests of locomotives on the apparatus provided for the purpose at Purdue University. The association agreed very heartily to the proposal, and the Executive Committee undertook to raise the necessary funds.

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There is an idea among some railroad men that a considerable part of the time spent by the master car builders and master mechanics at their annual conventions is devoted to pleasure-seeking and sociality. This is a mistake. We are not aware of any societies that devote closer attention to business during conventions. It has always been a surprise to us to find so many members sitting out the long sessions during a season of the year when the heat is nearly always oppressive, the more so, as the meeting-rooms to be obtained are generally very unsuitable, badly ventilated and hot. At the last M. C. B. Convention there were seldom less than 90 members present out of 120 and the Master Mechanics had during one session over 140 present all the time out of a total attendance of about 160.

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The *Railway Age* has been persistently urging the Master Car Builders' and Master Mechanics' Associations to institute a movement for raising funds to build a permanent home and meeting place for the organizations. The members do not enthuse very readily on this. The funds would have to come from railroad companies, and contributions of this character are difficult to raise. If the *Railway Age* realized how difficult it is to prevail on some railroad companies to subscribe a small sum annually to the printing fund of one of the associations they would understand why the initiated are reluctant to ask for large contributions.

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The Master Car Builders' Association have decided to send to letter ballot a recommendation made by a committee to have working drawings of the standard journal-box made on transparent sheets from which blue-prints can be taken. This will prove a decided help in making the dimensions of this standard uniform. We do not see any reason, however, for sending the matter to letter ballot, as it ought to be dealt with by the Executive Committee.

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The Committee of the Master Car Builders' Association, appointed to make tests of air-brakes, reported that the Pennsylvania Railroad Company had offered to establish for the association at the Altoona shops a building and complete apparatus for the testing of brakes. The Westinghouse Air-Brake Company have placed sufficient apparatus to represent the brakes of two trains of fifty cars each. This most generous offer was thankfully accepted.

A communication has been received from the agent in charge of the locomotive "James Toleman," criticising the remarks we made when describing the engine. The letter reached us too late for publication in this issue, but it will appear next month.

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The people of Lakewood and Jamestown, N. Y., are a unit in their praise of the people who attended the mechanical conventions. "They are the jolliest, freest-handed crowd we have ever had to do with," was the expressed sentiment.

The railroad supply business of the late H. L. Leach will be continued at 55 Oliver street, Boston. Mr. A. E. Leon will act as manager. Their air sand-feeding apparatus is becoming very popular and will be widely used.

### PERSONAL.

Mr. James Mooney has resigned as master mechanic of the Southern Pacific at Victoria, Tex.

Mr. A. S. Douglas, for some time superintendent of machinery of the Texas & Pacific, died last month.

Mr. W. B. Doddridge has been appointed general manager of the Missouri Pacific, with headquarters at St. Louis.

Mr. David Meadows has been appointed traveling engineer of the Canada Southern division of the Michigan Central.

Mr. Eulalio Encinas has been appointed roundhouse foreman of the Interoceanic Railway of Mexico at Pueblo, Mex.

Mr. Horatio F. Forrest, chief engineer of the Great Northwest Central, has been appointed receiver and manager of the road.

Mr. J. A. Edson has been promoted to general superintendent of the St. Louis & Southwestern, with headquarters at St. Louis.

Mr. Geo. H. Graves has been appointed superintendent of the Indianapolis, Decatur & Western, in place of L. A. Boyd, resigned.

Mr. A. A. Daniels has been appointed master mechanic in charge of the Paducah shops of the Newport News & Mississippi Valley.

Mr. Thomas J. Hennessey, traveling engineer of the Michigan Central, has been promoted to the position of division master mechanic.

Mr. J. L. Brown, master mechanic of the Pittsburgh & Western, has been appointed superintendent of the Allegheny Water Works.

Mr. M. Borden has been appointed superintendent of transportation of the Atlantic Coast Line, with headquarters at Wilmington, N. C.

Mr. J. M. Scroggins has been appointed foreman of the motive power and car department of the St. Louis & Southwestern, with headquarters at Waco, Tex.

Mr. T. F. De Garmo, who has been for several years general agent of the Trojan Car Coupler Co., has accepted a similar position with the Glidden & Joy Varnish Co., of Cleveland, O.

Mr. H. D. Galbraith has been appointed general master mechanic of the Fort Worth & Rio Grande, with headquarters at Fort Worth, Tex. He was formerly on the St. Louis & Southwestern.

Mr. Thomas Fleming has been appointed superintendent of the Denison & Washita Valley, with headquarters at Coalgate, I. T., in place of Mr. Edward Perry, who has resigned.

Daniel R. McBain has been appointed traveling engineer of the Michigan Central road west of the Detroit river. Mr. McBain has heretofore had charge on the Canadian end of the road alone.

Mr. E. A. Peck has been appointed general superintendent of the St. Louis & Iron Mountain in place of Colonel Ricker, resigned. Mr. Peck was formerly general superintendent of the C. C. C. & St. Louis.

Thos. Smith, for some years past machine shop foreman of the A. T. & S. F., at Topeka, has been promoted to the position of general foreman of the New Mexico Division with headquarters at Raton, N. M.

Mr. Fred Glover, formerly master mechanic of the St Louis, Cape Girardeau & Fort Smith, has been appointed general foreman of the motive power and car department of the St. Louis Southwestern shops at Tyler, Tex.

Mr. J. P. Hemdell, who recently left the Brooklyn, Bath & West End road on account of its consolidation, has been appointed superintendent of the Pittsburgh division of the W. N. Y. & P., with headquarters at Oil City, Pa.

Mr. L. T. Westrich, of Delphos, O., has been appointed superintendent of the St Louis division of the Toledo, St. Louis & Kansas City, with headquarters at St Louis. He will have charge of the lines from St Louis to Frankfort, Ind.

Mr G. A. Zemlin, for several years master mechanic of the Michigan Central at Detroit, died there last month. Mr Zemlin has been on the Michigan Central for twenty-three years, and was highly esteemed by the officers of the road.

We regret to learn that Mr J. S McCrum, superintendent of motive power of the Kansas City, Fort Scott & Memphis, has been suffering from severe illness. He is well nigh recovered now, and will be "at the old stand" after the Fourth.

Mr. George A. Goodell has been appointed superintendent of the Burlington, Cedar Rapids & Northern, in place of Mr Williams, promoted. Mr Goodell was formerly chief train dispatcher of the road and was subsequently assistant superintendent.

We have to acknowledge a pleasant call from Mr Herman von Littrow, reporter on railroads for the Austrian Government. He has been sent to this country to make an elaborate report on what there is in the exhibition and on our railroads likely to be of value to the Austrian Government.

Mr. Robert Williams has been promoted to be general superintendent of the Burlington, Cedar Rapids & Northern. Mr Williams has been with the company about fifteen years and has risen through the positions of general manager's assistant, purchasing agent and superintendent.

Mr. S. W. Mullinix has been appointed traveling engineer of the Newport News & Mississippi Valley, with headquarters at Paducah. Mr Mullinix is promoted from the position of master mechanic and, while only holding the title of traveling engineer, is practically assistant superintendent of motive power.

A notice has been issued that Mr. William Garstang, superintendent of motive power of the C. C. C. & St. Louis, has changed his office from Cincinnati to Indianapolis. We regret to hear that Mr. Garstang is in poor health. He contemplates taking an ocean voyage in hopes that it will help him.

In the course of a private letter, Mr Daniel Coxe, superintendent of motive power of the Delaware, Susquehanna & Schuylkill Railroad, says they are getting to have quite a railroad. As testimony worthy of sustaining this statement, he mentions that they are getting to have as bad collisions as any of the other roads.

Owing to impaired health caused to a great extent by overwork, Mr George W McGuire has resigned the position of general manager of the Butler Draw-Bar Attachment Co. A substitute was appointed to take his place, but it appears to us, from what we saw of Mr. McGuire at the conventions, that he is working as hard for the company as he ever did.

Several personal changes have been made on the Old Colony part of the New Haven & Hartford system. Mr. J. R. Kendrick, third vice-president, relinquishes the position of general manager, which is assumed by Mr E. G. Allen, one of the superintendents of the road. Mr. A. L. Ainsley is promoted from the position of station agent to the superintendent of the Middle division.

Mr. Isham Randolph, a well-known civil engineer, has been appointed engineer in chief of the Chicago Sanitary district. Mr. Randolph was for years chief engineer of the Illinois Central Railroad, and is regarded as one of the ablest engineers in America. He is the inventor of an interlocking signal system of great merit and of several other valuable railroad mechanical devices.

A. W. Gibbs, Asst Supt M. P. of the R. & D. at Atlanta, Ga., has been appointed to the position of assistant mechanical engineer of the P. R. R., with headquarters at Altoona, Pa. Mr. Gibbs is a graduate of the P. R. R., and has been for some time in responsible positions on Southern roads. It is a very high compliment to Mr Gibbs to be recalled to the old road. They are not much given to that sort of thing.

Horace W. Eddy has resigned as master mechanic of the B. & A. at Springfield, Mass., to devote all his attention to the extensive properties owned by his father and himself. Mr. Eddy's father, Wilson Eddy, was foreman of the Springfield shops from 1840 to 1850, and master mechanic from that date until 1880, when he resigned, and his son, H. W. Eddy, was appointed in his place. Thus these shops have been "in the family" fifty-three years.

Engineer Walter W. Mansfield, of the St. L. & S. F. Railway, recently received injuries in a wreck from which he died. Mr. Mansfield was one of the progressive, thinking engineers whose loss is always felt by their employers and their associates, one of the men who are proud of their calling and try to honor it and make it honor them. Mr Mansfield had been in the employ of the St. L. & S. F. for twenty-two years, he leaves a wife, mother, and three sons.

Mr Chas. Barnes, son of General Manager Barnes, of the Boston & Albany, has been appointed master mechanic of the Springfield shops in place of H. W. Eddy, resigned. Mr Barnes served his time in the Boston shops of the road, was for some years in charge of the machinery of the car shops at Alliston, Mass., and for the past five years has been in the traffic department. Mr. Barnes comes to the position with some fifteen years' experience on the road, and will doubtless fill the bill to the entire satisfaction of all concerned.

The announcement is made that Mr. H. H. Vreeland has been elected president of the Metropolitan Traction Co. Mr Vreeland has been for several years general manager of the New York & Northern Railroad, and is a particularly able railroad man. He rose through train service to the position of general manager, He filled in succession the position of brakeman, conductor and train master on the Long Island Railroad, and from there he went to the New York & Northern. This road has always been financially embarrassed, and Mr. Vreeland became noted for the way which he developed the resources of the road and for the small operating expenses incurred.

Senator Leland Stanford, the Pacific Coast millionaire who gave the State of California the Leland Stanford University, was one of the men who built the Southern Pacific Railroad. He had a great respect for locomotive engineers, considering that on them rested greater responsibilities than any other class of men in the republic, he left a request that part of his pall bearers should be selected from among the engineers of the S. P. road. So eight of the oldest runners were selected to serve with twelve other men, such as would naturally become the pall bearers of an old associate who was thirty five times a millionaire. Men in Senator Stanford's walk of life often do have a great respect for locomotive engineers, but they usually keep it to themselves.

The Master Car Builders' Association, in Convention at Lakewood, N. Y., elected the following officers for the ensuing year: President, E. W. Grieves, who is elected to fill this position for the second term. He is master car builder of the Baltimore & Ohio. First Vice-President, John S. Lentz, of the Lehigh Val., who has for years been one of the most prominent and useful members of the association. Second Vice-President, S. A. Crone, assistant superintendent car department of the New York Central. He is a comparatively new member, and does not take much part in discussions, but is a hard-working member of committees. Third Vice-President, T. A. Bissell, the well-known general manager of the Wagner Car Works, and long one of the most active members in the association. The Treasurer is Mr. G. W. Demarest, master car builder of the Northern Central, one of the veterans of the association. He is a quiet, retiring man, but takes a great interest in the work of the association, and is one of the most regular attendants of conventions.

Mr A. G. Leonard, whose name we have several times mentioned in connection with improved appliances used on the New York Central's fast trains, is a young man whose career ought to be a good example for others. When a young boy he entered the office of Mr. William Buchanan, superintendent of motive power, where he displayed so much zeal, intelligence and industry that he rapidly rose to be assistant to Mr Buchanan. He has an extraordinary grasp of details, and there is nothing connected with machinery and operating that he does not understand particulars of. When Mr. H. Walter Webb was elected vice-president of the company he selected Mr. Leonard for his assistant. The selection was a most fortunate one, for it gives the vice-president a living encyclopedia of everything connected with the motive power and operating departments. Mr Leonard has a strong love for mechanics, and much of his spare time is devoted to inventing improvements on railroad apparatus. The car vestibule handled by the Gould Car Coupler Co. was invented by Mr. Leonard, and so was the equalizing hydrostatic buffer arrangement used on the Columbian Flyer trains. He is a particularly modest and retiring young man, and does not look the kind of person who would ward off the fiends and cranks that haunt the lobby of a managing vice-president, but he keeps them out. We have been there and know whereof we speak.

At the Lakewood Convention the Railway Master Mechanics' Association elected the following officers for the current year: President, John Hickey, who is elected the second time. He is superintendent of motive power of the Northern Pacific, and has been for years noted for the encouragement he gives to the educational work done by this and similar associations. He was for several years president of the Western Railway Club. Second Vice-President, William Garstang, superintendent of motive power of the Cleveland, Cincinnati, Chicago & St. Louis. He has been an officer for three years, and takes a very active interest in the association, but was kept away this year by sickness. Third Vice-President, R. C. Blackall, superintendent of motive power of the Delaware & Hudson. He is extremely popular in both the mechanical associations and both have claimed him as an officer. He was anxious to retire from office this year, but the members would not consent. Mr O. Stewart is treasurer. He was long superintendent of motive power of the Fitchburg and has always been a hard worker in the business of the association. He is a good speaker, but seldom rises unless he is master of the subject under discussion. Mr. Angus Sinclair, of LOCOMOTIVE ENGINEERING, was elected secretary for the seventh time. He is very proud of the association and proud of being secretary. It is also a matter of personal satisfaction to the secretary that 106 active members and three associates have been added to the association in the last two years.

Mr. Walter McQueen, the famous locomotive builder, died at his residence in Schenectady last month at the age of 7[illegible]. He was born in Scotland, and came to this country with his parents when a boy. He learned the machinist trade in Troy, and when his time was out he returned to Scotland and worked there with the view of widening his experience. Returning to this country shortly after railroads began to extend, he went to Schenectady and obtained a position on the Utica & Schenectady Railroad, part of his time being put in as machinist and part as a locomotive engineer. Two years afterwards he was made master mechanic of the road. Here he remained for four years, and here he began his career as a locomotive builder, his road having been one of the first in America to build locomotives for themselves. A locomotive called the "Mohawk," which he built with cylinders 15 x 22, became famous for the tractive powers developed, and gave Mr McQueen a reputation as a locomotive designer. From the Utica & Schenectady road he went to the Hudson River Railroad and remained there until 1852, when he accepted the position of superintendent of the Schenectady Locomotive Works, which he held until 1876. His reputation as a designer grew and flourished, and the "McQueen" locomotives became famous all over the United States. As a young man Mr McQueen was noted for his progressive ideas, but as years grew upon him he became conservative and had a tendency to cling to the glories of the past. He was elected vice-president of the works in 1876 and retired from active management to give the lead to men of younger ideas. He never was much in sympathy with the designs or the methods which has given the Schenectady Locomotive Works so much celebrity during the last seventeen years. His most valuable life's work was done in the first ten years, when he held the position as superintendent. When he took the locomotive in hand it was a very crude machine, and he did as much as any man to establish correct forms and dimensions. He invented many improvements on the locomotive, but took out no patents on the same, being willing to make his inventions public property. Among his inventions that became most popular were the air-chamber for the water-pump and the solid saddle for cylinders.

### President Hickey's Address.

The address of President Hickey in opening the Master Mechanics' Convention at Lakewood, was one of the most comprehensive inaugurals we have ever heard. It discusses in a succinct, clear manner most of the topics that are before the railroad mechanical world. Most men in Mr. Hickey's position carefully avoid the quicksands intervening between labor and capital, but the president of the Master Mechanics' Association took a bold stand on the side of right and justice, and his brave words will give offence to no one whose opinion is worthy of notice.

A great portion of the address was devoted to the improvements in locomotive construction, operation and maintenance which are likely to reduce the operating expenses without impairing the efficiency of the motive power. The subject of compounding is discussed through several paragraphs and a belief is expressed that the prospect of making this form of engine a permanent success is encouraging. The necessity for enlarging bearing surfaces and for reducing as far as possible the number of working parts received lengthy attention.

That troublesome subject of engine ... was also intelligently discussed, and ... use of a simple form of draw-bar dynamometer to indicate the pull on the draw... was recommended. A somewhat novel suggestion was made to the effect that a standing Advisory Committee be appointed to advise with members on any disturbing and unsettled questions relating to motive power interests. It might also arbitrate matters of difference arising between persons selling, leasing or renting rolling stock or in matters relating to the construction of new machinery. It is evident from the address that President Hickey ... devoted a great deal of thought-planning to extend the usefulness of the association.

### An Excursion to the Oil Regions.

On Saturday, June 17, in the interval between the Master Car Builders' and Master Mechanics' Conventions, the New York, Lake Erie & Western and the Western New York & Pennsylvania Railroad Companies gave an excursion to the oil regions of Pennsylvania, which was heartily enjoyed by a large number of the members and their friends. The party was under the guidance of Mr. A. E. Mitchell, superintendent of motive power of the Erie system, who was untiring in his efforts to promote the comfort of all. At Meadville, the party was met by Messrs. Miller & Sibley, and conducted to the famous kite shaped race track and stables owned by the gentlemen named. A number of the finest horses were run out to show their form and style, and the visitors agreed that they had never seen such a display of splendid horses. But the sights in this line were only begun. The train proceeded to Franklin, and there Messrs. Miller & Sibley escorted the excursionists to a stock farm on the top of a hill where a princely lunch was provided. Then they adjourned to a grand stand and a magnificent display of blooded horses was made for the entertainment of the party. After a long array of fast trotters had been brought out for inspection, a change of "type" was introduced, and Jersey cattle, the finest of their kind, were led past. Then there was an immense herd of ponies and miscellaneous breeds of horses and other animals driven past. There was not much in the line of railroad appliances seen on the trip, but the party returned highly gratified with the unique display prepared for them by Messrs. Miller & Sibley, and with the interesting country where oil flows out of the ground in greater profusion than water.

During the time the Master Mechanics' Convention was at Lakewood, the members and their friends were invited by the Brooks Locomotive Works to visit the shops at Dunkirk. A large party accepted the invitation and went to Dunkirk by boat and a special train furnished by the Western New York & Pennsylvania. The visiting members devoted the principal part of the time to a careful inspection of the various shops. The fine tools in use, the expeditious methods of doing work and the admirable arrangement of the buildings, all excited much interest and admiration. We heard several of the members say that it was the first time they had seen a locomotive building shop, and it is safe to say that many new things were learned during this outing which was the only one taken by the association. The Brooks people provided a lunch for the party. A vote of thanks was given for the courtesies received.

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Before leaving Lakewood the leading members of the Committee of the Master Car Builders' Association, which decide on the next place of meeting, intimated that their preference was Saratoga. The Committee of the Master Mechanics' Association unanimously favored Saratoga, so it looks as if the next place of meeting would be settled without any necessity for the Joint Committee coming together.

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The exhibition of car couplers was unusually small at the Lakewood Convention. Among those shown, the American excited particular attention owing to its simplicity of form and because it stood an unusual number of blows in the M. C. B. tests before breaking. It stood an average of 12.5 blows before breaking, and 153,450 pounds of a pull. The coupler is of the M. C. B. standard, is of steel, and is made by the American Coupler Co., Chicago.

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A small boiler was exhibited at Lakewood with the Mack water circulator shown in operation by means of a glass tube on the pipe that connects the front part of the boiler with the water leg. It worked admirably, and was a striking and attractive sight. All day long a crowd of men could be seen around the exhibit watching the steady flow of water from the front of the boiler to the firebox. We understand that several master mechanics made arrangements on the spot to apply this circulator to their locomotives.

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Much interest was displayed by the master mechanics attending the convention at Lakewood in an exhibit made for Mr. William Halpin, of the taking off and putting on tires that were heated by the Wells light. The work was done very expeditiously and to the satisfaction of the numerous observers.

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A circular issued by the Edwin S. Jackman Co., of Chicago, intimates that Park Brother & Co. make more steel than any manufacturer in the business. Their tool steels are produced by the old English blister-bar method, the only method which has the test of years to prove its merit. This process is expensive and tedious, but the results are sound ingots, uniformity of temper, customers satisfied.

### EQUIPMENT NOTES.

The B., C. R. & N. are figuring on six new locomotives.

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The Fitchburg R. R. Co. are about letting contracts for one thousand cars.

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The Manhattan twenty engines were let to the Pittsburgh Locomotive Works.

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Mr. Silvius, of the J., St. A. & I. River, is about to begin work on 100 flat cars for service in the winter trade.

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The South Baltimore Car Co. have begun deliveries on the seven hundred box cars for the Boston & Albany.

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The 150 cars building for the Lake Street Elevated by the Gilbert Co. are to be equipped with the Morton system of steam heat.

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The Jacksonville, St. Augustine & Indian River road have placed orders for several engines, and will be in the market this fall for from seven to ten additional engines.

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The Delaware, Susquehanna & Schuylkill R. R. are in the market for one 17 x 24 passenger engine, two coaches and a 22 x 28 consolidation engine, adapted for hill work.

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The Delaware, Susquehanna & Schuylkill people have lately ordered 500 hopper gondola cars built after the Standard Pennsylvania series S. They have air-brake and Janney couplers.

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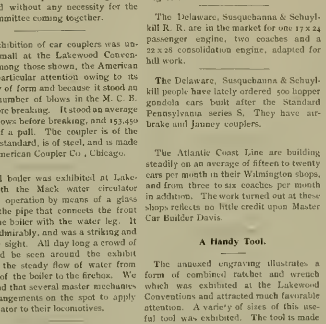
The Atlantic Coast Line are building steadily on an average of fifteen to twenty cars per month in their Wilmington shops, and from three to six coaches per month in addition. The work turned out at these shops reflects no little credit upon Master Car Builder Davis.

### A Handy Tool.

The annexed engraving illustrates a form of combined ratchet and wrench which was exhibited at the Lakewood Conventions and attracted much favorable attention. A variety of sizes of this useful tool was exhibited. The tool is made of the best steel and the work upon it is exceptionally good, the proprietors having expended a large amount of capital on special machinery for this useful shop appliance. It can be used for a great many purposes. As a ratchet-drill it can be turned equally well in either direction. It can be used with either Morse, taper or square shank-drills and with an easy made change it can be converted into a monkey-wrench or a holder for a bit-brace, a screw-driver, a reamer or a tap. We have not seen a tool for a long time that would be so useful in a roundhouse or on a locomotive. It ought at once to be considered a necessity for every tool room and we have no doubt that it will be so regarded when its merits become known. The tool is made by the Keystone Manufacturing Company, Buffalo, N. Y.



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The B. F. Sturtevant Co., Boston, Mass., have printed a third edition of 10,000 copies of their 200-page general catalogue No. 61, which describes the uses of their blowers, exhausters, engines, forges and heating and ventilating apparatus, and they desire to place a copy in the office of every superintendent, purchasing agent, engineer or manufacturer using such machinery. All who have not received a copy will confer a favor by applying at once to the above address. It will be mailed free of charge.

### Westinghouse Co. on the Karner Brake Trials.

*Editors*:

Your June number publishes a communication from the New York Air-Brake Co., which contains statements and implications not in accordance with the facts.

There is absolutely no warrant for the statement that the Westinghouse Company furnished fifty special air-brake equipments of delicate adjustment for the Karner tests. Upon the request of the New York Central road, we supplied fifty sets of our standard apparatus, differing not in the slightest degree from the standards that were originally established when the quick-action brakes were first placed upon the market, and wish now to finally and definitely state that we did not, upon the occasion of the Karner brake tests or at any other time when there have been competitive trials with the New York Air-Brake Co., use any other than our regular brake equipment, or procure results that cannot be at any time obtained from our apparatus in regular service when it is in good working condition.

We presume their reference to "the delicately adjusted triple valves" is occasioned by the temporary use of a graduating spring somewhat stiffer than our standard, and while the circumstances in this connection are a matter of record and are generally understood, there may be some of your readers who are not fully acquainted with the facts, which are substantially as follows:

When the quick-action air-brake was developed by the Westinghouse Air-Brake Co., all standards connected with it were fully established by experiment before the brake, as now used, was exhibited. A standard graduating spring was adopted at that time. The train of fifty freight cars which was exhibited by the Westinghouse Air-Brake Co. at a large number of places in the United States was equipped throughout with that standard spring. All the quick-action brakes which were then made, sold and put into operation upon railroads contained the standard graduating spring.

Several months afterward, when the quick-action brake had come into extensive use, it was found that in handling them by means of the old three-way cock upon the engines an emergency application of the brakes sometimes occurred when a service application was desired. As the three way cock was unsuited for operating the quick-action brake and as a great many were then in use upon locomotives, it was decided, after consultation with the railroad companies using the brakes, that temporarily, until these three-way cocks could be replaced by a suitable engineer's valve, a slightly stiffer form of graduating spring should be used in the triple valves, and it was distinctly understood that the stiffer spring was to be used only until the proper engineers' valves were substituted on the engines. More than a year ago these conditions were sufficiently realized to warrant a return to the standard graduating spring, which was done. Since that time it has been regularly and uniformly furnished in all quick-action triple valves sent out. The Westinghouse Air-Brake Co. has, therefore, never had more than one standard graduating spring, which was the spring used in our triple valves at the Karner tests, and which we have also supplied in many thousands of our quick-action triple valves, now in regular service.

In February, 1892, a series of brake trials was made at Burlington, Iowa, upon the Chicago, Burlington & Quincy Railroad. In those trials a series of four stops was made with a fifty-car train equipped with the Westinghouse brake having the standard graduating spring. Two slidometers for measuring shocks were used in the rear car, and the movements of each were measured. The record shows that the average shock for the four stops, as shown by one slidometer, was nothing and, by the other slidometer, one-


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Especially adapted for Locomotives.
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In ordering give exact diameter of Stuffing Box and Valve Stem.
None genuine without this trade mark.
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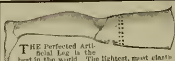

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Satisfaction guaranteed or money refunded.
Seats sent on one week's trial.
Send stamp for our twelve page catalogue and price list.
STANNARD & WHITE, Appleton, Wis.

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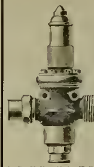

The MASON has for the last 5 years proved itself reliable and durable. The Pennsylvania alone has 800 of them in use, and among other roads which are ordering in quantities, having adopted them as the standard, are

C. R. I. & P., B. & A., Conn. River, Fitchburg, Penn Co., W. N. & Penn R. R., N. Y. & N. E., T. R. R. of St. Louis, and many others. We will send one on trial to any road not already using them.

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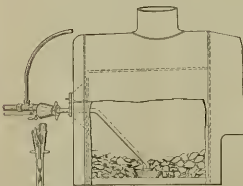

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**COMBINES SAFETY and CHEAPNESS.**

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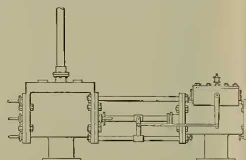

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THE only substantial, moderate-priced clock on the market. Movement has escapement jeweled; case cast bronze; front screws on; side wind; 6-inch, porcelain dial. Very elegant and accurate.

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THE
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These machines are especially constructed for, and adapted to railroad service and

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in common use. Modern locomotive service is more exacting in its demands, and requires a more efficient apparatus to meet its requirements, and we believe that these are met in this instrument more fully than ever before. It is simple in its construction, easily taken apart, and, readily repaired at small cost.

It will lift water, or take it under a head, as desired. It will lift water when Inspirator and suction pipe are hot, or when water is at a temperature of 120 degrees Fahr., and deliver to boiler at steam pressure of 35 to 200 lbs. without adjustment.

It has a minimum capacity of less than 50 per cent. of its maximum by actual test and service.

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...nth of an inch. Another series of four stops was then made with the same train and the same brakes throughout, except that the standard graduating springs were replaced by the heavier temporary springs in all the triple valves. The average shocks for the four stops were, by one slidometer, four-tenths of an inch and, by the other slidometer, five-tenths of an inch. A third series of three stops was then made with a fifty-car train of Westinghouse brakes, taken from regular service. These cars were picked up at random in the West Burlington yards, having been in use an average of more than two years, and their condition was not inspected in any respect except that of piston travel. As the brakes of this train also had the heavier graduating spring. The average of shocks of the three stops was as follows: by one slidometer, nothing and, by the other slidometer, four-tenths of an inch. It will, therefore, be seen that the use of the different springs produced no difference in respect to shock as there was practically no shock in either case—the sole purpose of the heavier spring being to avoid quick action, by careless or unskilled manipulation of the three-way cock, when a graduated application was desired.

The New York Brake was also tested in these trials at Burlington, and representatives of the New York Air Brake Company were present, and they are perfectly well aware that this company did not object to the very trying test of taking fifty cars from active service and without inspection or adjustment of any parts, except to take up the slack, submit them to a comparison with the new apparatus of both this company and that of the New York Air Brake Company. They are also aware that there was no proposition by the New York Central people to make use of brakes that had already been in service upon their road, for the Karner tests, or that we refused to make a competitive test under those conditions, and, being thus fully informed as to these facts, it is unnecessary to characterize their statement that we "were unwilling to submit brakes for test that had been in actual service."

The inaccuracy of their statement, that the Westinghouse triple valves used in the New York Central trials were unusually sensitive, will be fully understood by reference to the standing test No. 13, in the official report of those brake trials. This test was made to determine the sensitiveness of the quick action triple valves.

Without stopping to discuss the question whether the conditions were exactly what they should have been in the test, the conditions were unquestionably alike for both kinds of brakes, and the results of the test were the same for both kinds of brakes, except that when two cars alone were connected to the engine, the New York brake produced an emergency application in one trial out of three, while the Westinghouse brake gave only the required service application in each of the three trials. This conclusively demonstrates that the New York triple valve is liable to give an emergency action when not desired, and if, as stated in their communication, there was less than one pound margin between the service and the emergency action of the Westinghouse triple valve, the margin was still less with the New York triple valve. Their communication states that "the New York brakes were made to meet the Westinghouse standard used on the railroad, and would have been condemned without trial if they had been adjusted to such a narrow margin." It would therefore appear that, at the end of the standing test No. 13, the New York brakes "should have been condemned without trial."

The statement that shocks occurred upon the Westinghouse train in the Lehigh Valley brake tests is true, and the cause of those shocks is apparent to any one who has had any considerable air-brake experience. Tests were made upon trains just as they were taken from the car shops; the brake-shoes were not worn to the wheels, and the consequent variable friction of the brake shoes in the different parts of either train would wholly account for the unusual results of these tests. Such conditions might very easily cause shocks to occur with a good brake upon one train and prevent shocks with a poor brake upon another train. That the stops made were nearly 50 per cent longer with both trains than would have occurred under any regular service conditions, will sufficiently vouch for the existence of abnormal conditions. Had the cars of these trains been in service long enough to have worn the brake-shoes to the wheels, the conditions would have been usual ones and no shocks would have occurred to the Westinghouse train. The records show that, beginning with the tour of the Westinghouse exhibition train and up to the present time, there has never been a fifty-car train test of the Westinghouse quick-action brake, under any practical conditions of service, whether with the standard graduating spring or the heavier temporary spring, in which a shock so great or nearly so great as 12 inches has been produced in the train.

It must be manifest to any sensible observer, therefore, that very unusual conditions must have obtained to have caused an average shock in four stops of $12\frac{3}{16}$ inches with one slidometer, and $16\frac{1}{16}$ inches with the other slidometer. Such were the shocks recorded for the Westinghouse train in the Lehigh Valley tests, and they are characterized by the New York Air-Brake Co., in their communication, as "terrific." Since they consider such shocks "terrific," they doubtless realize that the shocks caused by the New York air-brake in the New York Central tests, the least of which is greater than the greatest of the Westinghouse brake in the Lehigh Valley test, and the average of which was more than 28 inches, can only be described, comparatively, by some stronger adjective, which they are privileged to provide.

THE WESTINGHOUSE AIR-BRAKE CO.

*June 23, 1893.*


HEAVY TWELVE-WHEELER, 169,000 POUNDS. BUILT BY SCHENECTADY WORKS FOR DULUTH & IRON RANGE. NOW AT WORLD'S FAIR.

### Schenectady Twelve-Wheeler.

The heavy twelve-wheeler shown in the annexed engraving is to be found in the exhibit made by the Schenectady Locomotive Works at the World's Fair. She is one of the heaviest engines in the Transportation Building and weighs 169,000 pounds. The cylinders are 22 x 26 inches and the driving wheels are 54 inches diameter outside the tires. The traction of the engine is 233 pounds per pound of cylinder pressure. As the boiler carries steam of 180 pounds pressure, the engine will be capable of exerting 35,000 pounds traction on a slow pull. The boiler is straight, 72 inches in diameter and is made of steel ⅝ and $\frac{11}{16}$ inch thick. The engine has been built for the Duluth & Iron Range and will go there when the Fair closes.

John J. Leighton, an engineer from the Wisconsin Central road, is doing a nice business in Chicago conducting a free hotel register office. Visitors go directly to his office at No. 311 So. Sixty-third street, which is just opposite the Illinois Central depot and the grounds, and there have the choice of any priced room in several good hotels. If one location or one price does not suit, Mr. Leighton places visitors in other rooms or other hotels. This plan makes it unnecessary for visitors to secure rooms in advance—buying a cat in a bag—but can go direct to this office and take the choice of all available rooms. Mr. Leighton gets his pay out of the hotels, and they are glad to list their rooms with him. Mr. L. is a Brotherhood engineer, and has the indorsement of the officials of his road and many others. We advise railroad men who object to being held up to put themselves in communication with Mr. Leighton before or on arrival at Chicago.

The most important railroad event of last month was the opening of the Great Northern to Puget Sound. This makes what is practically another transcontinental railroad. Closely following the ceremonies of opening this new system came the announcement of a material reduction of rates. The other lines carrying the business between the Atlantic and Pacific States have not been making much money and it looks as if the new line would tend to make some poor companies poorer.

After a long test of one pipe the Central R. R. of New Jersey have ordered ten Smith triple-expansion exhaust-pipes for their heaviest consolidation engines in freight service. This invention seems to be attracting a good deal of attention, and is being tried on a dozen different roads.

The Master Car Builders' Association have always been intensely jealous about motive-power men being nominated as presiding officers, but this has not prevented them from doing nearly all the real work of the association. To carry on the work of investigation thirteen committees were appointed last year consisting of fifty members. Among these there were twenty-seven motive-power men and nine of them acted as chairmen of committees.

The hydrostatic apparatus used so successfully in operating the equalizing buffers on the trains composing the Columbian Flyer, were made by Watson & Stillman, New York.

## A Method of Maintaining Standard Bolts and Nuts.

Editors:

Having noticed in some of your recent issues a discussion of the question of standard bolt threads and the means of maintaining the adopted standards by car and locomotive builders, I take the liberty of calling your attention to the accompanying article which was published in the *American Machinist* of May 12, 1892, and describes a method and a system by which the largest possible allowance can be made in the size of iron while still adhering to the standard and securing interchangeability of bolts and nuts. Special attention may be called to the fact that in Mr Bauer's system the bolts which are cut by dies that are adjustable to size are kept precisely to standard. This can be done by providing the proper gauges for use at the bolt cutters, these gauges being preferably adjustable, as those made by the Pratt & Whitney Company are, and kept to size by means of standard threaded plug gauges. It may be proper to add that personal experience with this system at the time of its adoption and observation of its working since that time have convinced me that it is entirely practicable, and that by its means the standard bolt threads can be rigidly adhered to with very little trouble; though of course with this as with almost everything else, there must be first, a recognition of the importance of adhering to the standard, next, a determination to adhere to it, and finally, intelligent supervision of the bolt and nut work.

FRED. J MILLER.

The production of standard screw threads involves problems, many of which have been satisfactorily solved, while others, mechanics and manufacturers generally, are not so certain of. In a sewing-machine shop or armory, where all threads are cut upon stock previously reduced accurately to size, the problem differs essentially from that which is presented in a car-shop or in a manufactory of agricultural machinery, where a large proportion of the threads are cut upon rough iron. And when it happens that threads of both kinds are to be cut in the same establishment, the problem is still further complicated.

The adoption of the Sellers thread as the standard form simplified the problem considerably, from the fact that taps and dies keep their size much longer in use when flatted in accordance with this system than when sharp, though it has been found advisable in practice in most cases to make the taps of somewhat larger outside diameter than the nominal size, thus carrying the threads up a little further towards the V shape and giving corresponding clearance to the tops of the threads when in the nuts or tapped holes, this plan also allowing for some wear on the extreme points of the threads of the taps without affecting the fit of the sides or angles of the threads, at which point good practice now requires that all threads shall be measured.

The most serious difficulty encountered after the adoption of the Sellers thread was found to arise from the difficulty in getting stock rolled close enough to gauge to admit of threads being cut upon it which should conform to the standard. Car builders especially were bothered by this problem, and finally, by the action of the Master Car Builders' Association, at their seventeenth annual convention, held in Chicago in 1883, limit gauges were adopted, to which it was understood all round bar iron to be used in the construction of cars, and especially for the bolts of cars, was to be rolled. According to the scheme of these gauges, ¼" round iron must pass through a snap gauge .255" in size, and must not pass through one .245" in size, thus limiting the variation in this size of iron to not more than .005" below the nominal diameter and the same above it, the total range of permissible variation being .01". The limit of variation then increases .001" with each larger size of iron, the limit for 1¼" iron being .0105" each way from the nominal diameter, or .021" total variation. This would seem to give ample range, and there is no doubt that iron ought to be kept within these limits; but as a matter of fact it is not generally kept within these limits, as an investigation of the matter will show, and many car builders and others who make rough bolts are finding great difficulty in keeping to the standard threads on this account.

Makers of taps and dies, who are almost without exception in favor of the exclusive use of the Sellers or U S Standard threads, often have calls for taps and dies, U. S. Standard "for rough iron," such orders coming from those who believe that such a thing as a U. S Standard tap or die can be made larger than the nominal diameter or to suit the size to which iron may be rolled; and no doubt most of those who so order think that if there are no such taps and dies then there ought to be.

An examination of rough iron will show that much of it is rolled out of round to an amount exceeding the limit of variation in size allowed.

In view of all this it may be desirable to know what the extreme variation in iron may be, consistent with the maintenance of U. S. Standard threads, *i. e.*, threads which are standard when measured upon the angles, the only place where it seems advisable to have them to fit closely, and in this connection we propose to review what has been done by Mr Chas. A Bauer, the general manager of the Warder, Bushnell & Glessner Co., at Springfield, O.

In this establishment 4,000,000 to 5,000,000 bolts are made and used annually. Most of these are made from rough iron, but many of them are, previous to being threaded, turned or finished to size in screw machines. These two classes of bolts are used mostly in nuts or holes which have been tapped with machine taps made in the establishment, while there are yet others which are usually turned and threaded in the lathe, these being used in the building and repairing of special machinery and tools used in the works; Pratt & Whitney's make of U. S. Standard hand taps, in sets of three, being used for this work. Previous to Mr. Bauer's advent the system there was the same as that found in most establishments of that character, then and now, *i. e.*, there was no system, and every practical mechanic will understand what that means without further explanation. The problem of how to bring order out of this particular chaos presented itself to Mr. Bauer about the time of the adoption of the standards of the M. C. B. A., and his solution (the scheme described below) has been in use there since 1883.

The main features of the plan may be stated briefly as follows All bolts, whether cut from rough or finished stock, are standard size at the bottom, and at the sides or angles of the threads, the variation for fit of the nut and allowance for wear of taps being made in the machine taps. Nuts are punched with holes of such size as to give 85 per cent. of a full thread, experience showing that the metal of wrought nuts will then crowd into the threads of the tap sufficiently to give practically a full thread, while if punched smaller some of the metal will be cut out by the tap at the bottom of the threads, which is, of course, undesirable. Machine taps are made enough larger than the nominal to bring the tops of the threads up sharp, plus the amount allowed for fit and wear of taps. This allows the iron to be enough above the nominal diameter to bring the threads up full (sharp) at top, while if it is small the only effect is to give a flat at top of threads, neither condition affecting the actual size of the thread at the point at which it is intended to bear. Limit gauges are furnished to the mills, by which the iron is rolled, the maximum size being shown in the third column of the table given herewith, while the minimum diameter, which is not given, may be the same as that of the M C. B. A., since a smaller limit is practicable below the nominal size than above it, the tendency in rolling being nearly always to exceed the nominal diameter.

In making the taps the threaded portion is turned to the size given in the eighth column of the table, which gives 6 to 7 thousandths of an inch allowance for fit and wear of tap. Just above the threaded portion of the tap a place is turned to the size given in the ninth column of the table, these sizes being the same as those of the regular U. S. Standard bolt, at the bottom of the thread, plus the amount allowed for fit and wear of tap, or, in other words $d' =$ U. S. Standard $d + (D' - D)$. Gauges like the one shown below the table are furnished for this sizing In finishing the threads of the tap a tool is used which has a removable cutter finished accurately to gauge by grinding, this tool being correct U. S. Standard as to angle, and flat at the point. It is fed in and threads chased until the point, or, rather, the flat of this tool just touches the portion of the tap which has been turned to size $d'$. Care having been taken with the form of the tool, with its grinding on the top face (a fixture being provided for this to insure its being ground properly), and also with the setting of the tool properly in the lathe, the result is that the threads of the tap are correctly sized without further attention.

The table, with the formula as given by Mr. Bauer, explains itself, and we are able to say, as a result of personal experience with the system, that it works well. Of course it is evident that one of the points of advantage of the Sellers system is sacrificed, *i. e.*, instead of the taps being flatted at the top of the threads they are sharp, and are consequently not so durable as they otherwise would be; but practically this disadvantage is not found to be serious, and is far overbalanced by the greater ease of getting iron within the prescribed limits; while any rough bolt when reduced in size at the top of the threads, by filing or otherwise, will fit a hole tapped with the U. S. Standard hand-taps before referred to, thus affording an easy practical proof, and one frequently given incidentally, that the two kinds of bolts or screws made for the two different kinds of work are practically interchangeable. Assuming the same minimum diameter for iron as that allowed by the M. C. B. A gauges, ¼" iron by this system can be .005" smaller or .0108" larger than the nominal diameter, or, in other words, it may have a total variation of .0158", while 1¼" iron can be .0105" smaller or .0309" larger than nominal—a total variation of .0414"—and within these limits it is found practicable to procure the iron.

STANDARD SIZES OF SCREW THREADS FOR BOLTS AND TAPS.

| 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | 10 |
|---|---|---|---|---|---|---|---|---|---|
| Nominal Dia. of Bolt. | Number of Threads per Inch | Actual Dia of Bolt | Dia. of Bolt at Bottom of Thread | Depth of Thread | Flat of Bottom of Thread | Dias of Top | U. S. Standard at Top of Thread | U. S. Standard Bottom of Thread | Hole in Nut before Tapping |
| A. | n. | D. | d. | h. | f. | D′—D. | D′. | d′. | H. |
| ¼ | 20. | .2608" | .1855 | .0371 | .0062" | .006" | .2668" | .1915 | .2024 |
| 5/16 | 18. | .3245 | .2403" | .0421" | .0070" | .006" | .3305 | .2463 | .2509" |
| ⅜ | 16 | .3845" | .2938" | .0474" | .0078" | .006 | .3945" | .2998" | .3139" |
| 7/16 | 14 | .4530" | .3447" | .0541" | .0089" | .006 | .4590" | .3507" | .3670" |
| ½ | 13. | .5166" | .4000" | .0582" | .0096" | .006 | .5226" | .4060" | .4236" |
| 9/16 | 12. | .5805" | .4543" | .0631" | .0104" | .007" | .5875" | .4613" | .4802" |
| ⅝ | 11. | .6447" | .5069" | .0689" | .0114" | .007" | .6517" | .5139" | .5346" |
| ¾ | 10. | .7717" | .6201" | .0758" | .0125" | .007" | .7787" | .6271" | .6499" |
| ⅞ | 9. | .8991" | .7307 | .0842" | .0139" | .007 | .9061" | .7377" | .7630" |
| 1 | 8. | 1.0271" | .8376" | .0947" | .0156" | .007" | 1.0341" | .8446" | .8731" |
| 1⅛ | 7. | 1.1559" | .9394" | .1083 | .0179" | .007" | 1.1629" | .9464 | .9789" |
| 1¼ | 7. | 1.2809" | 1.0644" | .1083" | .0179" | .007" | 1.2879" | 1.0714" | 1.1039" |

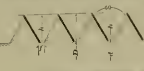
$$D = A + \frac{.2165}{n}$$

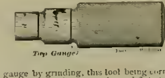
$$d = A - \frac{1.29904}{n}$$

$$h = \frac{.7577}{n} = \frac{D - d}{2}$$

$$f = \frac{.125}{n}$$

$$H = D - \frac{1.288}{n} = D - .85\,(2\,h)$$



Tap Gauge.

## Origin of Railroads.

It is common practice now, where U. S. Standard bolts are used, to make the machine or nut-taps with threads which are sharp at top, the essential points in which Mr. Bauer's system differs from those in common use being in the wide limit of variation in size of iron which it admits, in the fact that bolts are kept to the standard, the variation for fit and wear of taps being made in the nuts, so that by using taps adapted to the kind or class of work being done, the fit of bolts may be as desired, whether they be cut in the bolt cutter from rough iron, by dies in the screw machine on previously finished stock, or in the lathe.

The exhibition of old locomotives at the World's Fair is creating a great deal of talk about the first locomotives used in this country. On this subject a quotation from "Wood's Treatise on Railroads," a book published in 1831, the year that the "John Bull" was built, will be of interest

"Wooden railroads have been used from time immemorial in the mines of Germany. From the continent they were introduced, in the beginning of the seventeenth century, by foreigners, into England. The claim of the latter country to their invention is preposterous; although her writers have exposed their characteristic nationality by such frequent and confident assertions, that it has induced the uninformed to believe that the claim was founded in justice.

"The invention of iron railways—the greatest improvement of modern times for facilitating commerce—is, unquestionably, due to England.

"Railroads were, for a long time, imperfect, and limited in their extent. They were confined to collieries, mines and ironworks, and were deemed to be inferior substitutes for canals. The world is indebted to Oliver Evans, a native citizen of Pennsylvania, for the discovery of their latent and hitherto unsuspected value and pre-eminent importance. In 1784 he first conceived the idea of his high-pressure steam-engine, and the application of it to carriages on common roads, as a motive power

"He foresaw the superiority, and strenuously urged the adoption of railways and locomotive engines in lieu of canals, some time before the termination of the eighteenth century, and long before it had entered into the imagination of any other human being. His zealous efforts to promote this favorite scheme were in advance of the opinions of the age, he attracted no attention, and was charged with insanity for believing in the possibility of effects which are now daily witnessed. In 1799 he commenced the construction of a locomotive steam engine, which was to be tested on a railway to be made for the purpose. After frequent interruptions, he completed the engine in 1801, but the locomotive carriage was not finished for public exhibition until the latter part of the winter of 1803-4, when it commenced its majestic march through the streets of Philadelphia, in the presence of at least twenty thousand spectators.

"Mr. Evans urged, in repeated addresses to the public, the construction of a railroad from Philadelphia to New York and in 1809 attempted to form a company for the purpose of effecting it, purposing the investment of his whole fortune in the enterprise, experience having convinced him that the prejudices and ignorance of mankind could only be gradually removed and that time would demonstrate the truth and value of his plans.

"He published the following remarkable prophecy in one of his well-known essays, in which he reproaches his contemporaries for their tardiness in not adopting his suggestions The present generation will not use canals, the next will prefer railroads with horses, but their more enlightened successors will employ my steam carriages on railways as the perfection of the art of conveyance. In the meantime the steam carriages may be tested even on the present turnpikes. The reader will not fail to remark the perfect fulfillment of his prediction. The extent of the information respecting railways that Mr. Evans possessed was very limited. He knew merely that a greater load could be drawn on them by a horse than on a common road, but he was wholly ignorant respecting their structure and properties."

The immense plant of wood-working machinery of the J. A. Fay & Egan Co. at the World's Fair is attracting considerable attention, and has already secured them several foreign orders.

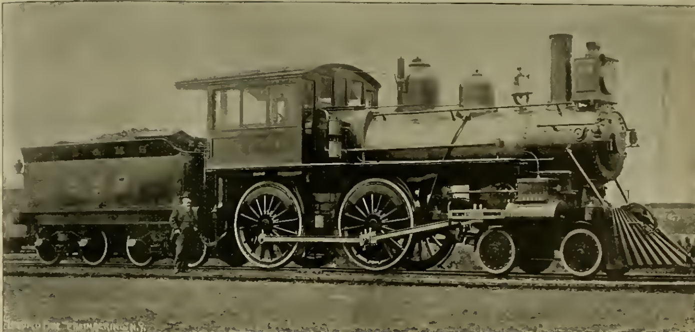
### OUR ENGRAVINGS.

Of late we have had a great many inquiries as to who made the fine half-tone plates shown each month in LOCOMOTIVE ENGINEERING. Credit is due the expert anywhere and we are glad to recommend the engravers of our plates to those wanting good work at reasonable prices. All the half-tones and reproductions we use are made by the STAR ENGRAVING & PRINTING Co., 607 & 609 Sansom St., Philadelphia, Pa. SINCLAIR & HILL.

Our Line Engravings are made by the wax process, a plan securing accuracy and distinct lines on original copper plates. They are made by BRADLEY & POATES, 251 William Street, New York City.

## Lake Shore Locomotive for the "Exposition Flyer."

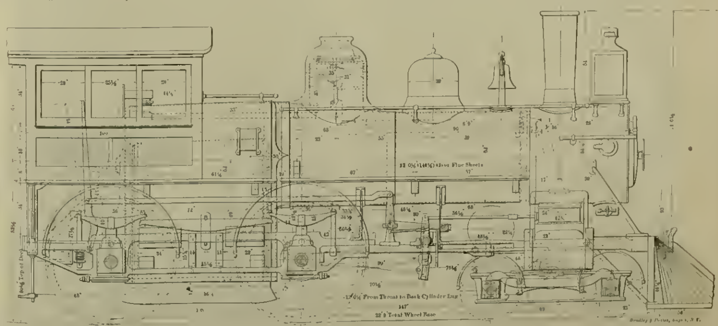
The photo reproduction and detail cuts, together with accompanying specifications, will give our readers all the information wanted about the construction of the locomotives recently turned out by the Brooks Works, at Dunkirk, for the Lake Shore road, to pull the "Exposition Flyer" over their line. This train runs from New York to Chicago in twenty hours, and maintains a speed of forty-seven miles per hour for over 500 miles on the Lake Shore section of the line.



Lake Shore Engine for the "Exposition Flyer" New York to Chicago in Twenty Hours

### SPECIFICATION

Of an eight-wheel express passenger locomotive engine having two pairs of coupled wheels and a four-wheeled swiveling truck for the Lake Shore & Michigan Southern Railway Co.



Elevation.

### GENERAL DESCRIPTION

Cylinders 17 in. diameter, 24 in. stroke
Driving-wheels—72 in. diameter.
Gauge—4 ft. 8½ in.
Fuel—Bituminous coal
Rigid driving-wheel base—7 ft.
Total wheel base of engine—23 ft. 9 in.
Total wheel base of engine and tender—45 ft. 8 in.
Weight of engine in working order 114,600 lbs.
Weight of engine on engine truck 34,500 lbs.
Weight of engine on main drivers 33,100 lbs.
Weight of engine on back drivers—32,000 lbs.
Weight of tender loaded 70,000 lbs.

### BOILER.

Type—Improved wagon-top Belpaire, with conical connection, dome on connection-sheet.
Working pressure—180 lbs.
Material—Steel, ⅝ in., 9/16 in., ½ in. and 7/16 in.
Riveting—Longitudinal seams, quadruple lap, without weit.
Riveting—Circumferential seams, double lap.
Waist, diameter at smokebox—52 in.
Waist, diameter at throat-sheet—60 in.
Tubes—268 in number, 2 in. diameter, charcoal iron.
Tubes—Length 12 ft., No. 13 B. W. G.
Firebox—78 x 34 in., inside ring
Firebox depth—81 in. at front end, 79 in. back end.
Firebox crown-sheet—Arched 1½ in., laterally in center
Brick arch—Carried on three 2½ in. water tubes
Heating surface—Firebox and arch pipes, 155 sq. ft.
Heating surface—Tubes, 1,258 sq. ft.
Heating surface—Total, 1,413 sq. ft.
Safety valves—1 Richardson muffled and 1 Richardson plain.
Extension front—Deflector in front of exhaust-pipe.
Stack—Cast-iron straight, 16 in. diameter
Exhaust-pipe—High double
Grates—Cast-iron rocking-bar

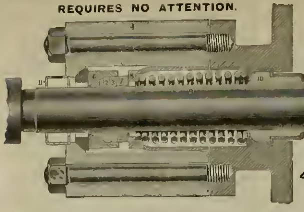
### MACHINERY

Cylinders—17 x 24 in., 84 in. centers.
Cylinder packing—Dunbar.
Piston-rod packing—Jerome.
Valve-stem packing—Jerome.
Steam ports—1¼ x 16 in.
Bridges—1½ in.
Exhaust port—3 x 16 in.
Valves—Allen Richardson
Valves, Allen port—⅜ x 16 in.
Valve, lap outside—1 in.
Valve, lap inside—⅛ in.
Valve lead in full gear—1/16 in.
Valve travel, maximum—6½ in.
Eccentric travel—5 in.
Link radius—68 in.
Link face—3 in.
Link centers of eyes—13 in.
Link block wearing face—5 in.
Link block flanges—7½ x 3½ in.
Link saddle-pin—1¾ x 6 in.
Link rocker-pins, top and bottom 1¾ x 4 in.
Link hanger centers—18½ in.
Link lifter arms, length—20½ in.
Reversing lever, multiple latch—Player's patent.
Reversing lever, throw on top—42 in.
Driving-wheels, diameter—72 in.
Driving-wheels, centers' diameter—66 in.
Driving-wheel tires, Midvale—With Mansell retaining rings.
Driving-axles—Hammered iron.
Driving-axle, journals—7½ x 9 in.
Connecting-rods, hammered iron, fluted—Fitted with straps and keys.
Coupling-rods, Midvale steel, fluted—Fitted with brass bushings.
Crank-pins—Midvale steel.
Crank-pins, main—4½ x 6 in.
Crank-pins, main coupling—5¼ x 4 in.
Crank-pins, main wheel fit—5⅜ x 7 in.
Crank-pins, back—3½ x 4 in.
Crank-pins, back wheel fit—4 x 7 in.
Frames, 46-in. centers forged solid 3¾ x 4½ in.
Frame, back end dropped down 5 in. to accommodate standard tender
Frame pedestal ties—Player's patent.
Engine truck, four-wheeled—Swiveling spherical center
Engine truck-wheels—31-in. Allen paper.
Engine truck-axles—Hammered iron.
Engine truck-axle journals—5 x 10 in.
Engine truck-axle springs—Detroit.
Driving spring rigging—Equalized. [hangers.
Driving spring auxiliary—Under rear spring
Driving spring—Detroit.
Lubricator, cylinder—No. 9 Nathan triple
Feed-water—Two No. 8 Monitor injectors
Oil cups, rods and eccentrics—Adjustable spindle feed.
Oil cups, eccentrics—Fitted with swab cups top and bottom
Oil cups, guides, etc.—Adjustable screw feed
Cab—Ash
Cab fitted with three windows on each side, front stationary, middle and back to slide.
Pilot—Fitted with shackle-bar
Brakes, train and tender—Westinghouse
Brake drivers—Westinghouse
Train signal—Westinghouse
Steam-heating apparatus—R. R. Co's. standard
Headlight—R. R. Co's standard.
Classification and signal lamps—R. R. Co's. standard.

### TENDER.

Frame—10-in. Channel steel
Tank—5/16 in. and ¼-in. steel
Tank capacity, water—3,100 gallons
Tank capacity, coal—6 tons.
Tank, water-scoop—Improved Ramsbottom.
Tender trucks—Diamond pattern
Tender truck-bolster—Steel I-beam
Tender truck-wheels—36-in. Allen paper
Tender truck-axle—Hammered iron
Tender truck-axle journal—4 x 7 in.
Tender coupler and buffer—Gould.

REQUIRES NO ATTENTION.



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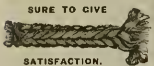

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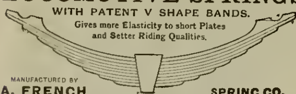

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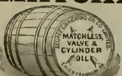


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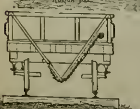
# RODGER * BALLAST * CARS.

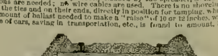



These cars are 34 feet long, and are built either 50,000 or 60,000 lb. capacity, M. C. B. Standard. They carry from 18 to 20 cubic yards of gravel or broken stone. In using them no ballast is thrown in the ditch, and none is wasted, as the precise amount of ballast needed can always be discharged. A train of 25 cars, carrying 500 yards of ballast can be unloaded and the ballast distributed, leaving the track perfectly cleared and flanged, as shown in the cuts, in from 12 to 15 minutes. This is all done by the regular "train service" (a conductor and two brakemen), no extra help being required. The track is perfectly cleaned by the spreader, so that a train can immediately pass over it at any rate of speed, without meeting any obstruction. No aprons are needed; no wire cables are used. There is no shoveling ballast from between the cars and no cleaning the tracks with shovels. The ballast is left between the ties and on their ends, directly in position for tamping, when the track is raised without being shoveled in from the ditch. The average saving per mile, in the amount of ballast needed to make a "raise" of 10 or 12 inches, will be about 400 yards, and often far exceeds this. The total saving per mile in material, labor, time, use of cars, saving in transportation, etc., is found to amount, in gravel, to from $250 to $400, and in broken stone it often amounts to $500.

These cars are in use on the Great Northern Ry., the Illinois Central, the Gulf, Colorado & Santa Fé, the Chicago & Eastern Illinois, the Penn. Lines West, and other roads.

Detailed information will be furnished by circular by addressing the

RODGER BALLAST CAR COMPANY, No. 1215 Monadnock Building, CHICAGO, ILL.



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### Curious Statement of an Engineer Who was Discharged for Burning an Engine.

I pulled down through —— siding to lay there for No. —, while going down through siding engine began working water. I kept my injectors on, though, until I got down to the water-works; then I took them off, thinking if she was not full I could fill her up when I got down to the lower end of the siding. When I got down to the lower end of the siding I stopped, tried my water and found three gauges of water in her, but to make *sure* that it *really* was *water* I lighted a *match* and saw that it really was water. I then took up oil-can and oiled up. By that time No. — came, and after —— was gone I went to pull out and the steam dropped from 125 pounds to 60 pounds, and I shut off steam. I then tried my water again and found that there was no water. I jumped out in the tank and got the pokers down and hauled the fire.

Q. What time did you leave —— ?

A. About 7.40 or 7.50 took water at——.

Q. How long did you lay there?

A. Long enough to take water. That would take me to —— unless I got laid out.

Q. Did you stop anywhere else on the road for water except at —— ?

A. No, sir.

Q. Did you find anything wrong on leaving —— ?

A. No, sir; injectors worked all right.

Q. How long did you lay there?

A. About fifteen minutes.

Q. Where did the water go?

A. I think the boiler was filled up with *gas* and when I opened up it went right out of the *stack*.

Q. Firebox was tight when you started?

A. Yes, sir.

Q. Did flues leak after you discovered there was no water in her?

A. No, because there was no water in her to leak out.

Q. How long have you been running?

A. About three years.

The above statement was made recently in the office of the M. M. of an Eastern road by an engineer who had dropped a crown-sheet.

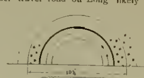
### Criminal Negligence.

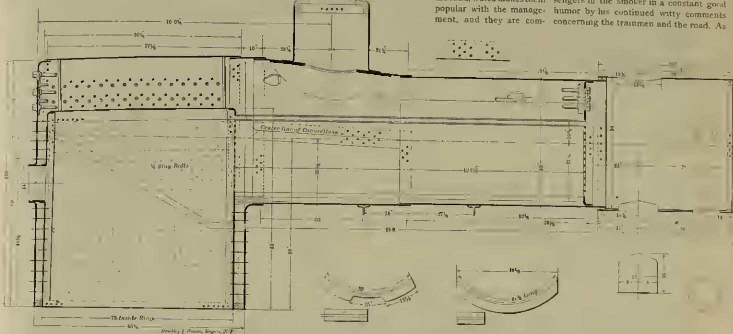
One of the most horrible forms of railroad accident is that where a switchman gets his foot caught in a frog and is held there till the wheels of the car cut him to pieces. Since all well-managed railroad companies have adopted the practice of filling their frogs with safety packing, this form of accident has become very rare, but it still happens sometimes. A dreadful case of the kind occurred on the Brooklyn, Bath & West End Railroad last month. This is a summer travel road on Long Island, and has no safety appliances that can be dispensed with. A man walking along the track got his foot caught in a frog, and before he could release it a train was upon him and cut him to pieces. If the Railroad Commissioners of New York were worth their salt they would make it hot for any railroad company that neglected to apply the safeguard provided so cheaply by filling frogs with wood.

Some years ago two Baldwin 10-wheel locomotives were bought by the Railway Co. of South Africa, and they are said to be so popular that this style of design is likely to strongly influence the forms of locomotive that will be purchased in future for this railway. A friend, writing on the subject, says that the engines are much easier repaired than the others on the road, which makes them popular with the management, and they are comfortable and convenient to handle, which makes them popular with the men.

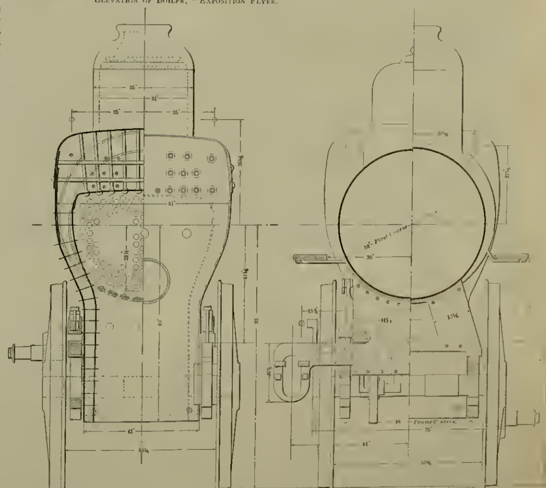
A bad runaway accident happened at Courtland, N. Y., last month, on the Delaware, Lackawanna & Western R. R. An engine was standing in the engine-house yard, which evidently had a leaky throttle. It started off of its own accord and went on to the main line, colliding with an express train on an iron bridge. It was said that the shock of the collision was so great that the light engine went almost entirely over the one pulling the train. The engineer and fireman of the express train were killed.

Riding over the Erie the other night a loquacious, tipsy Hibernian kept the passengers in the smoker in a constant good humor by his continued witty comments concerning the trainmen and the road. As the brakeman thrust his head in the door as the train pulled out of Waverly and called out, "O-we-go, next station," Pat yelled, "Ye ilhu, eh? Well, it's dommed glad av it Oi am, ye cud av gon long ago fer ahl we caired.'" Rogers tells this, and, of course, it is so.





Elevation of Boiler, "Exposition Flyer."



Cross Section Through Firebox. Boiler Head. Cross Section Through Guides. Cross Section Forward of Drivers.

### Handling the Brake-Valve.

BY WILL W. WOOD.

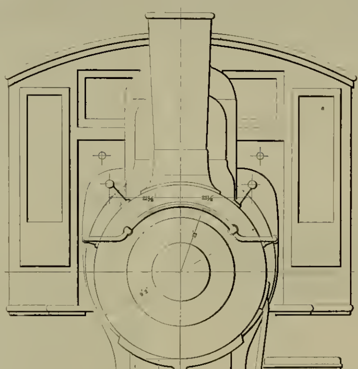
In this paper for May, a letter over the signature of A. W. Long states that air-brake instructors direct that when a light application of the brakes has been made and it becomes necessary to make an emergency stop, the brake-valve should first be moved to the full release position, held there a moment, then thrown to the extreme right and the emergency action of the triple-valves is assured.

The letter was reproduced from the *Engineer's Journal* for February, and is an extract from the article by Paul Sords, who is, to judge from his regular monthly contributions to the journal, a very fine expert in air-brake practice, and it is surprising that he accepts such an absurd and dangerous theory; but in the following number of the journal, another air-brake writer of weighty opinion ("Div. 31") affirms the idea that brake power may be gained in this way.

The triple piston must pull the slide-valve far enough to uncover a port leading to the emergency-valve before an emergency action can take place. The movement of this triple piston is governed by the air pressures against it, the train-pipe pressure on one side and the auxiliary reservoir pressure on the other. To make an emergency stop the train-pipe pressure must be reduced at least ten pounds lower than the pressure in auxiliary reservoir in order that the auxiliary pressure may be enough greater as to force the triple-piston against the resistance of the train-pipe pressure and to overcome the retarding effect of the friction of the slide-valve and the resistance of the graduating spring. Now, this differential pressure must occur before the quick action or emergency feature of the brake will operate. When the brakes are applied at service stop and the handle is thrown to full release position, the excess or normal pressure restored to the train-pipe from the main reservoir must all be discharged at the brake-valve until it is at least ten pounds less than that in the auxiliary reservoir; then the emergency action takes place. The brake-valve would not be left in the release position long enough to allow the auxiliary reservoirs to recharge or the brakes would release, as they begin to release at the same time the auxiliaries begin to recharge, and if the auxiliaries gain no pressure from that source it is plain that just as much more air must be discharged by the brake-valve as has been restored by it to the train-pipe; it takes time to do it and seconds of time are a great deal in an emergency.

Both the Westinghouse and New York Air-Brake Companies have labored to perfect their brake-valves, and have succeeded in producing engineers' brake-valves that may be handled successfully by those unfamiliar with the finer points of the brake mechanism if the engineman will only follow the directions in his instruction book. Young runners do a great deal of reading nowadays, and, naturally enough, many will believe the statements of those air-brake "experts" printed in technical publications and handle their brakes accordingly. Now, it doesn't require an air-brake wizard to work these new valves. They are simply three-way cocks with the addition of the equalizing discharge, which may or may not be used, and the excess pressure or feed-valve attachment. There are five indicated points for the brake-valves, both the Westinghouse and the New York, and the instruction books explain clearly when and how to use those different points.

Don't juggle the valve. If you want to make an emergency stop with the Westinghouse valve or the New York valve, throw the handle into the position for emergency stop, and leave it there until you have stopped. To release the brakes, put it back in the opposite direction as far as it will go, and when brakes begin to release draw it back to running position. To apply the brakes gradually, move the handle to service stop position and watch the black pointer of the gauge; it will show how much air you are letting out of your train-pipe, and you can graduate your stop by the distance it falls back. When you have exhausted 20 or 25 pounds of air your brakes are fully applied. Don't let out any more air; save it to help release the brakes and recharge the auxiliaries. You may run by—you will once in a while—but don't get rattled. After discharging 20 pounds of air the emergency-valve is inoperative, so don't shove the handle clear around into emergency position and waste all of your train-pipe pressure. If you run by you may have to back up, and you must release your brakes before you can do it, and it takes compressed air to release brakes as well as to apply them, but after making an application of the brakes, never turn the valve back to the release position, unless it is necessary to release the brakes, as there is nothing to gain by it, but a great deal to lose.



CROSS SECTION THROUGH TRUCK. FRONT ELEVATION.

### Breaking the Record.

The fast running made on different railroads during the last few months has excited among many locomotive engineers an ambition to do likewise. There is a feverish desire prevailing to break the record. Fast running on a perfect track, with locomotives in perfect order, and fast running on a track that is badly out of line, with locomotives having crank-pins out of true and side-rods none too strong, are very different operations. The safety margin under the latter conditions is too small for comfort. Men who have the record-breaking fever do not, however, pause to reflect on this and the men in charge of more than one Western road have had to resort to strong measures to prevent dangerously fast running.

About the last kind of service in which to make extraordinarily fast running is in the pulling of suburban trains, yet even with these, attempts have been made at record breaking. The trains on the Illinois Central that take people out to the World's Fair, provide what most travelers would call rapid suburban transit. They run six miles in about fourteen minutes, slowing up once to cross the tracks. An engineer engaged on this service was one day seized with the ambition to break the record. Before starting he directed his fireman to get her hot and to have a fire ready to keep her in that condition throughout the run. The signal was given, start was made and two of the brakemen failed to catch on, but the others climbed to the top of the cars and braced on their caps. It was time to do this, for within three minutes the Rogers double-ender had forced the train into a fifty-mile pace with the speed still rising. By the time the train was three miles out the conductor and brakemen on top of the cars were so busy clinging to the running-board that they could devote no attention to their caps and a small shower of the latter was seen falling into the lake. But the engineer never looked back. His only thought was on reaching Sixtieth street station and he got there in seven and a half minutes, almost cutting in two the fastest time previously made. It was a remarkably proud engineer who calmly moved that engine into the relay.

On returning to the starting-point he received fourteen days to rest up.

### Too Much Personal Attention.

A somewhat novel consideration persuaded Mr. J. Y. Smith, inventor of the Smith vacuum brake, to decline erecting a factory in eastern New Jersey for the manufacture of the brake. The officers of the Jersey Central Railroad took great interest in this brake when it was under development, and a great many of the first equipment made was turned out of the shops at Elizabethport. Mr. Smith was present a great part of the time, directing the manufacture and watching the details of the apparatus. He was greatly given to figuring on cost of production and on observing influences which accelerated or retarded the work done by mechanics. His observation of the habits of the men working at Elizabethport was edifying.

The question of erecting shops was taken up, and Mr. Smith's colleagues favored Elizabethport as a location, and strong local influences were used to get the works built there. Mr. Smith strongly opposed the locating at that place, but held off from giving any reasons for his opposition. When his friends were beginning to think that mere prejudice was influencing Mr. Smith, he explained that to do work satisfactorily a mechanic must have nothing to detract his attention from the operations in hand. He found that a considerable part of a man's time in Elizabethport was diverted from his work fighting mosquitoes. At a moderate estimate he considered that ten seconds out of every minute were consumed in slapping at mosquitoes or in soothing the wounds inflicted. That left too small a margin for useful work. The shops were not built there.

### Benefits Acknowledged.

It is refreshing in these days to find the people of a town willing to acknowledge that after a manufacturing concern has been fairly established it is a benefit and a source of prosperity to the place. Of the Mount Vernon Car Works, the Mount Vernon *Daily Register* says:

"There are scores of people living here, however, who have a very vague idea of the immense business transacted by this concern. All their money, which is paid out at the rate of \$75,000 to \$100,000 per month, comes from other communities. An average of \$25,000 to \$30,000 per month finds its way through the mechanics and laborers into the tills of our business houses, and this of itself is enough to give a good, healthy business vein to the community. The immense increase in population, the extension of the territorial limits of the city, the hundreds of new homes erected, the increase in business houses, the building of water works, the paving of our streets, and a score of other improvements are directly the results of the location of these works in our city."

Several railroad companies have given notice to their employés that leave of absence would be granted to attend the World's Fair, and that free transportation would be provided for themselves and families. The Pennsylvania Railroad Company, whose management are always in the front with kindnesses to the army of men employed, was the first to start this movement, and it was quickly followed by the Lake Shore & Michigan Southern. The public press commended the movement so cordially that a number of other railroad managers have hastened to intimate that they were prepared to do likewise. We hope the practice will become epidemic, and that all the railroad men in the country will have the opportunity to enjoy the great educational advantage offered by the splendid exhibit at Jackson Park.

We have received from Crosby, Lockwood & Son, London, the new and revised edition of Stretton's "Develop.. ent of the Locomotive," a work which we reviewed in December of last year.

# Practical Letters from Practical Men.

**Facts Wanted. There's a glut of Opinions.**

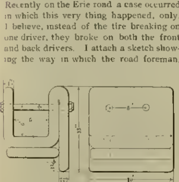
**Write on one side of the paper, state your point plainly and briefly, and then quit. We supply the generalities. No letters noticed unless name and address accompany.**

## Bringing in a Consolidation Engine with all Flanged Tires Broken.

*Editors:*

The question has often been asked by engineers and others how a consolidation engine with both the middle drivers blind, could be brought in in case of the tire breaking on the back or forward drivers.


Recently on the Erie road a case occurred in which this very thing happened, only, I believe, instead of the tire breaking on one driver, they broke on both the front and back drivers. I attach a sketch showing the way in which the road foreman,



Mr. Merritt Turner, of the Delaware division, brought the engine in. I think the sketch will very clearly illustrate what was done. The wheels were slid on these slippers.

H. A. Gillis,
General Foreman.

*Roanoke, Va.*

## Compound the Conductor.

*Editors:*

Reading your valuable paper so long and finding so many articles every year on fuel-saving devices, also the saving of the compound over simple engines, has kept me thinking on this subject, same as every other man that reads, but none of the boys say anything about the rear end of the train. I can haul a local freight train 100 miles on our division with a ton less coal, with two or three of our conductors in charge, than with some of the others, all things equal other ways. We have men who will switch thirty minutes at terminal getting air-brake cars behind engine. They will handle them switching on every side-track, no matter if they go through to end of runs, knocking down merchandise and stock and doing more damage to freight, with the extra coal burned, than their wages come to.

We have one man that switched twelve air-brake cars together this winter. The first side-track he had to go into had to double out, as it was very cold and flanges full of snow. That means fewer miles to the ton of coal. What I propose is to work these men compound, have a traveling conductor on each division that will pound some brains into their thick heads. Their port openings are large enough if they would retain them. Now, I am after the local passenger conductor, who is popular and has lady friends at most of the stations, who have no business but to come to the depot to have a chat with the boys. He loses two or three minutes every little while. This means one bucket more coal for 100 miles. I claim, every brakeman who is examined for promotion ought to be questioned on his knowledge of economy in handling a freight train. There is skill to be displayed there as well as at the head end that will pay any railroad company to take into consideration.

A. Eagle.

*Fond du Lac, Wis.*

## The Old Locomotive, "John Bull."

*Editors:*

In the May issue of your journal I have read with interest the article which relates to the "John Bull" engine of 1831, and beg to give the following information on the subject.

Just before leaving England I carefully examined Messrs. Stephensons' working drawings from which that engine was built in 1831, and last week I, with equal care, examined the engine "John Bull" as it now stands at Chicago, and I am perfectly certain that *the engine at the World's Fair is the real old Stephenson-built engine of 1831*, but at some time unknown to me the present circular firebox has been added, as when the "John Bull" was built it had a square firebox.

The "John Bull" was in every respect similar in design to the well-known Samson class, of which Stephenson & Co. built such a very large number in the years 1831, 1832 and early in 1833. Yours truly,

Clement E. Stretton, C. E.,
of Leicester, England.

*Pittsburgh, Pa.*


## Boss-Turner and Flue-Hole Cutter.

*Editors:*

I herewith send sketch of a very useful tool for turning or facing the bosses on rocker-arms or cutting various sized holes in boiler sheets and many other kinds of work. This tool is calculated to be used in an ordinary drill-press, and it was designed by F. H. Dersch, machine foreman at the Dubuque shops, C., M. & St. P. R. R. Tool-holder *A* slides through body *B* and carries tool *E*. The cross-feed screw *C* gets its motion from star *D*. The up and down feeding is done with the feed-screw of the drill-press. A hole is to be drilled in the article to be operated on the size of guide *F*, guide *F* steadies the tool, and where special machinery is scarce this tool will be found very useful and easily made.

J. C. Miller,
General Foreman.

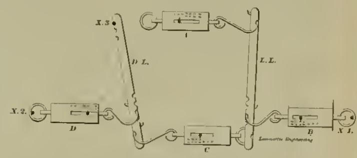
*Dubuque, Ia.*

## An Object Lesson in Brake Leverage.

*Editors:*

There are lots of men in this country looking after the repairs and adjustment of the air-brake gear to whom either calculating or understanding the brake leverage on a car is a mystery. They want to know how badly enough, but they do not get the right start, and have to depend on some one else for the "know how." With an ordinary knowledge of arithmetic and a little study of the subject of leverage as given in the Westinghouse instruction book, it can be made clear. As long as nothing breaks or gets lost from the brake-levers and rods it does not matter much whether all of us understand it or not, but it is mighty handy to know how all these things are calculated. To get a good start, get hold of four spring balances, such as can be found at any hardware store, graduated to weigh at least 24 pounds. They will not cost over $1 altogether. If you stand in with the merchant, maybe he will lend them to you. Go into the carpenter shop and get two light wooden levers, say 1 inch wide and ¾ inch thick, about 38 inches long. Cut notches in each end so they will be 36 inches apart, and also some notches near one end, 6, 7, 8 and 9 inches from the end notch. The sketch of *L L* shows how this is done. Drive some nails into a wide board or the top of a wide bench, as at *X 1*, *X 2* and *X 3*. Pull on *A*, which represents the top or pull rod. *B* and *D* show the strain on the brake-beams and *C* the bottom rod. By changing the hook of spring balances *B* and *D* into different notches you can get a good idea of the way the strains are divided. You will notice in each case that the strains on *A* and *C* added together always equal that on *B* or *X 1*, the brake-beam. Alter the position of *X 3* in the notches in the top end of *D L*, which represents the dead lever, and see how it affects the strain on *D* or *X 2*.

If you have an idea that the dead lever is only used to take up the slack of rods and shoes and has nothing to do with the strain on the brake-beam *X 2*, just hook




*C* and *D* together and you will find that *X 2* has as much less strain on it as the pounds pull at *A* subtracted from *B*. That will explain why in a tender or car that has no dead levers and the bottom rod "*C*" is connected directly to the brake-beam, that the pair of wheels next to the live lever always skid first. If you have a Westinghouse instruction book look at Plate 3, Fig. 7, and see the length of the standard levers used in passenger cars. The proportion of force marked there, 4½ to 1, is found by dividing the length of short end of lever 8 inches into the entire length, 36 inches. If the proportion was 4 to 1 the short end would be 9 inches long, if it was 5 to 1 it would be 7⅕ inches long, if 6 to 1 the short end would be 6 inches long. To work the other way, if you want four times the strain on the brake-beam that you have pulling on the top rod, divide the entire length between the outside holes in live lever by 4 and that will give you length of short end, or for any other proportion of strain on brake-beam the same way. As the levers for same style and size of truck should be all alike and a standard size, the difference in braking strain on the beams of a light and heavy coach or tender should be made at the cylinder lever of that particular coach or tender. This seems a more difficult subject to master, but it is just as easy after you arrange your levers and spring balances in the same manner as the two cylinder levers and accompanying rods, and test the strains at various points for fastening the connection which is near the middle of lever.

When you come to do your figuring, get the weight of car first, take not over 90 per cent. of the weight for braking strain, divide that between all the brake-beams. If the car weighs 50,000 pounds, 45,000 would be the extreme limit for braking force, divide by 4 for four brake-beams and we have 11,250 pounds for each beam. If the proportion of leverage on live lever is 4½ to 1, divide 11,250 by 4½; it should be 2,500 pounds, which will be the strain on top rod. If it is the Hodge system and has a floating lever which has top rod connected to one end and brake chain and rod connected to the other end, remember that the rod from floating lever to cylinder lever should have two times 2,500 pounds, or 5,000 pounds, which is the strain on outside end of cylinder lever. With a

10 x 12-inch cylinder, quick-action triple, and 70 pounds train line pressure, we have about 4,700 pounds pressure on piston. That, added to the 5,000 on rod at other end of cylinder lever, makes 9,700 pounds. Now divide the whole length of cylinder lever by 97, and $\frac{47}{97}$ of the whole length of lever goes next the piston, and the other $\frac{50}{97}$ comes next the rod end. Any other proportion can be found the same way. You will notice in Plate 3, Fig. 7, of Westinghouse instruction book, down in the bottom corner, that the cylinder lever has amounts opposite it running from 28,600 pounds to 44,000; this is the entire strain on all brake beams when connected in the holes opposite figures, which would seem to some to be the limit of breaking strain on a coach. Probably they think that is all the beams will stand, but there are coaches running that weigh over 70,000 pounds, and 44,000 is not enough to stop them to avoid an accident.

In these calculations it is possible there are errors made, check them up and prove them for yourself; if you find errors in these figures given in this, it will show you that your figures may be wrong also sometimes. When you get hold of the bottom facts in coach-brake leverage it is an easy matter to calculate freight-car leverage. I wish someone would contribute an article on driver-brake leverage, when cams between the wheels on spread brakes are used, as we see no computations on this subject in any of the instruction books.

Locomotive Engineering is a sort of school for all of us; we should contribute something once in a while on these subjects so the boys in the primary class can "catch on," and the other fellows who think they are going through the high school will brighten up wonderfully.

Clinton B. Conger.

*Grand Rapids, Mich.*

### Laying Out Back Cylinder-Heads.

*Editors:*

I noticed on page 357 of the October, 1892, issue of Locomotive Engineering an article from Mr. C. F. Gregory, of Detroit, Mich., criticising pretty severely my article on laying out a back cylinder-head, which appeared in your January, 1892, issue, and in his article he promises to explain a better method of doing this work. I have been watching for this promised explanation, but as yet have failed to see it, but perchance I have missed it, for Locomotive Engineering always contains so many good articles that a person is liable to miss one.

Brother Gregory says he does not like the paper template. Neither do I for general use; but please bear in mind that the work criticised was a roundhouse job, and the paper template was given as the quickest way and the way most easily grasped by a novice. But perchance it could be done as quickly with the dividers, in the following manner.

First put a center punch mark, *A*, Fig. 1, in the center of that part of the head which projects into the cylinder. Then drive a piece of light board with a piece of tin tacked in the center of it into the back end of cylinder the exact distance from the seat that the projection on the head arises from the seat on the head. Upon the tin get the center of counter-bore of cylinder. Then from this center with the dividers scribe a circle which passes through the center of each stud-hole in the cylinder-flange, and from the center, *A*, Fig. 1, scribe this circle on the flange of cylinder-head. Now move the board in cylinder out flush with the seat and be sure that the center mark on the tin is again in the center of cylinder counter-bore. Then take a straight-edge of sufficient length to reach across the end of cylinder and hold its top edge in line with the center mark on tin, and in this position make it conform to the level as taken from the long straight-edge resting on the frames back of the cylinders, and from the top edge of the short straight-edge thus held scribe a line through the center mark and across the face of cylinder-flange on right side of cylinder. Then with the dividers on the right side of cylinder-flange space the distance from this horizontal line's intersection with the circle through stud-holes, *B*, Fig. 2, to the bottom end of back steam port.

Now, without changing the divider points, use the *left* end of clearance space in head for a center, and make a mark on left side across the circle on flange of head, prick-punch the point of intersection, and through this punch mark and the center of head draw a line across the flange face on each side of head. Now, using the same point of intersecting lines on right side of cylinder flange for a center, space with dividers the distance to center of first stud-hole *above* the horizontal line, then using care not to alter distance between divider points, use as a center the intersecting point of lines on *left* side of head and scribe the distance across the circular line, and above the horizontal one; this will be the proper place for center of first stud-hole. Then space off distance from center to center of each stud-hole in cylinder from *right* to *left*, and lay off these distances on flange of head from *left* to *right*, and when holes are drilled $\frac{1}{16}$ inch larger than diameter of studs, the head will slip to place nicely. Now transfer the horizontal line across the flange of head to opposite side of head, and from thence across the flanged part to which the guide-blocks are fastened, and the holes for guide-blocks can then be laid off, as described by me in January, 1892, issue.

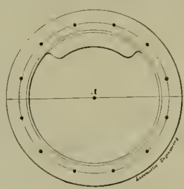



*Fig. 1*

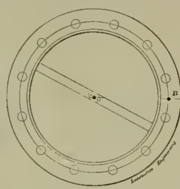



*Fig. 2*

Now, every one of my articles contributed to this paper have at all times been open to fair criticism. And please allow me to state right here, that before criticising an article, I believe it to be a person's duty to at least read carefully the article to be criticised, and thus become thoroughly acquainted with all of its points, with the object that no unjust criticism may be made.

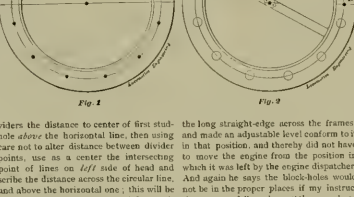
Let us now look over Bro. Gregory's article, and see if he read my article carefully before "tearing it to pieces." In the first place he says, "Some roundhouses have no means of drilling except by hand," and that perhaps I did not make allowance for that, and a little further along he says, "After block-holes are laid out the head is again taken off, and taken *somewhere* to be drilled." Now, it does not appear reasonable to me that even a helper who was endowed with common "horse sense" would take the head to the grindstone to be drilled while there was a drill-press in the roundhouse, as stated by me in the first part of my article, and I believe, had Bro. Gregory read my article carefully, he would have spared himself this humiliating "break."

Then he says, "I proceed to lay out holes for guide-blocks, by *leveling* engine, using long straight-edge across frames, etc." Now, I beg to say I did *not* level the engine, and if Mr. Gregory was "on to the job" he would have seen that I used the long straight edge purposely to avoid taking the time to level the engine. I placed the long straight-edge across the frames, and made an adjustable level conform to it in that position, and thereby did not have to move the engine from the position in which it was left by the engine dispatcher. And again he says the block-holes would not be in the proper places if my instructions were followed, as "the crosshead might have their gibs on the bottom." I do not see how the position of the blocks as described would affect putting on thicker gibs at any time, for in such a case the only thing to do would be to put more liners between block and bottom guide, and this has to be done in all cases where the thickness of crosshead lugs is increased and the same blocks are used.

Relative to giving the thickness of the head, I think it would be as well to do this, although I believe that most main shops keep the sizes of such parts as back cylinder-heads. Then, in regard to the impossibility of obtaining a piece of paper with which to make a template. Well, we will not discuss that point; and I am glad to read Brother Gregory's criticism, for it demonstrates how easy it is for some people to criticise the work of others, and his statement that he does not wish to criticise my writings reminds me of the boxing match in which one fellow said he did not wish to hurt the other, then knocked him through a board fence the first clip. Still, I believe that Brother Gregory means well, and will "get there" yet, and I wish he would give us his promised article, as I am sure it will be something instructive.

L. C. Hitchcock.

*Los Angeles, Cal.*




The "Pioneer."

### The "Pioneers"—Which?

*Editors:*

Inquiry was made for the old locomotive "Pioneer." Now, which "Pioneer" is it? I send a sketch of locomotive "Pioneer," built by Seth Wilmarth in 1851, for the Cumberland Valley R. R., and this is only one of the many engines of that name. In the away-back days two old locomotives put in an appearance on the old Pennsylvania State road (they were borrowed); they were single drivers and had the crank throttle-lever, so common in European practice. They were named respectively, "Pioneer" and "North Star." It is of these old engines I would inquire. They came and ran awhile and went away. I never knew where they came from, unless they came from the Portage road, which ran west from Holidaysburg, Pa., this road being a part of the main line of public improvements owned and operated by the State of Pennsylvania, afterwards absorbed by the P. R. R.

W. de Sanno.

*Indianapolis, Ind.*

### Why Should We Attempt to Set Eccentrics Before Wheels are Placed Under Engines?

*Editors:*

I have been particularly interested in the communications in regard to setting cams on axles in position before putting under engine. Everyone so far has said, "My way is not *exactly* correct, because there may be a variation in some parts of valve-motion which can be overcome by offset keys or an adjustment somewhere else."

If that is true, what is gained by setting them before putting under? If time is consumed in readjusting them, or something else, to make them right, then they might just as well be keyed on under engine after valves are squared and we are certain, by actual measurement, that they are in proper position.

The claim is made by some, that too much time is lost on account of engine being ready for the road, but waiting to key on eccentric cams. I think that argument is absurd. If it is so, there is a lack of system in doing the work.

An engine can be built or repaired, cams keyed on under engine and eccentric-straps and rods put in position in ample time, while the other necessary finishing work is being done.

It is done here (L. V. R. R.) right along without any detention whatever, the rule is, eccentric-cams are keyed on, straps and rods put up, everything complete, a day or two in advance of engine being ready to leave erecting shop. The method is as follows:

Cams are set on axles with set screws a certain distance from quarter lines (distance taken from an engine of same class having eccentrics correctly set), eccentric-straps are then fitted to a bearing before wheels are set under engine, requiring no fitting under engine, then at a convenient time we take the eccentric-rods and lay out holes in straps to fasten rods the proper length.

For forward motion we drill and ream all the holes in straps, and fasten rods permanently to straps with snug-fitting bolts, we never alter the length of forward eccentric-rods when fitting up new. But in back-motion eccentric-straps we lay out and drill one hole in strap for rod, making a slot $\frac{3}{16}$ in. longer than diameter of bolt, which allows of an adjustment of $\frac{3}{32}$ in. each way, which is ample enough to allow for any adjustment when setting valves; after valves are set we take back-motion eccentric-straps and rods to drill-press and get the remaining holes drilled and reamed (this is done while cams are being keyed on axle).

When valves are set we take down straps and mark position of cams on axle, mark off keyways, slip cams taward center of axle, and commence keying on our cams. We slip engine so that both forward key-

ways are on upper side of axle, one back of center line of axle and the other in front of C line. We then lay out four holes the length of keyway with a special c'amp, which is fastened on axle, permitting of easy adjustment, and a small ratchet, fitted with a flat bit drill, having a shoulder on, preventing it drilling out too deep. The holes are drilled out the required size and depth. With chise' the metal between holes is cut out, and with a steel drift the size of key the keyway is finished out, making a true, clean keyway, which is a perfect fit for key. Ends of keyways are left round, filing keys to suit. As two men usually do this class of work, while one man is drilling out the keyway the other man is preparing ends of keys to suit keyway; and while first man is chipping and drifting keyway, the other is drilling out the keyway on opposite side. Putting keyways in this position prevents any delay. Two keyways and keys are being fitted at one time.

Everything being ready, we drive on forward motion cams in position, making them a snug driving fit, tighten up set-screws and slip engine, bringing back-motion keyways in same position of forward motion for convenience of drilling and fitting, doing back motion in same manner as forward motion.

Cams are now permanently keyed on axle in correct position in a perfect mechanical way. We have no offset keys to bother us in case of a breakdown. We know that we can take a new cam from shelf, put in position and feel satisfied that it is right, as all keyways are cut in cams to template, making them interchangeable, and keys are standard. Straps are put on, rods coupled to links and the job is complete. There is no hard work about it, and when you compare the time occupied in doing it with other methods, and the accuracy of the work, I think there will be a saving all round.

It generally takes about ten hours for two men to do this work, it has been done in eight hours from the time of taking down straps and marking keyways to finishing job complete.

I certainly think it is a good thing to know how to set cams on axles before putting under engines, but see no practical advantage in doing it, as it is apt to consume more time and result in making too much alteration in valve motion.

EDWIN JAMES.

*So. Easton, Pa.*

### The Invention of the Steam Whistle.

*Editors*:

I notice on page 231 of the May number of your most interesting and widely-read paper, that in paragraph 54 you state that the steam whistle "was first applied to a locomotive in 1835 by Bury, an English builder." But according to good authority the steam whistle was first applied to a locomotive in May, 1833. I have by me now the "Midland Railway, Its Rise and Progress," by Williams, and on page 91, speaking of the Leicester & Swannington Railway, he says: "Soon after the appointment of Mr. Ashlen Bayster (January, 1833) a locomotive, while crossing a level road near Thornton, ran against a horse and cart. At that time the drivers and guards of trains were able to give the signal of alarm only by means of a horn, and when Mr. Bayster heard of the misadventure he went over to Alton Grange and mentioned the circumstances to Stephenson. 'Is it not possible,' he suggested, 'to have a whistle fitted on the engine which the steam can blow?' 'A very good thought,' replied Stephenson. 'You go to Mr. So-and-So, a musical instrument maker, and get a model made, and we will have a steam whistle and put it on the next engine that comes on the line.'" Then, again, in looking over the *Engineer* for 1892, I find on page 290 a letter from Mr. Clement E. Stretton, the best authority on locomotive history in England, in which he says: "It was put on in ten days and tried in the presence of the board of directors, who congratulated Bayster and Stephenson, and ordered other trumpets (or whistles) to be made for the other engines which the company possessed." He also says: "I herewith send a copy of the company's drawing, dated May, 1833, signed by Mr. Henry Cabry, the engine superintendent, showing that no possible doubt upon the matter can exist." And so I believe that the Bayster and Stephenson whistle of May, 1833, was the first ever used on a locomotive.

REGINALD WRIGHT.

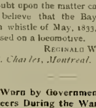
*Point St. Charles, Montreal.*

### Badges Worn by Government Engineers During the War.

*Editors*:

I have noticed for some time, articles by men who ran locomotives for the United States during the War and have been much interested by them.

I have in my possession (inclosed proof) the original badge presented to James Campbell by Gen. Joseph Hooker, in 1861,




upon Mr. Campbell's enlistment for three years as locomotive engineer on the U. S. M. R. R. It occurred to me that possibly "Old Soldier" might recognize the badge, as I understand all engineers had to wear one while in service of the United States.

Would like to learn their value, if any, outside of a personal relic; also, to ascertain how many of them are in existence at the present time.

J. G. CAMPBELL.

*Topeka, Kan.*

### Some Points on Tempering Tools.

*Editors*:

Toolsmiths should be adapted to their work and like it, be patient and of an investigating turn of mind.

Tool steel should be selected for the work it has to do, one kind being good for one kind of tool, but totally unfit for another. The selection of smith and steel can not always be regulated to our taste, but methods of working can be.

To attempt to handle too many tools in the fire is a bad practice; it is like handling eggs, in bulk, generally disastrous. The toolsmith who attempts to heat too many tools at a time, is very liable to burn or soak his steel, thus rendering it valueless. In some instances, when a large number of tools are required to be dressed, it becomes necessary to heat several at a time, but in the majority of cases it is a bad practice.

Taps, hobs, reamers, milling cutters and other tools of that order are subject to warping, cracking and general distortion in tempering, all of which can be overcome to an extent. First, by simply obtaining an equality of temperature or heat in all parts of the object to be hardened; secondly, the water to be used in hardening should be of the proper temperature. For example, a feather-edge cutter will not bear as much strain as a more bulky tool; hence it will not stand as cold a bath, for the colder the water the quicker the abstraction of heat, which will cause a sudden contraction of the thin edge. The method of tempering, so as to graduate to any desired degree or depth the hardness of the tool, is to immerse it in water, keeping it there just long enough to harden the surface and cutting parts to the desired depth, then quickly transferring to an oil bath. The object of this method is to overcome the strains and stresses which sudden cooling develops. The oil abstracts the heat in a slow, gradual and uniform manner. The water has produced the denseness of hard steel on the exterior, while the center is amorphous and soft, thus allowing the outside to compress and close up those minute fissures or openings caused by expansion.

Long tools tempered in this manner, if sprung or crooked, can be straightened without much difficulty after they have been hardened and tempered.

I sprung a 1⅛ x 16-inch reamer $\frac{3}{16}$ inch out of true and straightened it between two centers by means of a block and steel bar.

It is best to heat the steel, but not enough to start the temper before attempting to straighten.

In addition to the foregoing, it is well to relieve the tension where the hardened part joins the unhardened by drawing the temper, thus allowing a harmonious arrangement of the particles, or in other words to allow the particles to assume a normal condition. The idea is to equalize tension wherever it is possible to do so, thereby lessening the risk of cracking.

GEO. F. HINKENS.

*Gladstone, Minn.*

### Tools Shorten When Tempered.

*Editors*:

Why we draw the temper on tools after they are hardened, and what effect has it on a tool, is a question asked very often. For a sample take a reamer 1 inch in diameter, 10 inches long, get the exact length of it, then heat it to a perfect uniform heat and to as low a heat as it will harden at, then quench it, and when it gets to a temperature of 75 degrees get the exact length of it again, and, if your steel has refined as it ought to on the cutting edges, your reamer will be about $\frac{1}{32}$ inch shorter; then take and draw the temper to a straw color and let it cool slowly to a temperature of 75 degrees, and you will find that your reamer has shortened from $\frac{4}{1000}$ to $\frac{6}{1000}$ in drawing the temper.

Now, we are asked why does it shorten in drawing the temper.

In quenching your steel at the lowest possible heat it will harden at, and in a solution that will cool quickly enough to refine your steel, which a salt brine will do at a temperature of from 35 to 50 degrees, it will cool your cutting edges so suddenly that they will be at a temperature of 70 degrees when your center is still red hot; now, the cutting edges naturally draw the center with them while it is hot, and when the center gets to the same temperature of the cutting edges it must have a tendency to draw the cutting edges with it, which it does in quenching when it shortens your reamer $\frac{1}{32}$, but it still leaves a powerful strain on your cutting edges, which is relieved by drawing the temper and proven when your reamer shortens in drawing the temper.

A great many say they can prevent this in hardening. It is very easily prevented, providing you don't care whether you refine your steel or not; but you cannot prevent it if your reamer is of good steel and has been properly annealed before you send it to the machine shop, and refined as it ought to be in hardening.

W. G. LOFTIS.

*Madison, Wis.*

### Responsibility of Running Cars Without Sufficient Braking Force—Naming the New Brake-Valve—Danger in Practice of Restricting Supply of Catalogues—Value of Quick Action.

*Editors*:

I have often read of the quick-action feature of triple-valves being plugged, although I had heard of such things, I did not think I should have a practical illustration so soon, but a few days ago an inspector asked me to look at the valve on a coach that would blow out of the exhaust port, after he had cleaned valve and put in a new seat, No. 11, Plate D 26. I looked at the seat, which appeared tight, then took out emergency-valve seat to look at emergency-valve piston No. 8. It was not a piston at all, but a stop or plug, with a shoulder to keep it from falling through the seat; it fitted so tightly that the emergency-valve No. 10 would stick in it and could not close tight.

This is not the worst of it, by any means. This car was in a measure a special car put up by a well-known company, who run their cars over the different railroads, and who themselves furnish men to take care of their cars wherever they run; they also in their advertisements make great claims about not hesitating at any expense that will add to the comfort and safety of their patrons; but their cars are often found leaving terminals with brakes in such condition that I have been led to think there is a deliberate intention to make their cars do as little braking as possible—I presume, to get them to last longer.

Is there any one else who is having such an idea continually brought to his mind, while he feels that it would be an injustice to all parties concerned to entertain it seriously, but who cannot help seeing that such mistakes are invariably in favor of the parties who would be financially benefited thereby, and who, not being responsible in case of wrecks, would be in a position to collect damages from the very parties whom they were imposing upon?

LOSS FROM STINGINESS IN FURNISHING BRAKE CATALOGUES.

As for naming the new brake-valve, why is not Plate D 5, a good enough name? and, besides, this valve was in use here in '92. But right here let me say that there is a method of restricting the supply of air-brake catalogues by not placing them in the hands of the men who do air-brake repairs. That is very costly to the companies pursuing such a policy. I find it difficult to keep these men supplied, having some men who have worked a year or more on air and have never seen a catalogue. The writer, when beginning air-brake work, was often led to understand what work a piece or part did by looking at the names in the catalogue but I find many men who have to ask for "thingumbobs" and "cinfunnys" when they have to replace old parts with new, and in one case there was an hour lost by two men trying one night to agree about a valve-chamber bush No. 43, Plate D 6. The air man called it a "-ubley-whack" and the storeroom man a "skew-gee," and he could not be made to understand the chalk sketch made for his benefit.

Of course, this was an extreme case, but I have no doubt that the majority of air inspectors will agree with me when I say the catalogues that such repair men have not had, but which were needed, have cost their companies at least their weight in gold, and to this cause is due to a large degree the horrible and misleading names of parts and the very expensive air of mystery that has until recently enshrouded the air-brake business.

A BUSHING REMOVER.

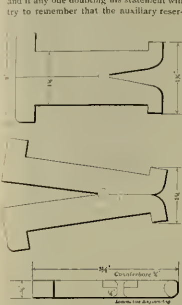
By the way, I once got up a valve-chamber bush puller, which we believe to be the thing here, and which seems to be even handier than the one illustrated in June, in that it will pull the bush if the upper receiving valve No. 31 has spread so it cannot be gotten out.

I am not a rival in the business and there is no patent on it, nor is it very expensive. It is made of ⅜-inch steel 1¼ inches wide, and in using it the short ends are brought together and slipped into the exhaust holes in valve-chamber bush No. 41, Plate D 6. The top part is then shut, and any open wrench, fitting valve-chamber cap No. 29, Plate D 6, or an alligator wrench, is placed under the projecting upper ends

and used as a lever. We have never known it to fail and I should have sent it sooner but had an idea I had done so. Of course, the edges are rounded off to fit 1¼-inch bore.

THE VALUE OF QUICK ACTION.

I must say Mr. Synnestvedt struck the mark in grand shape in his June article on the quick-action brake. Being pressed in my work, I had not realized what the May article meant until I saw his answer, which certainly ought to be satisfactory, and if any one doubting his statement will try to remember that the auxiliary reser-



voir pressure is in the nature of a fulcrum on which the quick action works, that it can only work when both brake-cylinder and train-pipe pressures are lower than auxiliary reservoir pressure, and that it requires generally thirty seconds for auxiliary to recharge from fifty to seventy pounds, they would tender him a vote of thanks for wakening them up.

GEORGE HOLMES.

*Roanoke, Va.*

### Why Didn't This Pump-Governor Act?

*Editors:*

A few weeks since one of the new model engineers' brake-valves with pressure reducer was put upon an engine by a representative of the Westinghouse Co., and a new pump governor, known to be adjusted to cut off at 90 pounds, was put on at the same time. The engine was run a week or more, but engineer complained that the governor did not appear to be of any use. This is the way it acted. Starting at zero, and pumping up, with brake-valve handle in running position, the red and black hands traveled together until 70 pounds pressure was attained, when black hand stopped and red one kept working up. So far, all right; but the pump did not stop at 90 pounds. It maintained the even tenor of its way until 120 pounds were stored, and had it not been stopped by engineer closing throttle, would have continued until air and steam pressure balanced. When the red hand indicated 90 pounds or more, if the handle was carried into release position for an instant, the pump would stop, but would commence work again shortly after the handle was returned to running position. If pump was started from zero with handle in release position, both hands would travel together to 90 pounds, when pump would stop. It would go to work after a little, however, if handle was carried to running position. It is but fair to state, for the benefit of those who would solve this puzzle, that there was a noticeable leak in train line under tender. On examination, the difficulty was quickly located and corrected. What was it?

CLARK L. PIERCE.

*St. Albans, Vt.*

### Some Odd Actions in Air-Brakes.

*Editors:*

I recently had a little experience with air-brakes that may be of interest to readers of LOCOMOTIVE ENGINEERING.

While looking over some freight cars my attention was attracted by an escape of air at the pressure-retaining valve. My first thought was that the emergency-valve was affected, but in this I was mistaken, as the trouble was not in the triple at all. When the brakes were applied the escape discontinued. This car was equipped with the Westinghouse standard freight brake.

I found a small hole in the pipe that runs through the auxiliary reservoir to connect that chamber with the brake-cylinder. It is said that these pipes have been known to burst or split occasionally, and in such cases the cylinder becomes part of the auxiliary reservoir and the brakes will set the moment the air is let into the auxiliary.

On another train I had brakes applied by a 20-pound reduction, service application, and, finding that the piston on the first car had a travel exceeding 8 inches, I closed the cut-out cock in the cross-over pipe and opened the drain-cock to auxiliary reservoir to effect a release of this brake without disturbing the rest. Instead of the triple responding instantly, it remained motionless for about five seconds and then moved, opening the exhaust-port and allowing brake cylinder piston to drop back about an inch and a half; when it closed the exhaust-port again, held it for about two seconds and again opened it, allowing the piston to drop back again about another inch and a half. The triple repeated this action two or three times until the piston reached the leakage groove when, of course, the brake came off. This car was equipped with the Westinghouse passenger brake.

I do not know exactly how to explain this action, and if any other air-brake men have met with the same experience I wish they would tell what they think causes it. In my estimation, there would have been no such action had an emergency application been made. The brakes were applied, service application, with a 20-pound reduction. The emergency-valve was defective, and after closing the cut-out cock and opening the drain-cock, the air in the train pipe, being of small volume, would leak through the defective emergency-valve faster than through the auxiliary drain-cock, thereby causing a variation in the pressures that were in communication with each side of the piston No. 5 in the triple. The check-valve No. 15 in the meantime acted, I suppose, upon each variation of pressure.

J. V. K. WALKER.

*Portsmouth, Va.*

### Defects of Air-Brake Cars—A Plan of Report.

*Editors:*

As almost all railroads are equipping their freight cars with air as fast as they are rebuilt, I would like to say there is no use in having air-brakes unless they are taken care of, especially air-hose and triple-valves. Keep good hose on cars and clean triple-valves once in a while.

In almost every train of fifteen or twenty air-brake cars there will be two or three air-hose burst in going over a division and they almost always burst between stations, so that the train will stop in about the length of itself; or before any one can comprehend what is the matter, the train will be standing still before a flag can be started back, and if there is another section following close, with no air-brakes, there is sure to be a smash-up.

You will very often see the first section with from five to twenty air-brake cars and the second section without any air-brakes. Car repairers do not repair air-brake defects, so that the air-brake car has to go until the car goes to the shop again. Car repairers will not even put hose on unless told to do so by the trainmen, and if train pipe is broken, or triple-valve will not work, they will cut car out and let it go and car will run two or three weeks without air-brakes working. You will find air-brake cars every day that can't be used on account of a broken train pipe or triple-valve not working, or no hose.

Car inspectors will not mark cars in bad order for air-brake defects; there should be some system adopted for trainmen to report defective air-brake cars, as car inspectors cannot tell without an engine attached to cars, whether they are in good working order or not. If trainmen should be ordered to mark the defective air-brake cars and also mark the defective parts same as car inspectors do the cars for other defects, I think that would be as good a plan as any, if lived up to.

FRED. F. LEE.

*Ottumwa, Ia.*

### Call Things by Their Right Names.

*Editors:*

One of your best correspondents, in speaking of eccentrics, uses the word *cam*, which is misleading. A cam is generally understood as giving an irregular motion, as in the case of the valve-gear of Western river steamers, although we get no irregular motion in the valve-gear of walking-beam engines from an ordinary eccentric. The eccentric gives a motion, but the lifters or wipers on the rock-shaft give irregular motion to the valves.

In speaking of valve-setting, the word "stretcher" is used in connection with the valve-rod. It is supposed it means a right and left thread nut, in which case it is liable to be a "shortener," but we suppose it is a local term.

The writer once had a fireman who spoke of the draw-bar between engine and tender as the "stiff shackle." No doubt but what railroad men in his part of the country knew it by that name. An old-time name for it was "draught iron," but 90 per cent. of railroad men will call it "draw-bar."

Another word that is misleading is *Babbitt* metal. Looking over the well-written "ad" of the Ajax Metal Company I see that they use the word "Babbitt." A great many persons who see a metal melted and poured into a bearing call it Babbitt, simply because it is melted in a ladle and used as a lining metal. Babbitt metal is an alloy of copper, zinc and tin, and is an anti-friction metal called after a man named Babbitt. Anti-friction metals were used before this man was born, so the word Babbitt does not signify metal. If a great many of the so-called Babbitt metals on the market were put under the "999," she would have to run through a canal to keep cool. Call it "Ajax," not Babbitt. We might pick up a cake of common soap and call it Babbitt's best, when, in fact, it was Siddall's worst. The soap the boys use here they call "Swanston's Toilet," when, in reality, Swanston knows nothing about it. Give things their right names.

W. DE SANNO.

*Indianapolis, Ind.*

### Mixing Quick-Action With Old Brakes.

*Editors:*

I know one railroad company that is equipping their cars with the quick-action triple-valve, and fixing the emergency-valve so that the emergency-valve is made inoperative until such time when they get them all equipped with the quick-action valve, when they expect to remove the obstruction and put the valves on all the cars to work at once or at the same time. They claim that a train with mixed valves, that is, some old-style and some quick-action valves, would not work together right. (I do not know what the company thinks about it, but I am told by men in the railroad service that is the reason they are doing it.) They say some cars would get more brake pressure than others and jerk the train, then again, some say they are doing it because the engines are not all equipped with the "Engineer's Brake Valve," and engineers cannot control the amount of air that discharges from the three-way cock so easily, and it is liable to make an emergency application too often, and when they don't want to. I think the last excuse or reason is the most plausible, as the ports in the three-way cock-plug run up and down, and after a port commences to open a movement of one-half of one inch opens the cock all the way.

I don't think the jerking would pull out many drawheads in making an ordinary service stop, even with mixed valves and three way-cock, on passenger trains if the engineer should use judgment in applying the brakes. I don't think the cars with the quick-action triple would stop suddenly enough for that, from the fact that the cars with old-style triple-valves would help to push them a little, and the springs that are a part of the drawhead, would prevent any great damage in that line. As railroad men know that, as a general thing, brakes are not always regulated so that they apply with the same force when the triple-valves are all the same, on account of bad adjustment of the brakes, some pistons travel nearly whole length of brake-cylinder, and some cars in a train will have six-wheel trucks with brakes only applied to four of the wheels, and other things that will cause an uneven braking of the different cars in the train, and we do hear of many complaints about trains jerking on that account.

If an engineer should be in a very tight place and want to stop in a very short distance, he would not stop to calculate how many drawheads he would pull out, he would try to prevent his train from taking a dive into an open bridge, perhaps, or landing in the middle of the other train in front of him. Then, we know that cars in a train are sometimes cut out, and in that case there is no brake on the car cut out, and a good brake on the cars front and back of it. Why would that not pull out drawheads or make a train jerk? I think it is a lame excuse to make the emergency-valve inoperative because it applies 20 per cent. harder. In emergency application of the brakes with quick-action triple-valves, the brakes will apply on twenty-five cars in the fraction of a second, while in an ordinary service stop it takes eight seconds, so you see the speed is 8 to 1 in favor of the emergency brake in time of danger.

FRED B. ARMSTRONG.

*Camden, N. J.*

### That Tank Triple.

*Editors:*

In regard to triple-valve, spoken of by Thos. Croden on page 219, I would say that piston in triple-valve being gummed up, it took quite a jar to start it, and by opening stop-cock at end of tank train-line pressure was exhausted much quicker than through engineer's valve, on account of the stop-cock being nearer the triple and no obstructions, and a large opening. Exhausting by engineer valve was more gradual and would not start the piston.

*Newark, N. J.* W. A. EAGLES.

### Wouldn't Work Automatic.

*Editors:*

I recently took an engine from shop that was using straight air on drivers and tank, but when I cut in for automatic it would work on the drivers but not on tender. Cleaned tank-triple without result, and then changed triple-valve, but still the tank-brake would not go on automatic, yet it worked straight air all right. What was the matter with it?

C. C. McMULLIN.

*Allegheny, Pa.*

### Sords and Long Not the Same Person.

*Editors:*

Your May issue contained an article signed by A. W. Long, which was written by me for the *Engineer's Journal* some time ago.

I had intended to let the matter pass,

but since you have called attention to the possibility of A. W Long and Paul Sords being one and the same person, it behooves me to refute the charge of being a repeater.

The article in question was sent to Locomotive Engineering without my knowledge or permission, and not by me

*Bellevue, O.* PAUL SORDS

## Mr. Long's Article on Air-Brakes.

*Editors*

I see a letter in the June number of Locomotive Engineering from Will W. Wood, in which he claims that the letter from A. W Long which you printed in the May number is almost verbatim copy of the article over the signature of Paul Sords, published in the *Engineers' Journal.* Is it a miracle or any great crime if two men should express their opinion in the same language, especially when speaking on the same subject? I will just say for the benefit of all concerned, that the communication which Mr. Wood refers to was written by me last November and was intended for Locomotive Engineering at that time, but I neglected sending it. This spring, after reading several air-brake articles, I decided to send my letter to Locomotive Engineering, not dreaming of the wrath to come. A. W LONG.

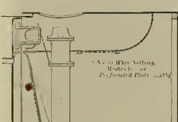
*Creston, Ia*

[All parties having now had their "say," we will publish no more communications on this subject.]

## Was It the Draft Sheet or the Engine Crews?

There has been a revival down on the old South Carolina road in the matter of saving coal. Superintendent of M. P. Roberts tried an experiment on one engine by putting in a deflector plate perforated with large openings (just as shown in iron doors for front car, illustrated elsewhere). This engine did so well that other engineers asked to have their engines equipped.

It was but a short time before most of



the men on the road were seeing how good a record they could make on the fuel report

They have shown a saving over their old performance sheet that beats any compound saving we have heard of. The men themselves say this is due to the new front end arrangement, and have induced Mr. Roberts to patent it.

While we are willing to believe good things of the perforated sheet, we are still firmly convinced that much of the saving results from the care taken and interest shown in their work by the engine crews, and that Mr Roberts holds this same view and gives his men due credit, as is proven by the posting in the roundhouses of the company of the following bulletin notice

CHARLESTON, S. C.

*To Engineers and Firemen:*

I desire to express to you my hearty appreciation, and to commend the spirit which has recently been displayed and the co-operation with myself and foreman in attaining fuel economies on this road. Our record of coal consumption in the past has compared favorably with other roads, but with the new draft-sheet and the efforts of our enginemen our record is most flattering, and is a credit to all concerned, and which can, I have no doubt, be greatly improved, which will be far in advance of the best performance of any of the compound engines that I have been able to get data from, and will result in attracting much attention from all parties interested in operating railroads Your efforts continuing in this line shall always have full measure of credit. The fuel account of railroads is greater than any other individual account of the machinery department, and on our road it is 35 per cent. of the total expenses of engines, including repairs, supplies and wages of engineers, firemen and wipers.

I can only add that I hope that all of our men will take the same interest in this fuel economy that the majority of our men are displaying, and I shall be able to show you a record that will make you all proud.

Yours respectfully,

(Signed) E M. ROBERTS, S. M P.

Men who give their engineers and firemen credit for effort and results, and not claim it all for themselves, are very apt to get their men interested in their work, and such an officer will save more money for his company per month than the inventive genius can show with all his devices in a year. There is more chance to save fuel through improvement in the men than improvement in the cylinders or valve motion.

## Reading Rooms on the Santa Fe.

The members of the Brotherhood of Locomotive Engineers have opened a reading room in the front part of their hall building on Main street, Newton, Kansas. The room is open free to the public, and is well patronized. All the leading daily papers and magazines are kept on file and all the railroad papers are to be found there.

Reading rooms are badly needed along the Santa Fe system. There used to be reading rooms at nearly all of the principal points along that system, and the men contributed money for the purchase of books and papers. One of the worst acts ever done by the late Allan Manvel was the closing out of these reading rooms. In his unscrupulous cheese-paring policy he closed the reading rooms to save the trifling expense of attendants and house room. It was a very short-sighted policy, and no doubt cost the company a great deal more than the trifling sums saved The man who throws obstacles in the way of the acquirement of knowledge sows seed that is reaped in a harvest of discord.

## An Improved Stand-Pipe.

This locomotive stand-pipe has been designed by Mr. Robert White, of Kingston, N Y, who has charge of the water supply of a prominent road.

The main improvement is in the valves, and, as can be seen in the detail cut, there are two water-valves, a large and a small one. This allows the fireman to start the water slowly, obtain a full open pipe, and, when his tank is nearly full, close the large valve and fill the tank full, without running over, by using the small valve only.

To the valve-stem is attached a piston, as shown, that prevents the too sudden opening and closing of the valves

A safety-valve prevents the ram of the water, when valve is shut quickly, from rupturing pipe or fittings.

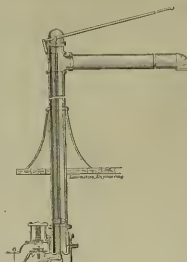
All the valves have hard rubber faces or seats, that last a long time and are easily removed and replaced.

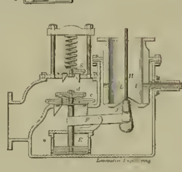
As might be expected of a practical man, this stand-pipe is designed to stand all kinds of repairing with the least trouble and expense and the shortest possible interruption of the water supply. No pipe joints need to be disturbed to refit it throughout, a hand-hole covers every part that needs to be get-at-able.

The base of the upright pipe turns on rollers or wheels, and in bringing the pipe into position for use it is raised considerably, and when released returns by gravity to its proper position.

The drain-cock is ingenious, and is shown in detail cut. A hole in the stand-pipe is brought opposite a pipe fitted with a spring packing, that keeps a bush pressed solidly against the column, allowing any water in the pipe to drain into pit. When the pipe is turned around for use the joint between it and the drain-pipe is broken.

Since these engravings were made the





inventor has designed a flexible joint, that allows the horizontal pipe to be depressed to any height of tank without the use of sacks.

The Joseph Dixon Crucible Co., of Jersey City, N J., have sent out a statement saying that their graphite paint is a sure remedy against the seven paint destroyers mentioned by Professor Dudley For further testimony under this head, we refer interested parties to the Dixon Crucible Co.

An order has just been received by the J A Fay & Egan Co., of Cincinnati, O., for a large lot of machinery to go to Padang, Sumatra, Dutch East India. This firm has recently issued a very handsome business card containing handsome engravings of the works of the company in Cincinnati The card also contains imprints of a great number of medals received by the company as prizes at the various exhibitions where their well-known wood-working machine has been shown

## Organization of Air-Brake Men.

The men who keep up and care for the air-brakes of our railroads have been talking for some time of forming a little association of their own, and, pursuant to a call issued in Locomotive Engineering for May, a large number of them met in Pittsburgh, Pa., on June 8th, and perfected an organization to be known as "The Association of Railway Air-Brake Men." The object of the association is briefly stated as "The uniform instruction and improvement of the air-brake service on the various railroads" A laudable cause for life and good reason for their encouragement

The following officers have been elected for the ensuing year

*President*—Robert Burgess, L. & N Ry., Louisville Ky.

*First Vice-President*—C C. Farmer, M K & T Ry, Parsons, Kan

*Second Vice-President*—S D Hutchins Big 4 Ry, Columbus, O

*Third Vice-President*—R N Martin, P R R, Renovo, Pa.

*Treasurer*—Otto Best, L & N Ry Nashville, Tenn.

*Secretary*—P. J Carney, M, L S & W, South Kaukauna, Wis.

It has been decided to leave the books of the new association open until September 1st, to enable any air-brake men who care to do so to become charter members

The cost will be small and the exchange of ideas, plans and kinks will be worth more than all the time and trouble taken by the association

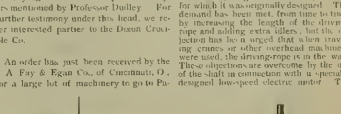
The only tendency of such a combination of men is to educate, to make them better mechanics and better able to care for the equipments in their charge, they should be encouraged by every railroad officer in the land

Notices of the work in hand, meetings, etc, will appear from time to time in these columns

## Electric Motor for Stow Flexible Shaft.

One of the handiest things around a railroad shop, especially the boilershop, is the Stow flexible shaft, so well known In a recent circular the Stow Mfg. Co. say

"There has been a growing tendency to increase the range of this tool beyond that for which it was originally designed This demand has been met, from time to time by increasing the length of the driving rope and adding extra idlers, but the objection has been urged that when traveling cranes or other overhead machinery were used, the driving-rope is in the way. These objections are overcome by the use of the shaft in connection with a specially designed low-speed electric motor The company has had this combination under consideration for two years, and now offer an electric portable drilling, tapping and reaming plant that can be carried to any distance from the source of power This motor has a normal speed of about 600 revolutions, which can be increased by a rheostat to 1,000 and 1,200, and reduced by gears to 275 without loss of power. These motors are for a voltage of either 110, 220 or 500."



ELECTRIC MOTOR FOR STOW FLEXIBLE SHAFT

On June 10th a large party of railroad men, doctors and newspaper men went over the line of the New York, Ontario & Western road to the summer resort at Liberty, in the mountains of Sullivan County, N. Y. The train was a new one, just from the Ohio Falls Works, and was pulled by the "140," an engine exactly like the one illustrated on page 197, of May. These moguls are exceptionally good engines for heavy traffic, and are extraordinarily alive on the start. It was for one of these that the claim was made a month ago that she ran a mile in twenty-five seconds. When interviewed on the subject General Manager Childs is reported to have said. "Well, we haven't got such large drivers as the Central, but, by gracious, we've got just as big a liar." A mile in fifty-five seconds was the best speed on the 10th. The new cars are very handsome and convenient. They are finished in oak, have Hale & Kilburn seats, Consolidated Company's steam heat, with Baker auxiliary; Frost lights, Gould couplers and vestibules, with brass handrails, Westinghouse brakes and signals. The "Ontario" does a big summer business, and should do more, for it runs through a beautiful country.

THE RECENT FLOOD AT MEADVILLE, PA. THE ERIE ROUNDHOUSE.

THIRTY-ONE INCHES OF WATER IN MEADVILLE SHOPS OF THE ERIE ROAD. MAY 16, 1893

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It was Master Mechanic E. M Roberts who was commenting to an appreciative audience on the remarks made by Mr Sampson Fox on steel making. "You see, don't sher know," said Mr. R., "It's in the way the bloom is handled that the quality of the steel depends. If you roll the bloom as it is poured you have a pore plate, but if you take the bloom and hammer it and work it properly, your sheets will be a blooming success." We disclaim all responsibility for the quality of the alleged jokes.

# Car Shops and Car Builders.

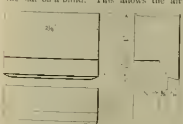
## South Carolina Fruit Car.

Words are hardly necessary to describe the car shown in the splendid engraving herewith.

This line of fruit cars was designed and built by E. M. Roberts, superintendent of motive power at the Charleston shops, and as they are properly marked, the length, weight, age and kind of attachments used are shown on the side of the car.

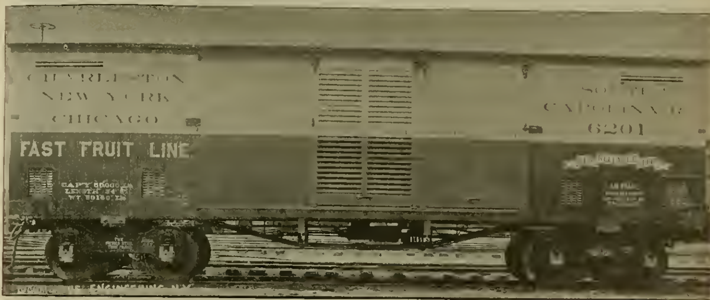
The upper half of the body is painted white, the lower half black.

A solid or ventilated door can be used at will, and there are four ventilating slides in the sides of the car. These slides are made of ⅛-inch iron, and are perforated, but the perforations are not cut entirely out, but are cut at the bottom and sides and the piece turned out, something like the slat on a blind. This allows the air to circulate, but prevents, in a large measure, the accumulation of sparks.

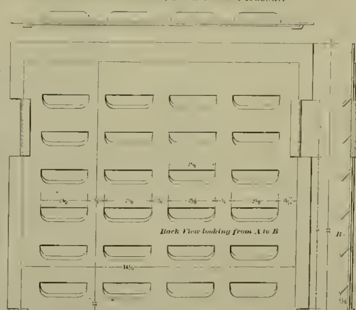


We also show a cut herewith of the punch used in making these perforated doors.

The car has Standard couplers, with Butler attachments, New York air-brakes, Hutchins roof and Fox pressed steel truck with 4 x 7-inch journals.



NEW FRUIT CAR, SOUTH CAROLINA RAILWAY.




## A Mechanical Oil-Box Lubricator.

Another form of the roller device for carrying the lubricant up to the journal of a car has been patented, this time by Mr. William H. Daniels, of St. Louis. We are sorry for Mr. Daniels. Not because he is an inventor or because there is any structural defect about his lubricator. Our sympathy pours out to him on account of circumstances over which he has no control, which will prevent him from making a commercial success of his invention. The invention is remarkably well worked out. It is a roller held up to the journal with spring arms, the stand of the apparatus being substantially secured by brackets cast on the oil box. If this invention were applied to the oil boxes of a car, it would work splendidly and give the journal just the quantity of oil necessary for lubrication. If a car inspector was to accompany the car so equipped over this whole continent he would find that the car would run cool with the smallest possible waste of oil. It would probably require no attention whatever in running from Maine to California, only the presence of an inspector would be necessary to prevent some blunderer from destroying the whole thing.

Car-box oilers entertain no malice towards patented lubricators, but this class of men are not leisurely and careful enough in their habits to suit the requirements of roller oil-box lubricators. When a car with these things in its boxes arrives at an oiling station, the man with the dope bucket knocks open the lid of a box, and not seeing any waste, jams in a supply with his battering ram. If any great resistance is offered, it is good day to the mechanical lubricator, for the dope man swears that some stupid cow has left half of a brass in the box, and if a jerk from the hook will not pull the thing out it is hammered in, even if the end of a pinch-bar has to be employed.

An improved axle-box lubricator is badly wanted, but it will never be a success until the dope man accepts the gospel of letting strange things alone, or looking before he leaps—at the end of a pinch-bar.

## Disputes in Car Exchange.

The Hannibal & St. Joseph rendered a bill against the Missouri Pacific for replacing coiled draft springs and charged 5 cents a pound for the same in accordance with M. C. B. rule 26, of 1891. The M. P. disputed the bill and said that manufacturers' prices ought to be charged. The Arbitration Committee decided that the charge was correct.

A dispute arose between the Union Pacific and the Northern Pacific in car interchange on a case which has repeatedly been brought before the Arbitration Committee under slightly different forms. The U. P. rendered a bill based on a defect card issued by the N. P. calling for one intermediate sill cracked. Charge was made for manufacturing the sill besides the 3 cents per foot for material and the twenty-nine hours for labor allowed under the M. C. B. rules. The N. P. disputed the charge made for manufacturing the sill and the position was sustained by the Arbitration Committee. Railroads belonging to the M. C. B. Association ought to understand by this time that they will not be sustained in charging more for repairs than the scale laid down in the Rules of Interchange. It is no use to say that the actual cost was greater than the sum allowed. There is a hard and fast rule and the Arbitration Committee will abide by it every time.

An interesting case came before the Arbitration Committee in a dispute between the Southern Pacific and the Chicago & Northwestern. An S. P. box car was given to the C. & N. W. at Council Bluffs, carded for 2 deadwoods, 3 draft timbers, 1 intermediate sill and 1 center sill, 1 end door-rail, 1 end door guide, 1 side door-stop split, 1 side and 1 end facia pierced, 12 end boards, 2 center plate-bolts, ends of 14 boards broken, mixed brake beams, 2 brake-beams cut, 30 side boards scraped, and 1 side sill half broken. The C. & N. W. accepted this car, and it broke down in the train and caused the destruction of the body. The C. & N. W. then asked the S. P. for permission to charge for defects mentioned in the card, to be deducted from the price of the body. The S. P. would not agree to this, and made a charge for the value of the car, less the regular deduction under the rules for depreciation. The C. & N. W. would neither agree to this nor to the referring of the case to the Arbitration Committee, which indicated consciousness of a weak case. The S. P. sent the case to the Arbitration Committee, however, and the latter decided that there was no authority for the deducting the cost of carded defects from the value of the car body. The car was evidently unsafe to run, and the C. & N. W. did wrong in accepting it.

The Central Railroad of Georgia sent a bill to the Norfolk & Western for the expense of renewing a Hinson car-coupler, for which the latter road had issued a card. The coupler was changed a year after the card was issued. The Norfolk & Western refused to pay the bill on the grounds that when a car is safe to run none but owners have the right to replace a draw-bar to bring it back to the original standard. The Arbitration Committee held that the bill should be canceled.

A curious dispute between the Missouri Pacific and the Burlington & Missouri River, was lately appealed to the Arbitration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In the use of Galena Oils there is an entire freedom from hot boxes, except when these are caused by mechanical defects.

The adoption of Galena Oils as standard railway lubricants by a large majority of the leading railways of this country is an evidence of their superiority, while the fact that the same roads use these oils to-day that used them more than 20 years ago, is an evidence of their uniformity from year to year and year in and out.

Galena Oils are in exclusive use upon three continuous lines from Boston and New York to the Pacific coast, and upon one continuous line from the City of Mexico to New York, thus demonstrating their adaptability to all temperatures and climates. Being entirely free from gum, these oils are not affected by dust and sand as other oils are.

We also furnish our customers SIBLEY'S PERFECTION VALVE OIL, which is also used exclusively upon a majority of the leading railways of America.

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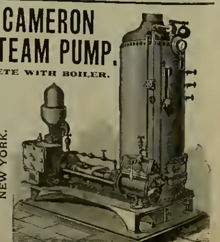
## THE CAMERON STEAM PUMP.

COMPLETE WITH BOILER.



THE A. S. CAMERON STEAM PUMP WORKS, Foot of E. Twenty-Third St., NEW YORK.

Send for Illustrated Catalogue.

Committee. A car belonging to the latter road lost an end door when on the M. P., and the road issued a defect card, so that the car could be returned to the owners. The owners charged $3 for replacing the door, the sum specified in the Rules of Interchange. The M. P. objected to this charge on the plea that the door used was cast-iron and that the charge ought to be made by the pound rates for that material. The Arbitration Committee decided that as the rules allowed $3 for an end door, that charge was correct, no matter what material might be employed.

A dispute arose between the Southern Pacific and the Chicago, Milwaukee & St. Paul over an odd question. The former company carded a car belonging to the latter for "one foreign cast stem draw-bar complete." On making the repairs the owners sent a bill charging for the expense of a new draw-bar, and crediting the S. P. for the old one. The S. P. claimed that they had a right to be credited with certain pieces of wrought-iron scrap used as attachments to the draw-bar removed. The Arbitration Committee decided otherwise.

A dispute that has been repeatedly decided by the Arbitration Committee again arose between the Nickel Plate and the Lake Shore. A car belonging to the former road was destroyed on the latter, and a claim for the full value of the car, less ten months' depreciation, was made. The car had been thoroughly rebuilt ten months before, and it was considered fair to regard it as new then. The L. S. people thought otherwise, and wanted the age of the car reckoned from the time it was first built. The Arbitration Committee sustained the position taken by the L. S. Company.

One of the most fertile causes of dispute in the interchange of cars, is the practice of accepting cars having defects that ought to be carded, and then trying to trace back the responsibility. A case of this sort arose between two Western roads and was again referred to last meeting of the Arbitration Committee. The Ohio & Mississippi rendered a bill against the Missouri, Kansas & Texas for the cost of twenty-three journal bearings placed under M., K. & T. cars. The claim was made under the M. C. B. rule which permits charge to be made for brasses worn out. The M., K. & T. held that the cars had been on the road only two weeks, and that therefore the brasses could not be worn out. The O. & M. answered that the brasses were not worn but burned out, yet that they were entitled under the rule to make the charge. This was disputed and the case went to the Arbitration Committee. They decided that as the brasses were in bad shape when the cars were received by the O. & M., defect cards should have been required. The rule relating to payment for worn-out brasses did not cover the case and the charge was not sustained.

### An Improvement.

One of the most thorough revolutions that we have ever witnessed in a manufacturing establishment has taken place within the last six months in the works of Rood & Brown, at Lancaster, N. Y. Mr. E. Chamberlin, the well-known master car-builder, took charge at that time and he went to work cleaning up and reorganizing things till he has now one of the neatest and smoothest running works in the country. They have kept turning out work while the improvements were going on, and the capacity is now materially increased, but still behind the requirements. They have introduced the use of gas for heating their annealing furnaces and for their coal ovens with very much saving of time and expense. They are engaged mostly on railroad work, malleable iron car couplers forming a large part of their output.

### New York to Chicago in Twenty Hours.

The New York Central Railroad Company began running on May 28th what they call the Columbian Exposition Flyer, which covers the distance of 966 miles between New York and Chicago in twenty hours. A representative of Locomotive Engineering was one of a party of journalists and others who were the guests of the railroad company on the first run. The train started promptly on time and every stopping point on the long journey was reached a minute or two ahead of time, the terminus at Chicago having been reached three minutes before the train was due. All along the route crowds of people were watching to see the train pass, the population alongside of the lines traversed evidently realizing that the train marked a new era in passenger transportation.

From Instantaneous Photo Taken Near Elkhart, Ind., by A. J. Horton. Train Running Over Sixty Miles per Hour.


Gould Vestibule, With Folding Steps and Leonard Hydraulic Buffers.

The putting on of this splendid train service is a very important event, since it enables a man to attend to his business in New York one day, travel to Chicago and be there during business hours, then return home in time for business the following day. It practically saves a day for a man who has to go to New York from Chicago, or the reverse.

The train was worthy of marking a new era in railroad passenger transportation, for all previous efforts had been surpassed to secure luxury and comfort for the passengers. The regular train consists of four Wagner coaches. The first is a combination car containing baggage-room, smoking apartment equipped with easy chairs, a buffet equipment, a library, a barber's shop and bath-room, besides lavatories. The three other cars are sleepers, two of them having large state-rooms, which reduce the main body of the car to ten sections. One of the cars has sixteen sections. All are finished in mahogany elaborately carved and the inside is very artistically decorated in designs specially prepared for these trains.

Striking novelties about the cars are the vestibule, the movable car steps and the hydraulic buffer, these improvements having been invented by Mr. A. G. Leonard, secretary to Vice-President Webb. The buffer, which also acts as a rubbing plate, extends across the whole platform, and is held up against the buffer of the other car by hydrostatic pressure. It is so arranged that the water pressure becomes an equalizer, and maintains an even pressure on the rubbing plate all the time. In rounding curves there is always a rubbing surface extending from the coupling or center to the end of the plates. The effect of the arrangement is almost entirely to eliminate the vertical and lateral shocks, the cars riding as if the whole train was one long car.

The platforms extend almost to the outside line of the cars, room merely being left for the width of the steps, which are folded up when the train is in motion, making a platform floor as wide as the car. The arrangement can be readily understood by an examination of the annexed engraving.

The vestibule has already been applied by the Gould Car Coupler Company to a great many cars, and is well known to travelers as the finest vestibule in use.

The train started promptly at 3 P. M. After getting through the long tunnel and over the various obtacles to high speed in the suburbs of New York, the engineer got into the regular swing of about sixty-five miles an hour, which has become familiar to those keeping the Empire State Express on schedule time. When we got clear of the city most of the newspaper men began making notes of the speed. There seemed to be a vague expectation that something striking would be done. Mr. M. N. Forney was one of the men most keenly interested at first. He alternately gazed at his watch and took notes of the time between stations, while Mr. John Player, of the Santa Fe, called off the passing points. Presently the practice got monotonous, the speed of fifty-five seconds to each mile being tiresomely uniform. Then Forney shut up his note-book with an emphatic snap and leaned back in his chair.

"What's the matter, Forney?" queried a friend.

"Well," he replied, "I feel concerning this train's speed as the man did about the minister's sermons. He always went to sleep at the beginning of the sermon, giving as his reason for so doing that he was perfectly satisfied as to the soundness of the preacher's theology. I am ready to sleep and agree to whatever speed any of you fellows may say we have made."

The spirit throughout the train was of perfect faith that the managers of the Vanderbilt lines could run trains at any speed they wanted, and that they would make the time promised. After the first hour it was rare to see any person watching the speed, although those who had not been accustomed to fast riding could not understand that a train going along so smoothly could be maintaining extraordinary velocity.

The engines that hauled the train were of the "800 class," particulars of which are well known to our readers, owing to the numerous illustrations and descriptions we have given them. They are eight-wheel engines with cylinders 19 x 24 inches, the driving-wheels 78 inches diameter. Handling these light trains is away below the capacity of the engines in ordinary weather, but the margin of excess power becomes very convenient in tempestuous weather, for no storm has ever been wild enough to prevent the Empire State Express being taken through on schedule speed. An extraordinary test of the endurance and steaming capacity of these engines was made when the "999" was run on the Empire State Express from New York to Buffalo, a distance of 440 miles.

The engines on the Flyer were changed twice on the New York Central—at Albany and at Syracuse. A slight ripple of excitement was present on the train on part of the last division where the phenomenal speed is usually made. The engineers of the train were remarkable for the uniformity of speed maintained, but the man running the engine into Buffalo could not forego the pleasure of showing off the capabilities of his iron steed. A few miles east of Batavia he tried what horsemen call a spurt, and covered 25 miles in 21 minutes and 26 seconds—an average speed of 70 miles an hour. One mile was made in 43 seconds—a speed of 84 miles an hour. The average schedule speed of the train from New York to Buffalo, or for the same class of train in the reverse direction, is at the rate of 50.3 miles per hour. On the Lake Shore the average speed for the distance of 530 miles is 47.1 miles per hour. The entire distance of 970 miles being made in 20 hours gives an average speed, including stops, of 48½ miles per hour.

The train does not run into the Union Depot at Buffalo, but passes through a cut-off at East Buffalo, thus avoiding the delays incident to the crowded yards. Here the train was coupled to a Lake Shore engine that looked very insignificant compared with the New York Central machines. Keen interest was manifested

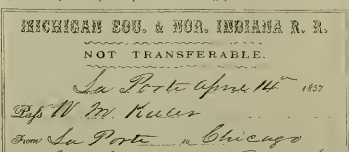
by the railroad men on the train to see how the small engines would handle the fast train. They proved quite equal to the work to be done, and reached every stopping place with a few minutes to spare.

The Lake Shore & Michigan Southern is a remarkably fine line for fast running, as there are no curves worth mentioning and the gradients are nearly all less than sixteen feet to the mile. The new engines built for this road to run the Flyer have cylinders 17 x 24 inches, driving-wheels 72 inches diameter and a boiler 52 inches diameter at the smallest ring, providing a total heating surface of 1,413 square feet. A working boiler pressure of 180 pounds to the square inch is carried. The total weight of the engine in working order is 104,600 pounds, of which 65,100 pounds are on the drivers. The general appearance of the engines will be understood by an inspection of the engraving shown in this issue. The engines have every appearance of skillful designing and careful construction. The proportions of cylinders and driving-wheels give 93.3 pounds for every pound of pressure in the cylinders and 14,735 pounds of tractive power when working full stroke, and reckoning 85 per cent. of the boiler pressure as mean effective pressure. The co-efficient of adhesion is 4.4—a low proportion, but likely to be sufficient for an engine that has little starting of trains.

Pittsburgh Compound Eight-Wheeler. Now at World's Fair

The question has frequently been asked the writer since this first train was put on running between New York and Chicago in twenty hours, What did you learn about high speed on the trip? Our readers may also feel like asking the same question. The answer is that it is just as easy to keep up an average speed of fifty miles an hour for 1,000 miles as it is to do the same thing for 100 miles, if the necessary equipment is provided and the track kept clear. The impression imprinted by the trip was that the railroad companies could easily shorten the time one or even two hours if they were inclined to make a great effort.

It may be seasonable to add that the Flyer is already a very popular train. While the number of people going to see the World's Fair is very far behind the expectations of railroad managers, and few people going to the Fair patronize the Flyer, the business men of New York and Chicago are giving it liberal patronage, so much so, that it is already said to be the best filled train running between the two great cities.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Machinist La Porte Shop

A. Beury Master Machinist.

An Old-Time Pass. A Keepsake of W. M. Keeler of the Journal Oil Co

## Mineral Wool.

Railroad companies are extensive users of asbestos, but few of the men who handle the material have a very clear knowledge of what it is. The most extraordinary thing about asbestos is its resistance to destruction by heat, and this constitutes its most valuable quality. Although its extensive use in the arts is quite recent, asbestos was well known to the ancient civilizations, but was used for different purposes from what it is now generally devoted to. A very fine quality of fibrous asbestos was called amianthus by the Greeks, meaning unpollutable. They made this material into shirts, and it was a great luxury in this garment, because it could be cleansed by being put on a fire. The cleaning process was done so seldom in these days that nothing short of a fiery ordeal was considered effectual.


Pittsburgh Compound Mogul Now at World's Fair

Asbestos is a silicate of magnesia, and generally contains about 40 per cent. of silica, 40 per cent. of magnesia, and 20 per cent. of lime, iron, alumina and water. The finest of the supply used to be brought from Italy, but this continent now furnishes asbestos that is equal to the best found anywhere, the most select part of the supply coming from Canada.

Asbestos is not considered valuable unless it is suitable working with twisted fiber for the making of cloth and rugs that are used in places where there is danger from fire. The waste left over from the long fiber is converted into packing cement, and the various other forms in which asbestos is used.

In some parts of the country there are large deposits of inferior asbestos which does not have fiber long enough to utilize for spinning. Efforts have been made to utilize this sort of asbestos for making brick arches and for similar purposes. It does not appear to be adapted for the functions to which fire-clay is usually applied, as it disintegrates under a comparatively low heat.

The introduction of asbestos has been of great service to the engineer and to the architect, but there is a tendency to use the material for purposes that it is not adapted to. Because it does not burn, the assumption is made that it will endure any temperature, which is not correct. Asbestos is also employed for a great many purposes for which mineral wool and other cheap substances are just as suitable.

W. G. Wattson, division superintendent, and Jos. B. Stewart, superintendent of telegraph and signals of the West Shore road, have recently invented a signal system for tunnels. One of these plants is in use in the Weehawken tunnel (4,200 feet long), on the West Shore. Every 100 feet there is an electric lamp. These are placed on a line with the engineer's eyes, the tunnel is divided into two sections, and the lamps operated by a track circuit. When an engine goes into the tunnel the outside lamps—lamps are strung 500 feet outside of each end—are put out, as well as those for 300 feet inside, and also every other lamp for 900 feet more. As the train proceeds there is 1,100 feet of lamps that are out, or at danger, behind it. Lighted lamps mean safety; lamps out, danger—stop. The circuit passes through the nearest signal towers, so that at any time the operator can put the lights out in any section or all sections of the tunnel, thus stopping all trains.

Pittsburgh Ten-Wheeler. Now at World's Fair

## An Unjust Rule.

The extreme reluctance of the Master Car Builders' Association to deal with questions which have not been calling urgently for settlement was very well illustrated at last convention when the question was presented for discussion "In case of vertical knuckles being worn out, would it not be proper to class them with brake-shoes and brasses, the owners being responsible?" The question is timely and the voice of the association ought to have been expressed upon it. These knuckles are wearing parts, and the owners are as much entitled to renew them as they are entitled to bear the expense of renewing brake-shoes and brasses. But the fact is that no rule has ever been so unpopular as that which made owners of cars responsible for the renewing of brake-shoes and brasses when the car is away from home, and the members of the association did not feel inclined to add another source of annoyance, dispute and injustice.

The rule which holds the owners responsible for the renewal of weakening parts when a car is away from home, works entirely in the interest of those who are inclined to act unjustly towards their connecting lines. A case came to our notice lately where a car was sent by its owners in New York State to Pittsburgh, expecting to get it back within a month. After it was away about a year a claim came in from Denver for renewal of brasses and brake-shoes. Then another claim came in from Las Vegas, N. M. Meanwhile, a chaser was searching for the car, and discovered that it had been wandering about in nearly every State in the Union. It was bad enough for the owners to lose the use of their car by fraudulent practices, and it seemed a satire on fair dealing to ask them to maintain the wearing parts when other roads were using the car illegally for their own benefit.

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One of the attractions of Lakewood, N. Y., as a place for holding conventions is the pleasure and amusement afforded by the fine Chautauqua Lake. The people who go to conventions have about as much liking for water as ducks, and their acme of enjoyment appears to be boating and fishing. The pursuit of the favorite enjoyments sometimes calls for a good deal of personal sacrifice. One party of about twenty persons made a start one morning about 3 o'clock and fished with great persistance till mid forenoon. All the idlers about Lakewood were at the landing, expecting to see heavy proceeds of the long endeavor. They were rewarded with some amusement, for the total was one fish about three inches long. The unerring skill of brother Krauth had saved the party from being whitewashed.

The system of steam heating was fairly successful in passenger trains last winter, yet we learn that a great many private cars, the owners of which adopted steam, are now being fitted with the improved form of Baker heater.

# ?A. What You Want to Know. ?A.

**Don't ask questions that simply require a little figuring to determine; make each question separate. No notice taken of anonymous questions.**

(75) J. L., Savannah, Ill., writes

Will you please explain to the Savannah Machinists' Lodge why the left side driving-wheels have flat spots before those on the right side? *A.*—If this is true in more than one case we do not know the cause of it. Think it will be found in one class of engine or under some peculiar circumstance only.

(76) T. W. Boyle, Long Island, asks

I would like to know the proper way to tell which side blows of a Richardson balance-valve, when a spring is broken, without taking off the steam-chest covers, also, of what use is the hole in center of the said valve? *A.*—By covering ports with valve and using steam a heavy blow will occur through hole in top of valve to exhaust port. The hole is put there to relieve the valve of pressure if any slight leak should occur.

(77) J. E. S., Mobile, asks

Having read the article of J. C. Miller in May, upon setting eccentrics before placing wheels under engines, I would ask what would be the objections to using your eccentric instead of template as shown; and why does he scribe circle equal to travel of valve? *A.*—It is always better to use a template to measure by than work laid out by the template; it is handier and there is less liability to make errors. The valve travel circle is drawn so as to determine point of cut off, etc.

(78) Gobo, Auckland, New Zealand, asks

1. Can you tell me how much an engine will increase her lead when hooked up close to the center, when she has, say, ⅛-inch lead in full stroke? *A.*—This all depends on the length of the eccentric rods or blades, the shorter these are the more the lead will increase as the links are hooked up. In this country we have some engines with less than 30-inch eccentric rods that increase their lead from $\frac{1}{16}$-inch in full gear to ⅜-inch at 6-inch cut-off; engines with rods about 80 inches long scarcely double their lead. 2. Does an engine with a stationary link increase lead by hooking up or not? *A.*—No; lead remains constant. 3. Are there any Joy gears in America; could you illustrate them? *A.*—There are only three or four locomotives with Joy gear in this country. 4. Could you give me a record of the accidents caused by drink and by excessive hours of duty? *A.*—There is no record of the *cause* of accidents kept in any country that we know of; the two mentioned are well up toward the head of the list.

### Novices in Sleeping-Cars.

The travel to the World's Fair is giving a great many people experience of sleeping-cars who never had been inside of that kind of car before. An observant man hears and sees a good many funny things said and done by the unsophisticated folks who are gaining their first experience in sleeping-cars. During a recent journey in Iowa the writer was greatly amused with a party of men, women and children who took possession of the sleeper. They appeared to have brought a large part of their household goods along and enough provisions to feed the party during a two weeks' stay at the Fair. On entering the car they began depositing their loads on the seats that were freest from impediments, and my section was quickly filled up till it looked like a pawnbroker's shop doing a thriving business. My head looked like a jack-in-the box peeping out of a case formed of sachels, bundles, rugs, cages and paper boxes.

The party comprised several men and matrons, a number of girls verging on womanhood, some three-quarter grown boys and a lot of promiscuous children. The girls began at once to exclaim about the wonders of the car, and one, who was particularly ill-bred, never ceased to shout revelations of her ignorance and want of sense. When the porter began making up the beds she giggled incessantly, and yelled remarks about how different he did things from what they did "to hum."

Not liking the idea of being pinned into a corner by other people's baggage, I mildly requested that the owners take their goods and chattels to their own seats. This appeared to give general offense, and scornful glances were darted at me from many eyes. Shortly afterwards, I went to the smoking-room and there met one of the men of the party and had a pleasant chat with him, giving some suggestions about sleeping-car etiquette. When we returned to the body of the car, he vindicated me to his friends by shouting loud enough for all in the car to hear "The old idiot is not such a bad fellow, after all! He told me how to dispose of my clothes when going to bed."

This was Uncle Ralph. He now became the oracle of the party on how to proceed in a sleeping-car. He explained what I told him—that there was a hook at each end of the berth where clothes could be hung, and a net extending the whole length for holding small articles. The first decided excitement of the evening was caused by a bevy of the women taking possession of the men's lavatory. With some difficulty they were turned out of that place by the porter. When the party began to retire, questions were showered upon Uncle Ralph:

"Oh, uncle, where can I put my bonnet? Uncle, shall I put my shoes in the net?" One girl asked her mother in a penetrating whisper to find out where the article was deposited which Byron refers to in the lines:

"They searched beneath the bed, and there they found—
No matter what, it was not what they sought."

But the most general interest of the people in the car was manifested when a young fellow reached over the rail of an upper berth and called out "Uncle Ralph, shall I take off my pants?" On the answer being in the affirmative, scarcely less fun was caused by his further question, "But how will I get them on up here in the morning?"

The party was up before the lark in the morning, full of chatter about the experiences of the night. They were getting accustomed to the strange surroundings, and the only bad breaks made were—one of the men sitting on the front of the bed changing his linen and a young matron using one of the basins in the gentlemen's wash-room to wash a child's soiled linen.

When the berths were made up, the materials for a princely breakfast were drawn from hampers, boxes and bottles. Fun and good humor prevailed and the experiences of the first trip in a sleeping-car are likely to form the subject of many a story for years to come.

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A correspondent writes asking if the report, published in the *N. Y. Press*, that an Ontario & Western locomotive ran at the rate of 144 miles an hour, on the 25th of May, is true. We think the daily press reporters are a little intoxicated on the 100-mile-an-hour elixir. It has never been made yet—except on paper.

### The Rise and Fall of the Erie Foremen's Mutual Admiration Society.

"A long time ago," said the Erie man, reflectively, "but not so darned long ago, either, we had a comical thing happen in the Jersey City shops.

"One of the foremen who had been located at an out station was ordered into Jersey City and given another job.

"His duties concerned the roundhouse work, which gave him some time to loaf in the shops and chin the other foremen.

"This man conceived the idea of forming an association of the road's foremen, as he said, for sociability and good fellowship.

"He named his idea to old man Boyle, the boss boilermaker, and Boyle at once said it was a good scheme, and added that the occasions of meetings could be made pleasant by a little presentation of something from the association to some one who had done something to make things pleasant.

"The old man proposed that they all meet the next day at noon. This suited the father of the order.

"Boyle was a dry old Scotch joker, and he at once went to all the foremen, put them on to the racket, and collected four cents from each to get a present for the founder of the Mutual Admiration Association.

"The next morning, at 11 o'clock, he slipped out, and returned in half an hour with a new Knox hat-box under his arm.

"When the whistle blew, the foremen, one by one, dropped into the boiler shop, and the father of the M. A. A. caught sight of the box, gave a shrewd guess where it was going, and kept in the background with commendable modesty.

"They had just got together when Master Mechanic Vreeland wandered into the shop, and was at once in a quandary as to the cause of the meeting, while strikes and demands for more pay flitted across his mind.

"But Boyle was equal to the occasion. He went right over to Mr. Vreeland and told him just what had happened (except what was in the box), and asked him to make the presentation speech.

This was a job that Mr. V. was peculiarly fitted for, and he made a happy little speech presenting the founder of the association with a hat, and hoped that their meetings would be pleasant, and that some such episode would occur at each gathering to bind them closer, etc., etc.

"'Speech, speech,' greeted the founder as he came forward to receive his present, and he made a feeling reply, in which he said that he should never wear this present without remembering each and all of his fellow workmen—it was entirely unexpected, etc., etc.

"There was a little awkward delay for a minute, and then Mr. Vreeland said

"'Well, put it on and let's see how you look.'

"With an 18 x 24 smile and a palpitating heart the founder of the M. A. A. cut the string and lifted the cover, a package in tissue paper was carefully lifted out, and he held up—not a hat, but one of those plain, every-day pieces of crockery, without which no well-regulated bedroom is complete.

"The M. M. was as much surprised as anybody, and as soon as he realized how ludicrous the whole thing was he made a sneak for the door and did his laughing outside.

"The founder of the association poised his present in the air for a minute, as if in doubt what to do, and then dashed it to pieces against a stack of crown bars, and that was the last meeting of the Erie Foremen's Mutual Admiration Association.

"Old man Boyle liked to got apoplexy laughing, and I really believe that there has been more fun out of that one meeting than if the order was in full swing yet."

### Don't Forget to be Heroic.

We often hear after accidents happen that certain enginemen stuck to their posts and were willing to face death and mutilation rather than do what in Colorado is called "striking the sod."

This is all right in theory, but in practice men with nerve try to save themselves after performing the little all within their power to save the train. There is not generally much time for reflection, when an accident is impending, much less for the expression of pleasantry and joking. Exceptions, however, sometimes happen.

On one of the Eastern railroads lately, where very high speed is common with passenger trains, the side-rod of an engine broke while running at a terrific velocity, and the broken parts were smashing things at a lively rate. The running-board and part of the cab disappeared like a flash, and Tom Maloney, the fireman, described an acrobatic feat in the promptitude with which he got to the back part of the tender. Philip Rogers, the engineer, was a little bewildered at first with the flying fragments of wood and iron, and the screaming steam, but he had sufficient presence of mind to shut off steam and apply the air-brakes.

Suddenly looking around and seeing Maloney in a place of safety, he began climbing up on the tank. On seeing this, Maloney exclaimed in a tragic voice, pointing his finger at the man who was deserting his post, "Phil Rogers' go back to your post, you son of a gun, and die like a hero." Philip did not rise to the heroics of the hour, but staggered back, and wanted to creep into the tank, from which humility he was saved by his cool-headed fireman.

### The End of It All.

A religious service was held in Chicago last month for the benefit of colored railroad men. There is an idea prevalent that railroad life of any kind is sadly demoralizing to those who follow it, and religious people particularly believe that profuse spiritual nourishment is necessary to neutralize the contaminations that all railroad men must receive.

At the Chicago evangelist meeting referred to, the most persuasive colored preachers of the land raised their voices in warning against the moral dangers of railroad and sleeping-car life. A layman who had been there agreed generally about the hardships of sleeping-car life, and dwelt distressfully on the iniquity of the growing custom that passengers are falling into of giving the porter only ten cents. De dime passenger was pictured as the most contemptible being that roamed the earth.

One of the elders waxed very eloquent on temperance. His peroration was striking. "Brudders," he shouted, "you hab too many high examples to 'scuse de sin of drinking. But beware of de habit. I'se heartrended to know dat drinking is encouraged in dis great Gomorrar by M. D.'s, and D. D.'s, and Ph. D.'s, and LL. D.'s, but dey will all bring up in Hades, where dey will be everlasting dry."

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Trainmen in New Hampshire are about to receive the benefit of an Act passed by the last Legislature, requiring railroad bridges to be raised sufficiently to allow trainmen to stand on the tops of cars without being knocked off. There are so many low bridges in New England that a brakeman's life is very precarious, and a change was very much needed. We think, however, that a more progressive plan would have been to give the railroad companies the option of putting air-brakes upon their cars. This is an improvement that the Interstate Commerce Law will require to be carried out soon, and it is scarcely right that the railroad companies should be required to spend a great deal of money on bridges, when the necessity of men going on the tops of the cars will soon be ended.

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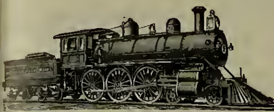

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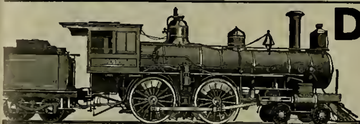

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# Locomotive Engineering

A Practical Journal of Railway Motive Power and Rolling Stock.

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Effect of a Lap Order

## The Real Inventor of the Steam Engine.

We think that there is an important link left out of the most interesting chain of locomotive development which the Baltimore & Ohio Railroad display at the World's Fair. They have embodied Sir Isaac Newton's ideas of a locomotive in a model, but they leave out the first practical steam engine whose performance led the way to locomotives being introduced. This first practical steam engine was built by two mechanics, Newcomen and Cawley, of Dartmouth, England, and contained the essential part which succeeding inventors and engineers improved upon. It had a cylinder and piston. Numerous other inventors and philosophers had tried to make steam do work, but they could not devise any sort of practical harness.

The Newcomen engine was an exceedingly crude machine, but it was the real genesis of our vast array of steam machinery. The engine was built in 1705, and it set the wheels of progress in motion as no other invention has ever done. Nothing else ever invented exerted half as much influence on the world. No event in the whole history of the world is equal in importance to that of these two mechanics putting their all into the construction of a machine to be moved by the power got from steam. The World's Fair ought to have honored these men, but we have seen nothing in Jackson Park that would serve to tell what Newcomen and Cawley did for mankind.

The progress of the steam engine dates from Newcomen's time, and there has been constantly a reduction going on of the quantity of fuel required to do a given amount of work. Newcomen used steam of atmospheric pressure to produce a vacuum under his piston, and the cylinder was employed as a condenser. The engine was not automatic in its action, a boy having been employed to open and close the valves. The engine made about ten strokes a minute and raised at its best 105,000 foot pounds of water to the pound of coal consumed.

Smeaton, one of the most famous engineers of last century, directed his attention to the Newcomen engine and effected various improvements upon it, among others giving it a valve motion. He raised the steam pressure to 8 pounds above the atmosphere, and succeeded in raising 120,000 foot pounds to the pound of coal used in the furnace.

James Watt got a model of a Newcomen engine to repair, and having some knowledge of natural philosophy, perceived that great loss of heat was occasioned by the cylinder being cooled down in order to form a vacuum at each stroke. He applied a separate vessel for a condenser. With steam of 10 pounds pressure he raised 320,000 foot pounds to the pound of combustible. Engines like what Watt used can now be trusted to show a duty of 600,000 foot pounds when using steam of 50 pounds pressure. The best forms of compounds with boiler pressure of 150 pounds now give a duty of 1,200,000 foot pounds per pound of fuel. Newcomen started this.

### A Reminder of Wood-Burner Days.

Old-timers who loved and swore by Mason engines—and there are many of them—will be glad to see the pictures of some old friends shown herewith. For his time, Wm. Mason built the best-looking and neatest-proportioned engine in this country, and but for size his engines would show up well with the crack engines of to-day. That the works kept abreast of the times in design is shown in the trim-looking "66" on next page, for the Old Colony, that was one of the last machines turned out before they gave up locomotive building.


STRAIGHT-BOILER MASON, LONG A FLYER ON THE LAKE SHORE.


ONE OF THE LAST FIVE-FOOT GAUGE ENGINES, BUILT BY MASON FOR THE ATLANTIC, MISSISSIPPI ... —NOW NORFOLK & WESTERN.

### How the Merit of American Locomotives was First Established.

In the July number of LOCOMOTIVE ENGINEERING there was a picture of the first locomotive built by the Norris Locomotive Works, Philadelphia, to be seen in the Baltimore and Ohio exhibit at the World's Fair. The engine is not a very imposing looking machine, but she is nevertheless well worthy of examination, for it was a close successor of this one, built almost on the same plan, which first gave the American locomotive a reputation abroad.

When railroad building first began, the British workshops were in a good position to build locomotives, for a vast business was already carried on in making other classes of machinery. American workshops were trifling in comparison, and many railroad companies on this continent looked upon England as the natural manufactory of locomotives. Consequently, the John Bulls, as they called several of the first imported locomotives, were looked upon as the best that could be made. Railroad men on this side of the Atlantic had no more pride in home-made locomotives than their daughters had in home-made dresses when the products of Paris could be purchased. A Norris locomotive sent to the home of the enemy proved superior to the best that English makers could put in competition.

In 1838 the Birmingham & Gloucester Railway was finished, and one part went up a hill with a gradient of 1 in 37, or nearly 143 feet to the mile. This grade was known as the Lickey incline. Such a grade was unprecedented in England for locomotives, and the most eminent engineers of the time, among them Brunel and the two Stephensons, expressed the opinion that it was impracticable to operate such a grade with locomotives.

Captain Moorson, who was chief engineer of the road, had heard about the extraordinary tractive power of American locomotives, and made up his mind to try one of them. He came to Philadelphia and returned with a Norris engine.

The day on which the trial of ascending the incline was to be made, a large crowd of spectators was there to witness the sight, many engineers and locomotive builders being present. The "Yankee," as the Norris engine was dubbed by the rival interests, went up the incline 2½ miles long with a load of 34 long tons at an average speed of 14½ miles an hour. Mr Burry, the famous English locomotive builder, was present and declared that "whatever American locomotives could do his could equal." He went to Liverpool and brought one of his best engines. This engine without a train was permitted to make a run at the hill, but she failed to go up, and the builder brought her back amidst the jeers and laughter of the crowd.

Owing to this triumph, the Birmingham & Gloucester Railway was equipped with Norris engines. The fame of the performance was the means of obtaining for Norris a contract to equip the Russian Government railways with locomotives, and the merit of American locomotives was established the world over.

### Breakage of Frames and Cylinders.

A discussion which arose at the Master Mechanics' Convention concerning the breaking of frames and cylinders was very seasonable, for this is a species of trouble experienced on nearly all railroads having heavy locomotives at work. The breakage of a frame or a cylinder is so expensive and causes so much delay that any information throwing light on the causes of breakage will be welcomed by all persons embarrassed by the difficulty. Quite a number of members spoke upon the subject, but we consider that the remarks made by Mr. J. M. Boon, of the West Shore, cover the whole trouble. Mr. Boon said:

"The starting-point is bad workmanship. Almost invariably, when a cylinder works loose on the frame it will be found on examination that the bolts originally put in were not a good fit—were too loose. At the very moment there is the smallest particle of play there, it makes a starting-point for breakage. Another cause of frames breaking is that too large-sized bolts are put into the frames. I know of locomotives that have got frames 4 inches wide and they have got 1¼-inch bolts

th ... se frames to hold the cylinders.
Tl ... way more than 25 per cent. of
th ... of the frame with that bolt
Tl ... is the frame breaks through
th ... it could not be otherwise.
... ne line of weakness exists to
ac ... cylinders working loose. We

...now increasing the diameters of the cylinders. We are throwing up the centers of the boilers far above the cylinders. The leverage due to the distance between the center of the boiler and the center of the cylinder, in comparison with the old practice, is enormous, and in working full steam on these cylinders with boilers carrying from 150 to 180 pounds pressure, the strain there is terrible, and yet we find locomotives that are going out, designed for that kind of practice, with a cylinder plate too small, too light. The result is the moment the engine gets working, something must go. If it is the frame that is the weakest point, it is going to break there. If it is the cylinder, it is going to let go there.

Another thing, a great many cylinders are cast that are not properly designed. We all know that in making a casting like a cylinder, the difference in shape, the change of circle and changes of direction, the disposition of metal—all have to be taken into consideration. Yet you will find large masses of iron placed in one point while another part is light. When the cylinder is cast trouble commences. It is cast on a ...—unequal expansion, and the cylinder gets hot and cold alternately, and the ...e comes, and very rapidly, when something is going to let go. The only way to stop frames from breaking and to get cylinders to last is to make them right at the start, and you will then have no trouble."


ONE OF THE LAST ENGINES BUILT AT THE MASON SHOPS.

### Steel-Making.

At the last Master Mechanics' Convention a resolution was adopted requesting Mr Samson Fox, the well-known steel-maker of Leeds, England, to speak on steel-making before the Convention. Mr. Fox said:

"Gentlemen, I consider you have done me a great honor in asking me to say a few words on the all-important question of the material of which our boilers have to be built. I would, in the first place, ask you to consider that I did not come here in the character of a teacher. I did not come to teach any one his business. But, happening to be in this country for the last few weeks, I have met a number of gentlemen who are interested in the question of firebox plate. No; steel plate for the purpose of fireboxes at sea has been with me a considerable manufacture for a long number of years. I think if I was to say to you that I have turned out within the last fourteen years at least 100,000 tons of firebox plate, which have been used solely for the purpose of making steam furnaces, I should be within the mark. You know very well that a man who has done a large amount of work must necessarily have made a large number of blunders, and it is out of the blunders that he finds what may be considered the best way of keeping on the straight path. (Applause.)

"First of all, I would put what I have to say more on the basis of what we consider is right at the present time. There may be great improvements yet, I dare say there will be. But what we consider in firebox plate-making, first of all, is to select very pure materials. That is to say, we will take pig iron, which contains in nature the smallest amount of sulphur and phosphorus. We do not mind very much about the amount of carbon. But we must have these two enemies, sulphur and phosphorus, away from the material that we start with. Further, we consider that it is necessary to know exactly the composition of the fuel that we use in every part of the work, so that the gas from the fuel has the same value in purity as the pig iron that we have already started to work with. Bridging these together, and both being cleared from these very serious enemies, sulphur and phosphorus, we may then go to work and expect to obtain a fair, reasonable result. But it is important also that the linings of the furnace, such as the sand and the ganister that we use, and also the bricks of which it is composed, shall be as pure as the gas and the pig iron.

"Now, bringing these materials together in their various forms and getting the chemical actions of one on the other, none of them possesses the qualifications to bring in with it something that it never contained, and, therefore, when the action is thorough there is no doubt that after such a start you will get as a result a pure plate. That is to say, that it should have for firebox purposes about .11 of carbon. You may put from .50 to .55 of ferro-manganese into it, but you should get your sulphur and phosphorus down to as low as .04 to .05. If you do that you will find that you have got a material which, if properly manufactured from the ingot down to the shorn plate, will do almost anything as regards standing fire and every other manipulation of turning it into a first-class boiler.

"But there are some considerations to be given to the manipulation. I believe, in some factories in this country, it is thought not necessary to put any work on to the ingot. That is to say, that the ingot is rolled direct into the plate. We hold a different opinion. We prefer for the best class of work to hammer the ingot, reducing it from about a 15-inch thick ingot down to about 5. Now, that ingot is hammered on the flat and it is hammered on the edge and the ends are cut off. But even after that it is necessary to exercise care in reheating such a slab, because we all know that we are troubled at times with lamination in the plates, and it generally occurs at the end of the plate. That has been clearly proved over and over again to be the overlapping of one side of the plate over the other, and in practice you will often find that men who are rushing their work will bring out their slabs not so well heated on the one side as on the other, and the consequence is that when such a slab enters your roll the soft side will run ahead and draw farther than the hard side, and the hard side is, as it were, rolled partially into the soft slab. Consequently, you will find that one part has overlapped the other. This may not show itself, even when the plate is short, even when it has been annealed, but still it will show itself in working some day. If that same chemical contact does not exist from the beginning to the end, and in every cubic inch of the plate, it will show itself when it comes to deal with the expansion and contraction due to its work in the boiler.

"Now, it should be the question for the user of such plates to buy only on the condition of certain mechanical tests and chemical composition. If a committee was to look fairly into the different tests set forth either in France or in Germany, or in England, they would find that there is a steadfast growing of the principle of standard tests, especially for firebox work. Those tests need not be anything further than specified, and the inspectors ought to see the plates tested on these grounds. The Board of Trade and the Admiralty of England, and many other associations such as Lloyds, and Bureau Veritas, set down that a piece of material shall be cut from a plate which shall in 10 inches of length extend from 20 to 25 per cent. The British Admiralty is 25 per cent. as the minimum, so is the Russian Admiralty, so is the French Admiralty. But the Board of Trade go down as low as 20 per cent., so that the elongation shall be, whether 20 or 25 per. cent. the elongation taking place within 10 inches of length pulled in an ordinary testing machine. In addition to that the Admiralties fix a standard of tensile strength. They say it shall now be more than twenty-five tons to the square inch, and they usually say it shall not be less than twenty-four—that is, our gross tons of 2,240 pounds. Now, if you are bound within the range of ton, you have got to have your chemical composition pretty uniform all through all the plates you make, and if you get an elongation, such as I have mentioned, of 20 to 25 per cent., that is a material that will be very good work.

"There is another point that I might mention in practice. We have found by experience that there should be a little difference in the amount of carbon, according to the thickness of the plate you are making. For instance, if you start with .11 for a quarter-inch plate and you are going to make half-inch plate which shall bear the same twenty-five tons and not lower than twenty-four, and with the same elongation of 25 or 20 per cent., then you must put a little more carbon into the half-inch plate than you did into the quarter-inch plate, and so on with the three-quarter-inch plate, and so on with the inch-plate—a little more still. If you keep the same carbon and expect the same tensile strength, you won't get it, because your material is made more dense in rolling down to a quarter plate than to a half-inch or three-quarters. These are features that have led to a pretty fair success on our side. I have made many thousands of tons of plate where we have undertaken to be only not more than ten hundred-weight on either side of a given point. In our thickest shell plate, at twenty-seven tons, I would not be more than ten hundred-weight on either side of the twenty-seven, and that can only be done by watching the carbon as to the thickness of the plate. We have been very successful indeed by varying the carbon.

"I am sure that, in this country, you have all the raw material that any one else has, in coal and in pig iron and in fire clay. You have all the conditions of purity of material, and if the purchasers and users of the plate were to lay down a standard of purity, and strength and elongation, that would be the very first thing to do, in order to get that uniformity in your firebox which is so much required. Of course, at first, your inspectors would have great trouble. They would have to throw out a good many plates. No one has any idea of the want of uniformity in plates, who has not acted as an inspector to the firms that are not so closely pinned down. The maker finds that he has got a good lot of material thrown out, and there is nothing like having such a lot of material thrown out to make him find out what is the right thing for him to do.

"I am very pleased to have had the opportunity of speaking to you. I want you clearly to understand that I do not say what I have said in any spirit other than as a suggestion, drawn from what we have learned in our experience on the other side, especially my own firm." (Applause.)

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The railroad companies running freight cars equipped with air-brakes are beginning to complain that the work of holding nearly all trains put upon the small percentage of cars having air-brakes is seriously increasing the expense of repairs. It is understood that the running gear of the cars must be made stronger, and all new designs are prepared to make the cars equal to the heavier strains put upon them. If the hard usage due to the use of air-brakes makes heavy repairs necessary to a car in the first few years after it has been built, it is likely to bring little profit to its owners. Some years ago a leading member of the Car Accountants' Association reported that the profits made by a car were nearly all earned in the first five years of its life. After that its mileage was so much reduced by the delays getting repairs that it practically cost as much as it earned.

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Two new patents on improvements in compound locomotives have been lately granted to Mr. Vauclain, superintendent of the Baldwin Locomotive Works.

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The *Railroad Car Journal*, of this city, has issued in pamphlet form an abstract of the decisions of the M. C. B. Arbitration Committee for the use of those interested in car interchange who do not keep the complete reports of this committee on file. The abstract makes a very complete index for the reports, and is, therefore, very handy.

### Unexpected Information From Tests.

There are too many tests of devices intended for use in railroad rolling stock that are made with a set purpose in view. A certain result is expected and everything is done to aid in bringing about what is desired. In too many cases this brings temporary success to articles that do not have merit. If knowledge of the real value of a device is wanted, it ought to be put in the hardest service to be found and kept there long enough to demonstrate what it is worth

A very good practice was mentioned by G. W. Rhodes in the course of a talk at the Master Car Builders' Convention. He said

"We sometimes find things on our lines in an unsatisfactory condition and we branch out in an endeavor to get something new. We should remember that we do not know anything about the new device—do not know of its bad points—although we do know the bad points of what we have tried of old. To select for a test the under part of a freight car we take what is probably the worst place It has been our practice to make our tests under the tanks of our engines In a good many cases we have had a curious sort of reply from those interested in the devices we are testing We are told they were not intended for tanks but for freight cars I do not attach importance to these replies The results I get under the tanks in three or four months would take me three or four years to get under a freight car Take the matter of brake-beams We have got some very interesting information from tests of freight-car brake-beams under tanks The manufacturers say their beam is not intended for tanks but for freight cars The brake-beam companies should recollect that tank service is not as hard a service as that obtained on a quick-action brake freight car. In making investigations, I believe if you put your truck under the tank the results will be much more satisfactory."

### Williams the Inventor of the Link Motion.

On another page of this paper we publish an interesting article from Mr. James Hedley, giving some reminiscences relating to the invention of the link motion. As Mr Hedley was an apprentice in Stephenson's works, at Newcastle, when the link motion was brought out, his views concerning the invention are of historical value The account generally current in engineering historical works, concerning the invention of the link motion, is that it was proposed by Mr Williams, a gentleman apprentice in Stephenson's works, and a sketch made covering his ideas. This drawing was given to George Howe, pattern-maker in the works, who found that the plan proposed by Williams was impracticable, but improved upon the invention and produced a link motion that worked satisfactorily.

The important point made by Mr. Hedley is that the drawing made by Williams was all right, and that the model made by Howe merely covered Williams' ideas, but that Howe tried to steal the credit of being the inventor of this important improvement. We are glad to be the means, at this late day, of publishing the real facts of the case

### The "Lord of the Isles."

This famous old engine, of the now extinct 7-foot gauge, attracts a great deal of attention at the World's Fair, and she is indeed a fine piece of work for 1851, the date of her building It will be interesting for our readers to see a picture of this engine "as she was. Many believe she has been much rebuilt in the last forty-two years. Our picture was taken of her as she was decorated for her run carrying the news of the close of the Crimean War in 1854. It will be seen by those who visit the Fair that she is unchanged. The fancy decorations off, and she was then as she is to-day—a fine piece of work. We got this picture from T Moore, of 1 Channing Crescent, London, N., England, who is a dealer in photographs, and has a very large collection of foreign locomotives. Those who have been asking us for English pictures should write Mr. Moore.

LOCOMOTIVE "LORD OF THE ISLES."

### Developing Railroad Shop Tools.

We frequently find railroad shops nowadays that are far from being well provided with tools for doing work properly, but our poorest shops are well off compared to what the best were fifty years ago. The following is a description by Mr. James W Holmes concerning what a Yankee master mechanic had to do when he took charge of what were then the shops of the most important railroad on this continent, the Philadelphia & Reading

"In the fall of 1843 that wide-awake engineer, mechanic and draughtsman and noble Yankee gentleman from Lowell, Lewis Kirk, was engaged and took charge of the shops on the 1st of October. At the time that Mr. Kirk took charge of the shops here there was but very little machinery. All that was here was one small lathe that would swing about 6 inches, used for the brass work for necessary repairs, and run by that old engineer, Thomas Barnet, one other small lathe, used for turning iron ferrules to drive into the copper flues at each end of the boiler to keep them from leaking; one good strong slide lathe, built in Norristown by Hugh Reed, and one old lathe placed on wooden shears for turning car axles, and two old lathes bought of the Reading Locomotive Works and used for turning engine and car wheels.

"Here I must explain to some of the rising generation, as I do not think there are ten men now employed by the company who know that at that time there were lots of freight cars on the road that had wrought-iron tires on their wheels the same as a locomotive. Three of these lathes had nothing but wooden shears for the heads to stand upon. There was also one old drill-press, and that was of no account.

"Mr Kirk saw the need of more and better machinery. He began by building a machine for planing iron, and an upright boring machine for boring car wheels, and followed this up by building other machinery of different kinds, such as a heavy all-iron large lathe, drill-presses, other lathes, planing machines, steam hammers and other machinery.

"In the following year he commenced to rebuild the old engines. He rebuilt two of the English for passengers. One he named the 'Antelope' and the other the 'Gazelle.' He altered these engines by taking one pair of wheels away, enlarging the other pair by welding out the spokes and placing a truck in front. These engines were put upon the passenger trains for a while, and certain men who claim the honor of having run the genuine 'Rocket' (but never did) may have run one of these engines. Mr. Kirk, about the latter part of 1844, began the erection of a brass and iron foundry alongside of the other shops. About this time, and during the beginning of 1845, he built the forge on the ground where it still stands, and commenced making the company's own tires for engines, which no other railroad in this country, or, I believe, in the world, did at that time. I think there was at that time but one place in the United States that made tires. They were nearly all imported from England."

### A Car with a History.

There is a car with a history running on a branch of the Nashville, Chattanooga & St. Louis which entitles it to consideration when it is the fashion to bring all historical members of the rolling stock family into notice. This car is worthy of attention for several reasons. It is old, and has traveled miles enough to give it celebrity. It is a novelty, inasmuch as it is made entirely of iron, and is a relic of very interesting events of the war.

The car was built by the United States military authorities, and was made of boiler iron, with doors of the same material. For several years it was used as a traveling powder magazine, and its regular purpose was the transportation of powder and ammunition to the Federal stations in the South. The car afforded perfect safety to its contents from those terrors, the bushwhackers, who threw away their ammunition in practicing upon the iron car, as their bullets flattened on its sides and did no harm. After following the armies all over the Southern States for four years, the iron car lost its mission with the return of peace. It was then sold with other railroad plant, and fell into the hands of the present owners.

For fifteen years the iron car was used as a baggage car on the Shelbyville branch. Then it was taken to the main line and used as an extra baggage car and sometimes for carrying passenger train freight. From that it was sent to the Lebanon branch, where it still does regular service for baggage

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The Pennsylvania Co. have changed their new compound from oil back to a coal burner. She will soon be tried on the New York division, where her seven-foot legs ought to make some show at the world's record.

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We received a great many complimentary notices about LOCOMOTIVE ENGINEERING and are careful not to bore our readers by repeating them. A letter that came in lately from Erie, Pa., is, however, too much for our self-denial. It was written because the paper had not been delivered, and added. "Although I am only a boy and I suppose my opinion won't count much, I wish to say, that for my part, if I could have but one paper in the world, that paper should be LOCOMOTIVE ENGINEERING. I begin about the 15th to wish for the 1st of the month, so that it will be time for the paper to come."

### A Fracas with Bushwhackers—An Undesirable Uniform.

In 1864, from among the loyal Georgians the Federal Government recruited two regiments of cavalry at Dalton. One of the trains loaded with arms, clothing and horse accouterments for these regiments

IN THE BLACK HILLS. SHIRT-TAIL BEND, IN DEADWOOD GULCH. GRADED THROUGH ORE WORTH $25 PER TON.

passed Tunnel Hill about 6.30 A. M. one fine morning, engine 136, Dan Clendening engineer. When near a small trestle the iron got too short, resulting in a bad wreck of the thirteen cars of the train, twelve of them followed the engine into the ditch and all hands "took to the bush." The train guard immediately formed lines on each side of the train, expecting to be attacked by guerillas. Two men were started back to flag trains following, and to notify the wrecking crew of the wreck; also, to have the commandant send reinforcements to the relief of the train guard.

Col. Ford of the Twenty-second Connecticut dispatched two companies of his regiment to the wreck. The soldiers who came back told us that the old fortifications at Buzzard's Roost were full of bushwhackers ready to attack their men; that the train was loaded with supplies for the first Georgia cavalry and would be a fat take for the "Johnnies."

As soon as possible we followed the soldiers and soon arrived at the wreck. The guard of the wrecked train had succeeded in holding the train until reinforced by Col. Ford, who had deployed his men as skirmishers on the mountain south of the track, where they could search the woods and old fortifications for "Johnnies," while we proceeded to clear the track for the passage of trains.

While looking over the situation and giving orders, Seth H——s, the wreck master, found a car loaded with uniforms for the First Georgia. It being a beautiful morning and Seth feeling a little "kittenish" thought it would be fun to dress himself in soldier clothes, so he donned the uniform of a cavalry sergeant, saber and all. The first I knew of this was when I heard the command, "Attention, squad." The men had got out the rigging and were ready for a pull. "Engine to the rear, march, steady," commanded Seth. I had just caught on to what he wanted, when the "Johnnies" opened fire on us from the north side of the road.

Fortunately none of our guard or crew were killed or wounded. After the volley, Lieutenant Wilson, commanding our train guard, gave the order to his men to deploy as skirmishers and look out for themselves. While all this was going on Old Seth was lying as close to the ground as possible, trying to get out of his soldier clothes, but he had become entangled in the harness of the carbine and saber and was making but slow progress of freeing himself. In his excitement he began calling for help. I had been hugging Mother Earth as close as possible on the side of the engine farthest from the danger. Seth's cries sounded so pathetic I went to him, thinking, perhaps, he was wounded and needed assistance. When I got near him I asked what the matter was; he replied "For God's sake help me out of this pesky rig; for if the 'Johnnies' get us and find me togged up in soldier clothes and with arms in my hands it is Andersonville sure."


IN THE BLACK HILLS. B. H. & FT. PIERRE CROSSING THE DEADWOOD CENTRAL.

Here let me say they always paroled railroad men. As there was but one volley fired, we very soon were at work again, but I had to do all the bossing on the north side of the track until Lieutenant Wilson and his gallant Spencers came marching down the mountain with thirty-nine bushwhackers, twenty seven horses and a mule. The bushwhackers had divided into two squads, one taking the north, the other the south side of the track. The squad on the south side retreated before the superior force of Colonel Ford, for the purpose of giving the squad on the north side an opportunity to overpower the guard in charge of the train; they had made no calculation on the wrecking crew arriving so soon with an additional guard of forty-two tried and true men armed with Spencer rifles.

The First Georgia received their clothing and accouterments and did some good work in the mountains around Dug. and Carter's Gaps. I know several of their widows who are receiving pensions from Uncle Sam, also several of the men who lost an arm or a leg in the good cause.

JAS. H. HESLEY.

*Rome, Ga.*

### Testing Locomotives on Rollers.

Some years ago, the authorities of Purdue University, at Lafayette, Indiana, purchased a Schenectady locomotive, and set it on rollers as large as driving-wheels, for the purpose of running the engine so that the university students might receive instruction concerning the handling and operation of a locomotive. When the engine was put in running order, it was discovered that many things could be found out in the working of this engine that could not be correctly ascertained in road-service tests. Accordingly, the American Society of Mechanical Engineers and the Railway Master Mechanics' Association have determined to make tests of locomotives on the Purdue University apparatus, for the purpose of finding out things that cannot be settled by road service.

At the last Master Mechanics' convention, Mr. D. L. Barnes gave interesting facts concerning the working of the Purdue University locomotive. He said

"The locomotive is mounted on a pair of carrier wheels exactly like a pair of locomotive drivers. It is provided with the same force, makes the same noise and acts exactly as a locomotive does on a road, excepting such things as pertain to the road-bed. I have never been an enthusiast for shop tests, believing that there are a great many other things that cannot be settled on the road. For instance, no one knows how to set the valve for a compound locomotive, so far as I know, to get the best results. No one knows how large to make the receiver, or the proper ratio between the cylinders of high and low pressure The two-cylinder compound locomotives are getting lots of trouble for the lack of that knowledge, and four-cylinder locomotives are giving a lot of trouble because the valves are not properly arranged We

IN THE BLACK HILLS. THE F. E. & M. V. CROSSING THE DEADWOOD CENTRAL.

have not yet seen, as I said the other day, an indicator card from a compound locomotive at sixty miles an hour that is a credit to the engine or that is as good as a card taken from a simple engine at the same speed. It has been asked whether it is economical to run a locomotive with the throttle partly closed or wide open. That question was settled by the Purdue University last year They tried that test, wire drawing from 180 to 140 pounds As had been predicted before, the wire-draw- produced superheating. The super- ating was as much as 25 degrees, but economy fell off immediately. The . of potential or the loss of possibility of doing work by losing pressure due to wire-drawing makes a loss of 20 per cent in the efficiency of the engine In every case where the dry pipe pressure was 60 to 80 pounds less than that in the boiler, the loss was from 15 to 25 per cent Such a question as that is very much better settled in the laboratory

"Then, again, in regard to counterbalancing. We have never known, so far as I am aware, just what to do This Schenectady engine was built with great care. They are known to make very well counterbalanced engines. But she would not run in the laboratory. At 55 miles an hour, she got dangerous to the apparatus. When the engine went one way the counterbalance went the other. With the pointer on the engine, you could see right away what the trouble was. They put on more counterbalance, and the engine worked very satisfactorily.

"The temperature of the smokebox is another thing we want to know more about. The pyrometers we have used are wholly unsatisfactory. They vary as much as 200 degrees, when put in the same smokebox and under the same conditions. At the University, they use a copper ball, which they put in next to the flues. They know the weight of the copper ball They drop it in water when it comes out, and in that way get a record of the temperature.

"Another interesting thing they found down here was the lifting of the drivers due to the counterbalance. I got down under the machine—it is very accessible—and I could see in between the drivers and the carrier when the counterbalance was up But, to settle that question, they fed a wire around between the two wheels, and first found that the wire was flattened down when the counterbalance was down. When the counterbalance was up, the wire passed through whole, showing that the driver does lift from the rail. These are only a few questions that can be settled in the laboratory, that cannot be settled on the road. This is a very expensive piece of apparatus. No one rail-

IN THE BLACK HILLS. WASHOUT IN GOLD RUN, ON THE DEADWOOD & LEAD CITY. TRAIN BETWEEN TWO WASHOUTS FOR A MONTH

road company would feel justified—unless it was very wealthy—in building it. It is only by the joint action of railroads and locomotive builders that these tests, which are very necessary, can be carried out."

### Reminiscences of Early Reading Mechanics.

We have received a great many valuable reminiscences concerning early railroad matters from Mr James W Holmes, of Reading, Pa , a very old employé of the Reading road. Mr. Holmes writes

"In looking over the May number of your valuable paper, I see that you want to know who has drawings of a picture of any kind of the locomotive 'Excelsior,' whose boiler was carried on separate trucks. You expressed the belief that the engine was built at Reading.

"There was such an engine built here forty-seven or forty-eight years ago, but her name was not 'Excelsior,' but 'Novelty.' She was built by that exceedingly live gentleman, Lewis Kirk, after a design furnished by the able superintendent of the Reading, Mr. D W. Nicholls. I worked on the engine, and naturally know something about her. I turned all her driving-wheels.

"In your May number you give us a likeness of the late Charles R. Peddle, of Terre Haute. You are correct about his working here forty-six or forty-eight years ago under Mr. Kirk Your readers might perhaps be interested in knowing what has become of these men whom you call his associates That ingenious and inventive mechanic, Lewis Kirk, died from too much hard brain work in studying out improvements of machinery. His head became affected, and he died in the insane asylum, at Harrisburg, about twenty-five years ago. Mr. John O. D. Lilly was killed on the railroad that he served his time on. He went to visit his brother, General William Lilly, and went to walk up the track of the Hazleton branch of the Lehigh Valley, from Packerton to Mauch Chunk, and got struck by a train and killed. That was about four years ago. Mr Andrew C Vauclain died at Altoona, while in the employ of the Pennsylvania Railroad, a few years ago. His brother James is away out West somewhere, and, I think, is still alive. Mr David Clark is a master mechanic on the Lehigh Valley Railroad to-day, and is still hale and hearty and able to tell the old railroad reminiscences himself. If he were aware that you were anxious to have a picture of the 'Novelty,' he would have a drawing made and sent to you, as he is a very accommodating gentleman.

"All these men were gang bosses at the time you speak of, except Clark Peterson, who was foreman of the Pennsylvania roundhouse, in Philadelphia, the last I knew of him.

"Colonel Frank Hain, general manager of the Manhattan Elevated Railroad, who is also a Reading man, has in his employ Emanuel J. Rauch, one of the old Reading pioneers, whom I think can give you a great deal of information about the 'Novelty,' for I think he was employed here about the time the engine was built.

"In one paper you speak about President Lincoln's private car, and you say that it was built about the beginning of the war. That is a mistake, as the car was built only twenty-nine years ago, in 1864. I did some of the finishing of the ornamental work of that car, which was finished brass work."

The Thompson Smokeless Fire Company, Pittsburgh, Pa., have sent us an illustrated catalogue showing their smokeless furnace applied to various kinds of boilers, house ranges and stoves In this system the firebox is so arranged that the fuel is continuously distributed in a finely regulated rain-like feed, and the air supply so adjusted that the gases arising from every ounce of coal are provided with an equivalent volume of air, and special facilities which positively insure the thorough mixing and uniting of the oxygen and other gases prior to reaching that temperature when they all ignite, and thus result in the most perfect combustion of fuel—there being nothing but pure flame passing into and through the flues, which, after doing service, escapes in the form of carbonic dioxide gas.

A late issue of the *Patent Office Gazette* contains particulars of a patent granted to Mr. S. M. Vauclain, Philadelphia, for an improvement on pistons It is described as a combination in a piston of two sections, each section composed of a disk, hub and ring, one section being the counterpart of the other, and each having an annular cavity to receive packing There is to each section a series of radiating ribs extending from and terminating in enlargements at the ring portion. Bolts are passed through the enlargements for the purpose of holding the parts of the piston head together independent of the piston-rod. This combination forms a hollow piston head which combines lightness and strength.

### Specifications Favored Cheap Material.

That analytical tests are by no means conclusive concerning the quality of steel for certain purposes, was proved by the action of the French Spring Co. several years ago. They had been in the habit of making all their springs of crucible steel and no springs had ever proved so durable But with the growth of railroad laboratories, a movement arose to purchase steel springs that had to meet certain analytical and physical specifications. This enabled the makers of inferior steel to compete on equal terms with those whose product had been famous for durability and uniform service. The company named was compelled by competition, fortified by the

IN THE BLACK HILLS WORK OF A MOUNTAIN FRESHET

specifications, to enter upon the use of open hearth steel for springs. The most inferior springs now upon the market will come up to the ordinary specifications Those that are known as the makers of the most inferior steel springs could not have worked up a business but for the movement in favor of specifications as a satisfactory condition for the purchase of spring material.

### Size of Compound Locomotive Cylinder.

A question that comes up very often among railroad men in connection with compound locomotives is · What ought to be the size of the cylinder to produce a compound of equal starting power to a simple engine? This question was discussed by Mr. Reuben Wells at last Master Mechanics' Convention, and he called for information bearing on the question. Mr. William Forsyth, in answer to this, said:

"In reply to Mr. Wells' question as to the proper diameter of compound cylinder, when you want to meet the power of a simple engine, the English designers and the German designers gave us a rule, quite early in the day, of compound engines, which was to make the compound high-pressure cylinder 1 inch larger in diameter than the simple engine which you want to make it equal to, and within the small range of diameters which we use in high-pressure cylinders—this rule seems to have worked out very well. It is near enough, because if you need a little more power you can make it up in the extra pressure."

Mr. Wells, in answer thereto, said "Mr. Forsyth spoke of the rule given us by English mechanical engineers in regard to the increased size of the high-pressure cylinder in a compound locomotive over its equivalent in a single engine. They give it as one inch. But if you will make the calculation, the difference between a cylinder of 12 inches and a cylinder 13 inches in diameter, amounts to about 18 or 19 per cent., but when you go up to the difference between a 20-inch and a 21-inch cylinder it is only 9 per cent., so that the rule is not a correct one for the different sizes. It may be correct enough as between a 12 and a 13, or between a 15 and a 16, but it is not sufficient when you get up to a 20 and 21—those higher diameters.'

Shops of the C. M. & St. P. at Milwaukee, Wis.

### A Decided Change Needed.

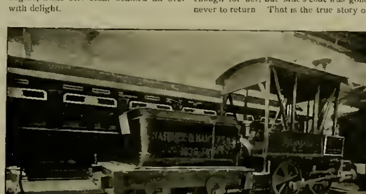
"Nearly all inventors are blind to the faults of their own progeny, but we think that the inventors of smokestacks that are certain to arrest sparks, and everything else, have been a little more infatuated than any others with their inventions." These were the sentiments expressed by an old traveling engineer at last meeting of the club.

"When I hear about new spark-arresting smokestacks," he continued, "I always think about one that Seth Ham got out, when he was engine-house foreman at Alexandria during the war time. It was a very imposing invention when it appeared on the engine, and seemed to be a half-breed between a tobacco hogshead and a balloon. Mr. Ham was very enthusiastic about it and felt certain his stack was going to effect a revolution in spark arresting. He applied it to one of the best Rogers engines owned by the Government, and every detail of construction received his careful personal attention. Engineer Billy Blank took the engine out after she was ready and made a trip with her to Manassas and back

"Mr. Ham was waiting anxiously to hear the particulars about the success of his invention. He was on hand when the engine arrived at Alexandria, but stood around the engine-house till the fine-steaming Rogers got to the turn-table, before he asked the good news from Engineer Blank.

"'Well, Billy, how did she do?' inquired Mr. Ham.

"'Splendid, splendid,' answered Mr. Blank. 'That is the greatest spark arrester I ever saw,' he continued, and he looked up quizzically at the front of the engine, while Mr. Ham beamed all over with delight.



The "Mississippi" an Old-Timer, Now at the World's Fair.

"'It works first-rate, then?' remarked the inventor, pleased as a boy with a new pop-gun.

"'Yes,' said Mr. Blank, 'it is a splendid spark arrester, but there is a small change which I would like to suggest being made on it.'

"'What is that?'

"'Well, I think it would be an improvement if you would turn the stack upside down, for the draft all appears to be downwards.'

"The smokestack disappeared next day, but Mr. Ham never spoke to Billy Blank again."

### What Became of Mac's Overcoat?

It is not correct that James Macbeth had his overcoat stolen at the Convention, although he returned without it. The fact is, Mac believes that no locomotives can run freely except those belonging to the New York Central. On his way to Lakewood he desired the opportunity to pick flaws in the performance of the W. N. Y. & Pa. engine pulling the train, so he displayed to the engineer his badge of the Convention and asked for permission to ride. The thermometer was 95° in the shade, and, of course, Mac had his winter overcoat on, but it occurred to him that comfort would be increased by taking it off. Sitting on the fireman's side, he began to realize that summer had come and that a little more air would be welcome. So he rose to open the window. At that instant the fireman opened the fire door, and Mac's overcoat gently wafted off the seat and slipped into the firebox. The fireman protested that coal was good enough for her, but Mac's coat was gone never to return That is the true story of why he did not take his coat home from the Convention, and all the insinuations heard about uncles were covert slanders.

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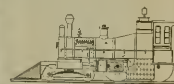
The Master Car Builders' Association has had for several years a committee investigating the subject of "Protection of Trainmen and Lettering Fast Line Cars." We have several times been asked what intimate connection there was with the two subjects to account for their assignment to one committee. We have always given up the guess. Perhaps some of our car-building readers could explain it.

### A Device for Fooling Steam.

The cut herewith was taken from the patent specifications of a recent invention that is intended to put heat into the water in the boiler, without wear and tear on the firebox, and at the same time furnish a high and dry altitude for consumptive steam.

The inventor is going to put a double air pump under the boiler somewhere, run the piston by a cam on the axle and pump air, that has been heated in passing around the firebox, into the boiler. He says "Compressed hot air serves a double purpose, first, to aid in heating the water, and secondly, to hold the damp steam down and to thus increase the effect of the fire upon the water. The invention is particularly applicable to locomotive boilers, because more power is developed within the same size of boiler.

What an elegant scheme coming down hill. She could be made to pop all the way "just as easy," and at the same time the engineer would know that the damp steam



was down on its back and that the hot air was calmly setting on its chest while holding its bare posterior against the firebox.

Of course this kind of a thing costs little and runs without friction—takes no power to force hot air into a boiler against 150 pounds of steam. Then there would be no more mysterious (?) boiler explosions where *gas* gets into the boiler and raises Cain; air will neutralize any kind of gas, and when explosive gas sneaks into the boiler it's altogether more than likely that the hot-headed air wouldn't get up off the chest of the poor old steam at all—it would just stick out its foot, trip up Mr. Gas, get him by a leg and butt his brains out against the dry pipe. Oh, there will be lively times when they get this cyclone sucker on. It'll be a cold raw day in March for any damp steam that shows up then, and it will save many a cylinder-head, too.

### A Striking Wheel Exhibit.

One of the interesting exhibits at the Master Car Builders' and Master Mechanics Conventions were specimens of the manganese steel wheels, made by the Taylor Iron Company, of High Bridge, N. J This metal is so hard that it cannot be cut with tools and is water toughened. Some of the mine car-wheels shown had been in use for months, being "spragged" (slid) every day without a perceptible flattening The tested wheels shown went far to prove the maker's claim that these wheels are unbreakable Referring to tests in this direction, they say:

"We have dropped many wheels edgewise from a height of 30 feet on a 2,500-pound anvil block, each many times upon the same point in the circumference, without effect other than to bend and batter the flange until it was flush with the thread. It also requires from forty to fifty blows of an ordinary car-wheel drop, weighing 1,120 pounds, falling 12 feet, to knock the hub out of a manganese wheel. A cold weather test was made—the thermometer was below zero—by laying the wheel on the ground, flange down, and striking the flange 150 blows at one point with a 20-pound sledge, without effect, except to bend the flange. Expansion or contraction tests made by pouring a ring of molten cast iron 1¼ inches by 4 inches around and against the tread of a wheel, leaving it on for fifteen minutes, (making a much more sudden and higher heating of the rim than it is possible to get in service from brake friction) then suddenly removing it, produced no effect on either plate or spoke-wheels."

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### Location at World's Fair.

We have opened an office at the World's Fair, and want all our friends to call and get acquainted. A representative of the paper can be found at Section U N, post 18 Transportation Building Annex—just at the rear and one aisle to the left of the Canadian Pacific passenger train. Any of our friends can have their mail addressed there in our care if they desire. The files of the paper can also be seen.

### Steel Under-Frames for Cars and Tenders.

When the strength and durability of steel is compared with wood, it seems strange that car builders on this continent have done so little to apply the stronger material to the principal members of a freight car. The repair yards of every railroad in the country supply convincing testimony that the weakness of wooden under-framing causes no end of expense, danger and delay, yet practically no progress is making to substitute strong steel for weak wood. The steady increase of car loads and the heavy locomotives coming into general use, add greatly to the destructive shocks that must be resisted by car framing, yet there has been very little additional strength added to the parts subject to the constant blows. Hence, nearly all repair yards are filled beyond their capacity, and ill feeling is engendered between the traffic and car departments, owing to delays of freight caused by broken-down cars. It appears to be high time that the men responsible for the designing of cars were doing something to introduce a stronger material for under-framing.

At the last Mechanical Convention two reports were submitted bearing directly and indirectly on this subject, but it did not appear that the members of the convention considered that there was yet urgent necessity for a change from the prevailing practice. We believe that the subject needs to be agitated and that railroad companies would be the gainers by extended investigation and discussions on the subject of metallic under-framing.

Steel under-framing for all sorts of cars is rapidly coming into use in several European countries, and they have been used with great success on the railways in India. Wherever this material is used it results in greatly reducing the expense of car repairs.

A report was submitted to the M. C. B. Convention on steel center sills for freight cars which, after outlining the experience with metal frames on American railroads, says:

"The advantages that may be expected from the use of metal center sills lie almost solely in the increased durability and the reduced cost of inspection. A metal center sill, when it is properly made, is the equivalent of a continuous draw-bar arrangement from end to end of the car; and being composed of material having a high tensile strength, steel center sills can be readily made so secure as to require but little inspection. The center sills of a car and the draft-rigging attachment are the parts of the car body which require the most attention from car inspectors and cost more to maintain than other parts of the car body, therefore it might be expected that the introduction of steel center sills would reduce the cost of running repairs.

"In case of wrecks it is a question whether the steel center sills would not be more expensive to repair than wooden ones, but the total cost of repairs to center sills and draft riggings caused by the class of wrecks which would seriously damage a steel center sill is not very large; and although the use of a steel center sill might increase materially the cost of repairing center sills after bad wrecks, yet, owing to the fact that on a well-appointed road bad wrecks are not numerous, the result would not be an increase in the total cost of all repairs, in fact, the greater durability of a suitable steel center sill ought to so reduce running repairs as to give a decrease in the total cost of all repairs to car bodies.

"It is, of course, true that wooden sills frequently last for fifteen years where the cars receive reasonably good service; but the present tendency is to use a sub-sill the entire length of the car to prevent damage to top and draft sills. With the present heavy equipment the result of this is that the total weight and cost of a car is greater with the present construction of wood than it would be with steel center sills, at the prices at which steel is now offered. In any considerable quantity, steel sills can be purchased for less than 2 cents per pound."

A report was submitted to the M. M. Convention on tender frames in which it was stated that of those who answered the circulars about half the number were in favor of iron frames. This indicates considerable progress, for a change to a new material naturally moves slowly.

Those who oppose the use of iron frames are nearly all inclined to lay great stress upon the cost of repairing iron frames in case the engine has a wreck. The same argument is used against the economy of using steel for under-frames of cars. We believe that this objection is based on a fallacy. The expense of repairing the damage done in wrecks is not so great as it is reputed to be. Apart from that, it is not good policy to refuse to adopt a superior article for fear it might be damaged in a wreck. If a steel under frame is properly made it is likely to prove so much stronger than a wooden frame in case of a wreck that more money can be spent to advantage in repairing it.

When iron tender-frames were beginning to come into use we had the opportunity of noting the behavior of two of these frames. One of them went through a bridge with the engine and the tank was entirely destroyed, but the frame was little worse and did not cost $5 to put in perfect order. A year or two afterwards it was in a head-end collision, and came out little worse, although the wooden frame belonging to the other engine was destroyed, as wooden frames generally are when they go into a bad wreck. The other iron frame had better fortune, and did not meet with accident. We watched it for five or six years, and in that time it cost nothing for repairs. We had been previously prejudiced against iron frames, because everybody said that a wreck would ruin them. One of these convinced us that they came through ruin in very good shape, and the other appeared to teach that a frame that required no repairs in five years could afford to take the chances of going through a wreck.

### Compound Locomotives.

A very valuable and interesting report on compound locomotives was submitted by the committee of the Master Mechanics' Association of which Mr. George Gibbs is chairman. The report was devoted principally to the reviewing of the progress made in compounding during the year and to the testimony of those who have compound locomotives in use concerning the performance of such engines. The increase of compound locomotives in service since last year is considerable, and a large number are still under construction. The committee gave figures which showed that in June of this year 422 compound locomotives were in use in this country, as compared with 114 in use a year ago. They also had information that 108 compounds were under construction in this country and 75 American compounds in use in foreign countries.

The report discusses the testimony for and against compounds in a thorough and impartial manner, as might naturally be expected of Mr. Gibbs, who did the principal part of the work. The following conclusions were come to: The compound is suitable for a variable class of freight service. Its range of economy in such service is fully as wide as the simple. Its increased coal economy over the simple in the average freight service will be found to be between 10 and 15 per cent. when in good running condition and handled with intelligence. A well designed compound should not be more difficult to keep in a serviceable condition than a simple. The net running cost of a compound will be less on many roads than of simple. In passenger service the availability of the compound is undetermined. Complicated designs of compounds are not likely to prove successful or economical.

The report elicited a long discussion. The drift of it was that those best informed concerning compound locomotives considered that they saved about 20 per cent. of fuel in freight service, and that the saving in passenger service was very doubtful. It was evident that the members of the association considered that the compound was a moderate success, and that there is a future for it in the motive power of American railroads.

### Dangers of Inferior Material.

In the controversy that has arisen lately among railroad companies and makers of boiler steel about the quality of the material furnished, there has been an inclination on the one side for purchasers to blame the makers for supplying an inferior article, and for the other side to retort that the tendency towards an inferior article has been encouraged by the disposition manifested to purchase the cheapest regardless of quality. We are inclined to believe that railroad companies are much more to blame for the inferior steel supplied for boilers than the makers of steel. There is nothing more certain than that the quality of a material in demand will eventually regulate the supply. Some railroad companies talk very bravely against all material of an inferior quality, but somehow they will buy the cheapest, tests and specifications notwithstanding.

It is very important from the standpoint of self interest that railroad companies should purchase nothing but first-class material for fireboxes and boilers, but those who are willing to pay one cent a pound extra for material that will give superior service are in the minority. Nearly all railroad companies buy their steel in the cheapest market and depend on luck to get good results. Luck does not favor this species of stupidity, and fireboxes have to be renewed after half the service that good material would insure. And this is why the shout is heard all over the land that firebox steel is not as durable as it used to be. There are roads, with the reputation of being first-class, that never purchase a pound of first-class steel for boiler purposes. All they consider is cheapness in first cost.

Inferior steel for fireboxes generally brings its own reward in the shape of premature renewals, and the greatest injury done is to the railroad companies following the policy of purchasing inferior material. But there are other lines of inferior purchase in which others besides the buyers are sufferers. A great many steel axles have been put under cars of late years and certain companies purchase these axles in the cheapest market. When this is done, Bessemer steel axles are invariably supplied, and articles of this material are not safe to put under a car. Several companies recognize the danger of using Bessemer steel axles, and place them only under freight cars, where they are not likely to commit wholesale slaughter in case of breakage. The slaughter, however, is merely a matter of degree. The breakage of a Bessemer steel axle is likely to kill only a few trainmen, and they do not inquire so strictly into the causes of an accident as passengers are likely to do. It is, however, a scandalous condition of things that railroad companies are ready to jeopardize the lives of trainmen in order to save a few cents on the cost of an axle. It is scandalous, but it is done daily, all the same. Who is going to deal with this outrage? We understand that the subject is under investigation by members of the Interstate Railroad Commission. We cordially hope, in the interests of humanity, that they will find the means of prohibiting the use of inferior axles under any kind of cars. An amendment to the law relating to safety appliances could be easily framed which would make the use of dangerously weak axles too risky from a financial standpoint. That would end their use.

Since writing the above we have received a copy of "Proposed Specifications for Steel Axles" prepared by the officers of the Pennsylvania Railroad. The proposed specifications will require the same chemical composition for both passenger and freight car axles; and the freight car axles, in addition to the chemical tests, will be submitted to a severe drop test. All axles will be rough turned throughout. This new rule will practically call for the same kind of axle for passenger and freight cars. It is a move in the direction of safety and follows the dictates of humanity. We most cordially trust the proposed specifications will be adopted and that other railroad companies will quickly follow the example shown by the Pennsylvania.

### One-Sided Contracts.

A good many railroad companies might get a lesson worth learning in a decision lately given in a suit against the Western Union Telegraph Co. It is a common practice with many companies to issue tickets with a great many conditions attached that the buyer never thinks of reading and to which he is no party. The Western Union has been in the habit of doing the same thing, one of their conditions being that they will not be responsible for the correctness of the messages that are not repeated and paid for twice. A business man whose message was distorted sued the company for damages, and obtained judgment in spite of the rule requiring a message to be twice paid for to insure accuracy. The court held that putting these conditions on the message form did not constitute a contract. Many railroad companies might as well save the printer's ink that they waste in putting conditions on tickets that the purchaser never reads.

By the way, it shows the long suffering

of American business men that they endure without revolt the inflictions put upon them by the Western Union Telegraph Company. Unless it be at the principal stations an operator is seldom found who can read ordinary handwriting. The very cheapest kind of labor is employed, and any message departing from the most elementary expressions is certain to be distorted. A collection of what are commonly called "bulled" messages would be a curiosity. Some of our readers with plenty of leisure would find collecting such messages a most amusing pastime.

## Boiler and Cylinder Proportions.

So many men have the opportunity, this year, of studying the development of the locomotive, by means of the splendid exhibit shown at the World's Fair, that there is more than usual interest in the subject. A remark frequently heard by those examining the splendid specimens to be found in Jackson Park is, The engines of to-day are larger than those that preceded them, but are they better proportioned? Are they built so that they will perform more work for the units of heat expended than the engines that are now considered ancient? A careful study of the American locomotives exhibited at the World's Fair, and of the run of engines built during the last year or two, convinces us that the modern engine is more efficient, as a means for converting heat into work, than the average locomotive of the past.

At all times there have been locomotive designers who had the power to distinguish the proper proportions for producing high efficiency, and their engines were celebrated in their day and generation. There have been other influential designers who persisted that certain essential principles could be violated with impunity, and their engines were wasteful. The same characteristics are to be found among locomotive designers to-day, and the same results follow, but the engineering world is nowadays so thoroughly informed about the proportions of every new class of locomotive that public criticism is calculated to restrain personal vagaries.

To discuss all the proportions of the modern locomotive as seen at the World's Fair and elsewhere, would be beyond the scope of one article; but we may profitably devote some space to looking into the proportions of boilers to cylinders. The proportion of these parts has never been the subject of a settled rule; but calculations made respecting the amount of heating surface to cylinder content of a great many locomotives, old and new, convinces us that there is an intimate relation between the two which cannot be much deviated from with impunity.

An English engineering journal writing on this subject says: "However much change may be effected in the type of a locomotive, certain proportions appear to be incapable of alteration without doing harm, 2½ square feet of heating surface ought to be provided for each square inch of piston area, or what comes to the same thing, one piston's area in inches multiplied by 5 will give the square feet of heating surface the engine ought to have."

This empirical rule is not far from being correct, but it gives a ratio too low for the ordinary run of American coal. It gives, however, a greater heating surface than many of our old locomotives were provided with. Take an American engine that was famous a decade ago, viz. the 17 x 24-inch eight-wheel engine popularly used for general service, freight and passengers. This engine seldom had more than 1,000 square feet of heating surface and the above rule called for 1,135 square feet.

The rule based on square inches of piston area, although it suited fairly well for engines with 24-inch stroke, was away off with shorter and longer strokes. A rule likely to be much more accurate, is the heating surface per cubic content of cylinder. Taking the proportions of heating surface and cylinder capacity of our older classes of engines, we find about 160 square feet of grate area provided for each cubic foot of cylinder. In a list of twenty-four locomotives selected from those at the Chicago Exposition and others that are doing well-known passenger service train work on different roads, we find that they average 220 square feet of heating surface to the cubic foot of cylinder capacity.

Some of the engines on our list are decidedly inferior specimens of locomotive designing, and they depreciate the general average. It will be noticed, however, that the allowance of heating surface to the cylinder that measures out the steam has been materially increased in the last ten years. Among extremes on our list, are Buchanan's "999," with 295½ square feet of heating surface to the cubic foot of cylinder; a Norfolk & Western, with the same proportion; a Baltimore & Ohio engine, with 131 square feet of heating surface to the cubic foot of cylinder, and the latest New York, New Haven & Hartford hard-coal burner, with 136 square feet of heating surface to the cubic foot of cylinder. The class I engine on the New York Central, to which the celebrated "870" belongs, has 232 square feet of heating surface to the cubic foot of cylinder. This may be regarded as the standard fast passenger engine of the road, and no locomotives running are more successful. A fast passenger engine designed by Mr. J. W. Cloud for the Erie, in 1888, which was considered a particularly well-planned engine for the time, had 200 square feet of heating service per cubic foot of cylinder. The fast passenger engines on the Old Colony, which are noted for their efficiency, have 194 square feet of heating surface to the cubic foot of cylinder. The latest Lake Shore flyers have 224 square feet of heating surface to the cubic foot of cylinder.

It is certain that designers who venture below 200 square feet of heating surface to the foot of cylinder are on precarious grounds, especially with passenger engines, which are now required to supply steam for car heating.

The proportion of the steam-making capacity of the boiler to the cylinders which have to be filled ought to receive the most careful attention of those who are responsible for the successful operation of locomotives, but it sometimes receives little consideration. Abnormally large cylinders are reputed by some designers to be economical, since they will do the required work with a short cut-off and admit of using steam expansively. We have known of a great many locomotives that have been built in Europe and in this country with large cylinders that were to get along with small boilers, but they never gave satisfaction in service, and the cylinders had eventually to be bushed. A representative case of this kind happened in England some years ago which excited a great deal of attention and discussion at the time.

When compound locomotives were coming into use, and claims were made that they were saving coal, Mr. Johnson, locomotive superintendent of the Midland Railway, insisted that the only way saving could be effected was in the use of the enlarged cylinders, which admitted of the steam being used expansively. He held that the same results could be obtained in an easier way by enlarging the cylinders of simple engines. To show the faith that was in him, he had a group of engines built with cylinders 19 x 26 inches and about 1,150 square feet of heating surface, giving 146 square feet to 1 cubic foot of cylinder. Every encouragement was given to the enginemen to make a success of the new class of engine. The best enginemen on the road were selected to work the engines, the best coal to be found was provided for them, the tubes were cleaned carefully at the end of each journey, and the best adjustment of draft appliances possible was made.

In spite of all this the engines were a failure from the start. They would not steam. The locomotive engineering world took sides about the engines. One side said, What else could you expect? You can't expect to run express trains with engines that have cylinders large enough to half empty the boiler at each stroke. The other side argued that the boilers were large enough for the cylinders, but too small for the engineers; the real trouble being that the engineers could not be prevailed upon to work the engines hooked up close enough. Valves with long lap were put in to make the engines use the steam expansively in spite of the engineer; but the only effect of this was to cause the engines to lose time in starting and to give firemen practice with the pinch-bar. Eventually the engines had to be altered.

Similar experience was gone through with a class of engines built for the Erie seven or eight years ago. Other roads in this country have attempted to make powerful engines by the use of large cylinders without boilers to correspond, and always with the result of failure.

Another fallacy which has obtained many converts, is the theory that by providing a large firebox, the boiler would make sufficient steam with small tube-heating surface. The firebox surface is certainly very efficient for evaporating water, but it cannot be utilized to advantage unless there is sufficient tube area to carry off the gases freely. When the tube area which constitutes the chimney for the firebox is restricted, restricted nozzles must be employed to intensify the draft. The lessons of the experience learned by expensive experiment are, that ample heating surface must be provided for free steam-making, and that the flue area must be made large enough to permit the fire gases to pass through readily.

This is now the accepted gospel of locomotive designing and its influence is apparent on what may be termed the modern American locomotive. The heretics who attempt to be guided by different articles of faith are not likely to receive much enjoyment from their independent beliefs, especially if they be reduced to practice.

## Better Steps and Handholds for Locomotives.

It always seems ridiculous to hear anybody claim to have accomplished reforms, when it is known that the person doing the talking has only talked and not actually had a hand in the reforms made, and no one can despise more than ourselves the newspapers that head everything "as told exclusively," etc.

But, for all that, we cannot help thinking that, somehow or other, all the kicking we have done for the past five years about bad engine steps and handholds has done some good, for within that time almost every builder in the country has made better steps and better handholds.

Looking at all the sixty-odd locomotives at the World's Fair, there was but one that we could object to, and that was very much like those in general use five years ago.

The railroads, and not the locomotive builders, are to blame for these dangerous traps; the builder generally makes what the specification calls for, and it costs about the same to make a good step as a bad one, and the cost of locating it is the same in any case.

The Brooks Works have recently gotten up a splendid tender-step, large, extended toward the engine and two steps cast in one piece, closed at the ends and back; the only improvement that could be made would be to perforate the step to prevent the accumulation of snow and ice. Their suburban engine has a step and handhold arrangement that cannot be improved on.

The Pittsburgh Works have a good step, but have made some recent improvements in their handholds; they extend the handhold on the cab from a point half way up the window right down past the cab deck and curve it in to the lower lug of the cab bracket. This is the best handhold we now know of on locomotives—handles are an abomination.

Baldwin probably makes the best tank handhold, but there is not so much difference here, the thing to do is to make this handle long enough, it should extend from top to bottom of tank.

Many handholds are put as nearly over the steps as possible, this is a mistake, ample handholds should be provided on the engine and tender, and a large, substantial step located between them. If an engine is standing still a man will usually use both hands in getting on, but if moving in either direction at moderate speed the experienced railroader will grasp the *first* handhold with both hands and let the motion swing his body toward the step, by the time his feet are planted there he has got hold of both handholds and is safe.

Steps strung on a rod below the cab bracket and held by set screws are a delusion and a snare, they are too small to step *at* when the engine is moving, no one knows whether they will turn on the rod or not—they usually do—and they are eternally getting turned or bent by striking ties, rails, or other material, or snow. The only real good they are is to allow men to get into the cab in the shop while the tender is disconnected. It would be better if they were off every engine and a longer step put on the tender. These abominable engine-steps have cost more than one poor fellow his legs or his life.

The engine at the World's Fair, with the bad steps, belongs to the C. & O. Railroad. The tank step is a board on wrought-iron hangers, it is not large enough, and is placed so far under the tender-deck that it is almost impossible to put a foot on it to get *off* the engine. While to get *on*, at any speed, is dangerous—because the step is just about the distance below the deck to let a man's knee under it when his foot is on the step—this makes it almost impossible to straighten out the leg, and, if thrown hard, might of itself cripple a man. This engine has small handholds, and the regulation engine-steps on a rod.

On road engines men usually need to get on when they are going ahead, and as the tender handhold is always larger, longer and *lower down* than the engine handholds, nine out of ten men will mount by that. In swinging on this way the steps are on the wrong side, and experienced men will usually put one foot on them, but put the other on top of the first axle-box of the forward tank-truck, this is safest, as it distributes the work of overcoming the inertia of the body to three points, the hands and each of the feet. If in place of the costly and dangerous engine-step in the shape of a fire-shovel, the master mechanics would put a step on the corner of the truck-frame or box, it would be better, a flat piece of boiler plate would answer well enough.

It will always be necessary for men to get on and off moving engines, orders to the contrary notwithstanding, so the thing to do is to furnish good steps and reliable handholds with as much uniformity as possible. It were far better they be too good than too bad.

## The Handicap in Locomotive Building.

The Grant Locomotive Works, which became insolvent in the beginning of June, are not likely to be put in operation soon. The works had only been in operation a few months, and their success as a manufacturing enterprise was greatly hampered from the start through labor troubles. Competition in the building of locomotives is so keen that there is little profit in the business, and the only chances for a new concern to succeed is by the use of the most approved appliances for cheapening the cost of production operated by men specially skilled in the work. The great bulk of the workmen employed in the successful locomotive works are specialists who perform recurring operations very rapidly. These men are trained to the business by years of practice and they all work on the piece-work system. No new establishment can compete with work done in this way unless the same methods are adopted and adhered to. It would be just as reasonable to expect that a sewing-machine factory could be run successfully in Chicago on the old system of doing all the work by all-round machinists, as it is to expect that locomotive works in Chicago can be carried on with profit to the owners on a day pay system with every workman running one machine

But this was the foundation of the dispute which arose between the Grant Locomotive Works Co. and their workmen. The managers of the works wished to establish a system of piece-work similar to what prevails in all other locomotive building shops, and the workmen would not consent to the arrangement. They would work only by the day, and an agreement was entered into among the men that no one should work more than one machine.

The workmen in the neighborhood of Chicago may be united and powerful enough to prevent the general introduction of piece-work into the Grant Locomotive Works, but if they succeed in doing that, it is certain that the works will never build locomotives and sell them in competition with other locomotive builders.

### A Whistling Abomination.

On most of the railroads of the country, that make any pretentions to keeping up with the times, there is a rule forbidding enginemen from blowing their whistles while passing a passenger train, except to prevent an accident.

No man can say but that the practice of blowing whistles in close proximity to a loaded passenger train is very annoying to all the customers of the road and does direct injury to many whose nerves are sensitive, especially women and children. The writer recently saw an infant frightened almost into spasms by a switch-engine whistling fiend employed in the Hoboken yard of the D. L & W —one of ...oads where whistling is a large part ...e business.

...n the road in question, switch and ...ht engineers are allowed to open their ...ar piercers beside passing trains indeed, there seems to be a disposition to wait until there is a crowd to hear the whistle before it is used.

In years gone by, a good deal of "tooting" was indulged in on all the roads, but nowadays the whistle is used to protect people and warn trainmen, and any road careful of its reputation for comfort prune the whistling all that is possible.

If it seems absolutely necessary for switch engines to whistle twice before moving ahead, and three times before moving back, then the railroad owning said switch engines owe to the public the use of smaller and weaker-lunged whistles; the marrow-stirring fog-horns in use should be choked.

If anyone wants to see the whistling mania in all its original noisiness let him ride a few times between Hoboken and Newark, in the State of New Jersey, and note how patiently the switchers in the coach yard wait for the trains before they screech, and observe the effect on the people in the car when a freight train whistles beside it in the tunnel, or note the second-nature regularity with which the engineer of the incoming local waits until he is beside the outgoing one before he hangs his arm over the whistle cord and rests himself on it for a minute or two.

Whistling beside passenger trains is as offensive to passengers as smoke, cinders, bad lights or cold feet, and any road will spend money to lessen any of these. They could stop the whistling by a bulletin notice and an example, and, as most of them will try to accomplish impossible things by this means, it is all the more surprising to find roads that don't try to stop the noise and annoyance when it would cost nothing but an effort—then think of the cars that steam would haul if put into the cylinder instead of worked up into noise to try men's souls with.

### Why Don't They Pay Promptly?

Railroad business keeps up remarkably well all over the country, but the companies are preparing for a depression in trade and helping to bring it on by declining to purchase anything not absolutely required for immediate use. Bitter complaints are heard among railroad supply men, about railroad companies delaying the payment of bills. A curious thing about this is that the companies best able to settle their obligations promptly are the first to plead stringency of the money market as an excuse for delaying the payment of outstanding accounts. There is no class of people doing business who have less justification than railroad companies for the practice of delaying the settling of bills, for they do a strictly ready money business themselves, and it is only common fairness that they should pay out promptly. Men doing business with them are perfectly aware of this, and they do not spare denunciations of the practice that puts them to so much inconvenience. All this helps to cultivate an anti-railroad sentiment among those who are naturally the best friends of railroad companies.

### The Pratt & Whitney Catalogue.

Those interested in first-class machine tools ought to send for the new illustrated catalogue just issued by the Pratt & Whitney Co., Hartford, Conn. Those who are familiar with this company's goods will readily agree to the claim made in the catalogue that "the reputation of the company's tools for exactness, convenience, elegance and adaptation to the end sought is the result of a well-defined policy as to sentiments of fair dealing Every opportunity for improvement has been accepted, and no device that could add to the usefulness of the tool has been neglected. They have sufficient weight to secure strength and durability without clumsiness, they are simple in design, convenient in arrangement of parts and accurately constructed"

The list of tools has been materially increased since the last catalogue was issued, and contains all the lighter tools used in machine shops and some very powerful ones Among the latter is a double-headed milling machine which is used in some shops to flute side rods, work that it does in half the time taken by a planer. The catalogue contains such a great variety of familiar tools that we cannot go into particulars, but we would strongly recommend master mechanics and others who are in the habit of making their own small tools, to get this catalogue and study over the prices. This will present a strong argument against making small tools in railroad shops

"Some Points on Steel-Tired Wheels," is the title of a pamphlet issued by the National Car-Wheel Company, Depew, N. Y. The pamphlet serves as a notice that the company named is about to begin the manufacture of wheels. They are said to be exceptionally well provided with the best modern appliances used in wheel making If they make their wheels as good as their description of the attributes of a good wheel, they are certain to secure a good business

William Sellers & Co., of Philadelphia, are building two large electric cranes for the Robinson-Rex Manufacturing Company, of Pittsburg. Each of these cranes has a span of 80 feet, one being of 30 tons and the other 80 tons. The cranes are provided with a double trolley, a distinctive feature which enables the cranes to be engaged on two separate pieces of work at the same time, or both trolleys can be used together.

### PERSONAL.

Mr. John S. Funk, master mechanic of the Northern Central Ry., at Marysville, Pa., died last month.

Mr. James Brady has resigned as division master mechanic of the Gulf Colorado & Santa Fe at Temple, Tex.

Mr. Linton Williams has been appointed superintendent of the Abbotsford & Northeastern, with office at Athens, Wis.

Mr. Henry Schacks, late superintendent of motive power of the Illinois Central, has returned from a visit to Europe.

Mr. John A. Willey has been appointed traveling engineer of the Black Hills division of the Fremont, Elkhorn & Missouri Valley R R.

Mr W. A. Walden has been appointed acting master mechanic of the Atlanta & Charlotte division of the Richmond & Danville Railroad.

Mr William Moncure, superintendent of the Carolina Central, has been appointed superintendent of the Raleigh & Gaston and Raleigh & Augusta Air Line.

Mr. L. P. Ligon, foreman of repairs at the Radford, Va., shops of the Norfolk & Western Railroad, has been promoted to the position of master mechanic

Mr W. W. Atwood has been appointed manager of the Middlesex Valley Railroad, with headquarters at Naples, N. Y, in place of Mr. H S. Stebbins, resigned.

Mr. F B. Farmer, for some years instructor on the Westinghouse instruction car, has been appointed local agent of the company at St. Paul in place of John Church, deceased.

Mr. A. A. Braden, master mechanic of the Lake Shore & Michigan Southern shops at Norwalk, O., has been appointed master mechanic of the shops of the same road at Cleveland, O.

Mr. G. W. Offutt has been appointed superintendent of the central division of the New York & New England, with headquarters at Providence, R. I., in place of Mr W S Jones, resigned.

Mr. T. R. Chatham has been appointed road foreman of engines of the Richmond & Danville R R., to succeed Mr. W A. Walden, promoted to the position of master mechanic of the same road.

Mr J. N. Kelley, general foreman of the shops of the Gulf Colorado & Santa Fe at Temple, Tex, has been appointed division master mechanic of the road at Temple to succeed Mr. James Brady, resigned.

Mr. E. E. Elden, who has been connected with the Elkhart shops of the Lake Shore & Michigan Southern, has been appointed master mechanic of that company's shops at Norwalk, O., to succeed Mr. A. A. Braden.

Mr Charles H Hogan, the famous engineer of the New York Central whose portrait appeared in the last issue of LOCOMOTIVE ENGINEERING, has been appointed road foreman of engines of the Buffalo division of that road.

Mr John Forster has been appointed assistant master mechanic of the Atchison, Topeka & Santa Fe, at Argentine, Kansas, in charge of Kansas City terminals, *vice* Mr. W H. Traver, resigned to accept service with another company.

Mr J S Graham, master mechanic of the Lake Shore R R, at Cleveland, resigned lately, but we understand that President Newell insists that he shall remain in the service of the company. He has been with them a great many years.

Mr. M. Hopkins has been appointed general manager of the South Side Rapid Transit Railroad, of Chicago, in place of Dr. Bernard, resigned. Mr. Hopkins rose from the position of brakeman on the Chicago & Northwestern to be superintendent.

Mr. Gus T. Neubert has been appointed division master mechanic of the Panhandle division of the Atchison, Topeka & Santa Fe, with headquarters at Wellington, Kansas, *vice* Mr. John Forster, promoted. Mr. Neubert was formerly general foreman at Nickerson, Kansas.

Mr. C. Thompson, son of Mr. Charles Thompson, superintendent of machinery of the New Jersey Central, has been appointed master mechanic of the Kings County Elevated Railway. Mr. Thompson has been for several years a foreman at the New York Central shops, West Albany

Joseph York, the old engineer, whose life story was told in LOCOMOTIVE ENGINEERING of July, 1892, and who spent May and June at the World's Fair, he having been engineer on some of the old engines there more than half a century ago, went home ailing early in July and died on the 7th.

Mr. Robert Burgess, air-brake expert for the L.& N., at Louisville, Ky., and president of the new educational association of air-brakemen, has accepted a situation as instructor on the Westinghouse Company's air-brake car. The Westinghouse Co. could not have secured the services of a brighter air-brakeman.

Mr. B. Haskell, master mechanic of the Northern Pacific at Missoula, Mont., has accepted the position of superintendent of motive power and rolling stock of the Chicago & West Michigan and Detroit, Lansing & Northern, with headquarters at Grand Rapids, Mich., to succeed Mr W S Morris, who resigned April 1st.

At the late mechanical conventions, Mr F. W Coolbaugh, of New York, interested himself in collecting money for the benefit of the children who receive treatment in the *Daily News* Sanitarium, in Lincoln Park, Chicago. We see, by a note in a Chicago paper, that $87.89 had been received for this noble purpose.

Mr. Charles B. Bush, superintendent of the middle division of the Michigan Central, died last month at Jackson, Mich Mr. Bush rose through various positions to be superintendent, having been on the road forty-four years. He was a remarkably pleasant gentleman and was highly popular with all the men under him.

Mr. A Von Borries, superintendent of machinery of the Hanoverian railroads, is in Chicago, visiting the Exhibition He has been appointed by the Prussian government one of the jurors in the railway department of the Exhibition. Mr. Von Borries is an inventor of several important improvements on compound locomotives

The numerous railway friends of Mr Harvey Middleton will be pleased to learn that he has been appointed manager of the Pullman Works, at Pullman, Ill. He has been for several years superintendent of construction at the works. At different times before that he was superintendent of machinery of several of our most important railroads.

Mr. T. A Lawes, who has been for some time master mechanic, in charge of the Brightwood shops of the Cleveland, Cincinnati, Chicago & St. Louis, has been made mechanical engineer of the road Mr Lawes was for some time chief draughtsman for the late W. F. Turreff, on the

C., C., C. & I., and passed through the position of shop foreman to be master mechanic.

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We have to acknowledge a pleasant call from Mr. Serge Kareischa, of St. Petersburg, Russia. Mr. Kareischa is engineer of ways of communication, and consulting engineer of the Russia Southwestern Ry. He is also a member of the Imperial Russian Technical Society. He expressed himself as being very much interested in LOCOMOTIVE ENGINEERING, and in the proceedings of the American Railway Master Mechanics' Association.

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Mr. C. E. Schaff became trainmaster of the Cleveland division of the Big Four after a rapid advancement from a yard position. Nearly two years ago he resigned to accept the position of general superintendent and purchasing agent of the Peoria & Pekin Union, of which Joseph Ramsey, Jr., is president. President Ingalls has now selected Mr. Schaff to go into his office as secretary, with power to act in Mr. Ingalls' absence.—*Cleveland Leader*.

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All those who attended the late mechanical conventions, will remember how industriously Mrs. George McGuire, of Cleveland, labored to collect money for the Fresh-Air Fund for children. This is a labor of love which Mrs. McGuire undertakes every year, and we are glad to learn that she met with unusual success at Lakewood. She asked for no larger sum than twenty-five cents, and that only from men. A great many must have contributed, for we read in a Cleveland paper that she turned in the sum of one hundred dollars to the Fresh-Air Fund.

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The employees of the New York & Northern invited their late general manager, Mr. H. H. Vreeland, to have a finishing interview with them as a body one evening last month. They began the proceedings by getting Master Mechanic Millen to present Mr. Vreeland with a handsome cane and a flow of kindly eloquence. Others then took turns in telling how well they enjoyed the treatment given to them by their late general manager, and a delightful evening was spent expressing friendly sentiments and impressing various good things provided for the inner man.

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We are acquainted with no master mechanic in the country who has made a better record, under difficulties, than Mr. Thomas Millen, of the New York & Northern. With remarkably small facilities for doing work, he kept the rolling stock of the road in wonderfully good order, and was always cheerful and hopeful that better times would come to the company, and money would be forthcoming to stock his shop with much-needed tools. His superior officers must have appreciated his efforts, for, when Mr. Vreeland left, to accept a high appointment, Mr. Millen was promoted to the position of superintendent. He still performs the duties of master mechanic, and we feel certain that he will make an excellent officer for the dual position.

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A rather pretty story is told in a late issue of the Philadelphia *Times* concerning Mr. S. J. Potts, lately promoted to be trainmaster of the Pennsylvania. Mr. Potts has been in the employ of the company for a good many years, having entered the service as brakeman. When he applied for a position on the Pennsylvania Railroad, he was destitute, having spent all his money seeking employment. But he had good clothes, and hearing one evening that there was a vacancy in the train service, he went to apply for the job dressed in an evening suit. He got the position as brakeman, and was told to go out at once. So he went out and made the round trip, dressed in a claw-hammer coat and no vest to speak of. The boys made fun of him, but he did not mind and hung to his job.

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The following well-known railroad master mechanics have received the honor of being appointed judges of the transportation exhibits at the World's Fair. Mr. John Hickey, superintendent of motive power of the Northern Pacific, and president of the Railway Master Mechanics' Association, Mr. J. N. Lauder, superintendent of rolling stock of the Old Colony, and past-president of the Railway Master Mechanics' Association, and Mr. L. P. Losee, superintendent and master mechanic of the Pennsylvania at Wellsville, O. Mr. R. C. Blackall, superintendent of machinery of the Delaware & Hudson and 2d Vice-President of the Railway Master Mechanics' Association, was offered the appointment of judge of exhibits, but was compelled to decline owing to the absence of the general manager.

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Our readers will find on another page an interesting letter from Mr. James Hedley on the invention of the link motion and giving other interesting reminiscences of early railroad engineering. Mr. Hedley is of peculiar interest to engineers himself, for he is a nephew of the famous William Hedley, who was undoubtedly the father of the locomotive. He was the first man to build a practical locomotive that did paying service hauling cars, and it was by examining Hedley's locomotive that George Stephenson obtained the ideas of how to build one. It may interest our readers to know that Mr. James Hedley has two sons master mechanics of American railways. One is Mr. E. M. Hedley, of the Brooklyn Union Elevated; the other is Mr. Frank Hedley, for several years master mechanic of the Kings County Elevated and now of the Lake Street Elevated in Chicago. Both are young men of much promise and both are a credit to the engineering race from whom they sprung.

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When the owners of rival railroad companies became alarmed at the progress which Mr. A. A. McLeod was making towards regenerating the Reading, and used their combined influence toward taking the financial support from under his feet, they appeared to think that a dangerous power was suppressed. The energies of men like Mr. McLeod are not so easily quenched, although they may be banked for a season. Since retiring from the Reading, Mr. McLeod has been recuperating and devoting a little of his superfluous energy to straightening out the affairs of the New York & New England road. The weakness of that property has always been that one end is bottled up without a natural terminus. It looks now as if Mr. McLeod was going to force it on to New York City. He has taken a leading part in incorporating a road to connect with the New England road and extend to New York. There will be hard times around if he does not push the enterprise through. We have noticed lately that the people of Philadelphia are beginning to acknowledge that their city lost a [illegible]ful friend when Mr. McLeod left the Reading.

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## Samson Fox.

One of the most interesting strangers in attendance at the railroad mechanical conventions was Mr. Samson Fox, whose name is associated in the minds of railroad men by the pressed-steel truck which bears his name. Mr. Fox is much more familiar to the engineering world at large as patentee and maker of the Fox corrugated furnace.

The life of Mr. Fox is a good illustration of what native energy and ability will do for a man who has had a poor start in the race of life. Mr. Fox entered as an apprentice in a large engineering establishment in Leeds, England, when he was fifteen years old, to learn the business. When he was twenty-one years old he was promoted to be foreman of a department. Two or three years afterwards the superintendent of the works was taken sick and Mr. Fox was appointed temporarily to the position and held it a year. Then he was sent to the Exhibition of 1862, in London, in charge of a large exhibit. As he expressed it himself, this was the first opportunity he had of wearing a black suit of clothes.

When in London he learned about the scientific classes in connection with the South Kensington Museum, and when the Exhibition was over, entered as a student, learning drawing and applied science. After a time he returned to his old employers and worked in various capacities, but finally decided to start business for himself, making boiler-plates, flanged beads, etc. One day, when reading the Government boiler inspector's annual report, he was struck with the number of collapsed furnaces, and got ruminating on the subject. It suddenly struck him that by corrugating the furnace a stronger furnace could be constructed with the thin sheets necessary. He went to work in this line and achieved unparalleled success. There are now 72,000 of his corrugated furnaces in use. This furnace effected a revolution in the steam pressure carried in marine boilers. When it was first introduced the prevailing pressure was 70 pounds to the square inch; it is now 160 pounds. There are 200 triple-expansion engines in use that draw steam from boilers pressed to 200 pounds.

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The New York, New Haven & Hartford Railroad management have raised the pay of the conductors, brakemen and other employees of the Providence division. When this division was operated under the Boston & Providence Company it paid the largest dividends of any railroad in the country, and the employees were among the worst paid in New England. When the Old Colony got the road the management did not prove any more generous towards the men than the old company had been, but the New Haven Company has displayed a much better feeling of justice. The Old Colony people were noted for the small salaries they paid to foremen, master car builders, master mechanics and others in the responsible positions that preclude the exercise of pressure in asking for justice. We hope the New Haven people will remember this class of men, for New England is greatly in need of the example of a railroad company being willing to pay the men fairly who are responsible for carrying out the details of management.

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## Pleased with Lakewood.

When the railroad mechanical conventions met last year, instructions were given to the committees having the selection of a place of meeting for this year to arrange for a place as near to Chicago as possible, to make it convenient for those who wished to attend the World's Fair. When the committee met to effect the final arrangements, they found it impracticable to select a suitable place near Chicago, and Lakewood, N. Y., was chosen with considerable misgiving. It was the best that could be done, but those responsible for locating the convention there were afraid that the accommodation would prove unsatisfactory. The conventions are past, and all are happily disappointed in their fears that the place would not be popular. We do not remember hearing fewer complaints with a place of meeting. This has been due to a great extent to the efforts of the hotel keepers to do all in their power to promote the comfort and convenience of their guests. Mr. Brady, proprietor, and Mr. Fox, manager, of the Kent House, deserve all praise for their untiring efforts to please their guests, and Mr. Frisbie, of the Sterlingworth Inn, is equally deserving of credit. The visitors carry away so many pleasant memories of the place that we believe the conventions will go there again.

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## Some Short Notes of Long Tramps.

[EDITORIAL CORRESPONDENCE.]

I don't know of a harder job than tramping around the World's Fair grounds for a week—firing a hog is child's play to it.

But I want to say right here, that every railroad man who can muster the money, and get the lay-off, ought to take in the Fair. Never before has there been collected at one spot on the earth such an array of the products of human skill; and, no matter how long a railroad man stays, he cannot help going away proud of the fact—for fact it is—that the Transportation Building is the most interesting, and the exhibits the best arranged, of all the great palaces in the White City. Not alone is this building of railroad and other transportation exhibits interesting to those in the business, but to all the visitors, with few exceptions.

In one exhibit alone, that of the B. & O. Ry., there is the whole history of railroad development, not alone in this country, but in the world.

A full-sized model, or an actual machine, of every steam locomotive, of any particular design, from Newton's kettle, that blew a jet of steam back into the air, up to the magnificent compound at the head of the Royal Blue train, is here shown.

Here the men of to-day can see what the fathers of the locomotive had to contend with, the material they used and the results they accomplished.

Here are actual locomotives that have been in the service for fifty and sixty years, and were just taken out to come to the show—grisly old fellows, small and queer, but with an honorable record of a long life of hard work, commenced before most of us were born.

I couldn't help but think that if these old "grasshoppers" and "mud-diggers," and the rest of them, were conscious of passing events, and could remember, they would each feel—as they looked across the aisle at the mammoth engines of 1893—very much as an old ape would feel who had just been convinced that the Darwin theory was correct, and that he, himself, was great-grandfather to some shining example of the human family—myself, for instance.

Besides the forty or fifty models, or actual ancient engines, this company also show 1,700 large pictures, in which there are four series, one shows the development of the locomotive, and is complete, from Genesis to Revelations, another shows the development of the brake, from the ox-cart skid to the latest automatic; still another series shows the development of track, from the old cast-iron fish-belly rails three or four feet long, up to the thirty-foot rail of 100-pound steel on stone ballast, while the fourth traces the car from the oldest to the last.

Besides this, there are here, framed, many old and interesting drawings, some of them from the hands of noted men who long ago went away on ships of air into that unknown and eternal subsequently, leaving behind them monuments of their work.

The "old-timer," who feels unhappy with his modern engine, and is continually sighing for "the good old times," should come here and see some of the good engines in use before the war, Masons', Griggs', Perkins', Winans' and a few more of them—you couldn't hire them to run them now.

It is only seventeen years since the Centennial, but seventeen years ago the Junior Philosopher was young—just a tender young thing—and well he remembers with what awe he gazed upon the B. & O.'s mogul passenger engine "600," that stood beside an old "grasshopper," with the proud words over her, "B. & O. Ry., 1876," while the old walking-beam engine bore, though rather shamefacedly, the legend, "B. & O. Ry., 1831."

Well, only seventeen years have come and gone since then, the Junior Philosopher is not so spry in the legs as he was;

that magnificent mogul is an old engine, with visible signs of palsy, and no slight indication of Bright's disease, or stone in the bladder. She is as small, in comparison to some of the locomotives of '93, as the grasshopper was small to her only seventeen brief summers ago; yet that old grasshopper is here, looking just as chipper as in '76, been sawing wood steady ever since, and has no intention of giving up yet—of course, she don't intend to do any more of the hard work, going to let the children do that, but when it comes to doing chores for her keep, she is worth just as much as a full hand—so, it seemed to me, she was thinking.

The array of modern locomotives is complete, almost every maker in the country being represented, not by one but by many engines. There are French engines, fearfully and wonderfully made, German engines, English engines, old and new, and, ah! what finish of sheet-metal work and paint.

But, going from the fine finish, but complicated parts, on the foreign engines to the simple, massive, easily-repaired and get-at-able American engines, every son of the soil will feel proud of his country and its motive power.

There are four air-brake companies, exhibiting 100 brakes each, and an instructor is constantly in attendance—and the boys keep them busy. This alone is a great educational feature.

The famous old war engine "General" is here, and attracts a great deal of attention.

The "John Bull" came here from New York, under her own steam, and all the boys want to see her. 'Cause she went running in '31.

The "De Witt Clinton" stands outside, alongside of the "999," and men, women and children are asking continually "Where is that '999?'" I confess, I wanted to see her, myself. She is certainly the queen, and Solomon in all his glory was not furbished up as Nat Sawyer insists on the "999" being, if a fly lights on her, Nat sends one of the boys out to get rid of that speck.

If there is anything about a locomotive, any kind of metallic packing, injector, lubricator, oil-cup, headlight, or the like, that you want to know about, you can find their headquarters right here, and a polite attendant to explain anything you don't know.

Are you interested in compound locomotives? Well, here is a French 4-cylinder, a Webb 3-cylinder, Pittsburgh 2-cylinder, Schenectady 2-cylinder, Rhode Island 2-cylinder, Brooks 2-cylinder and 4-cylinder, Baldwin 4-cylinder, not one, but several of a kind.

Here is the largest engine in the world, a whale, and you can't see how the track holds her up and a firebox about the size of a bed-room. I heard a fireman say to his pard, after a long look at her firebox "Say, Jim, they 'ort to back the pay-car right up here and tell the fireman to help hisse'f."

Foreign cars will make the compartment system plain to you—so plain you won't ever want to ride in 'em.

The automatic vacuum brake, used so much abroad, is here shown in section and explained.

Not only railroads, but every means of transportation, from a pack mule to a steamship, is in this building, but there is enough modern railroad equipment from all over the country to keep one interested for a week.

Hotel charges are not so extortionate as pictured. You can stop out near the grounds and get a good room for from $1 per day up, eat where you wish, the restaurants are thick.

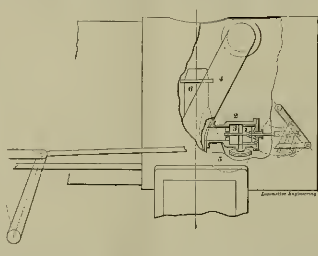
I believe that it would be a good investment for any railroad man to come here, if for only three days.

Of course, if one wants to go up Midway Plaisance and see the elephant, and hear the speaking pig, ride on the big wheel, pinch the leg of the tattooed woman to see if she is real, see the harem of the King of the South Sea Islands (where the summer uniform is to braid the hair in four spikes, instead of two), why, all this will cost you extra money; but the great show itself is dirt cheap, and it's worth 50 cents a day for a week to see the magnificent buildings and the beautiful grounds that have sprung up from the marsh at Jackson Park like a mirage.

J. A. H.

### Starting-Valve for Compound Locomotives.

The annexed engraving illustrates a new form of starting-valve for compound locomotives, invented by Mr. T. W Heintzleman and Mr. C. T Noyes, of Sacramento, Cal., and applied to several Schenectady compound locomotives in use on the Southern Pacific. The valve consists essentially of a valve and casing connecting the receiver and the steam exhaust pipe as shown. This attachment is an addition to the ordinary intercepting-valve and does not interfere with the operation of the latter, its purpose being to enable both cylinders to act independently while starting. When the engine is in full gear back or forward, a connection with the reverse lever throws the valve into the position shown in the engraving. This opens the auxiliary port 3, and permits steam to pass from the receiver 4, by the auxiliary pipe 5, to the exhaust pipe 6. This allows the steam from the high-pressure cylinder to pass into the atmosphere. A separate starting-valve is provided to admit live steam to the low-pressure cylinder, which escapes in the usual way. The notching up of the engine automatically pushes forward the piston 1, closing the auxiliary valve 3, and permitting the engine to work compound. It is a very simple form of apparatus and is said to work very well.




Mr William Buchanan, superintendent of motive power of the New York Central, has got up a very handsome illustrated catalogue containing engravings of the most famous locomotives belonging to the road. There are half-tone cuts of the "999," the "De Witt Clinton," the "Exposition Flyer" on its way, and line engravings of all the leading classes of engines with tables of dimensions. By following back the classes, one can form a good idea of the increase of power required gradually as trains grew heavier and faster. In 1881, the first-class express engine had cylinders 17 x 24 inches, and driving-wheels 70 inches diameter, 1,353 square feet of heating surface, and weight 42 tons in working order. Three years later the cylinders had increased one inch in diameter, the weight of the engine was 49 tons and the heating surface was 1,598 square feet. Then came, in 1889, the 870 class, with cylinders 19 x 24, driving-wheels 78 inches diameter and 1,821 square feet of heating surface. That is the best type of modern passenger engine.

### EQUIPMENT NOTES.

The Kansas City, Pittsburgh & Gulf are about to order 600 cars.

The Nevada Central has ordered some locomotives from Baldwins.

The Waco & Northwestern are about to order two locomotives and one chair car.

The Michigan Central has ordered three locomotives from the Baldwin Locomotive Works.

The Central of Georgia is building, at its shops, at Macon, Ga., several new parlor cars for the "Nancy Hanks" train.

The Seaboard Air Line has just ordered the construction of forty-five patent stock cars at the shops in Portsmouth, Va.

The Beech Creek Railroad people have placed an order with the Lebanon Manufacturing Company for 250 freight cars.

The Soo Line has ordered one heavy consolidation locomotive from the Rhode Island Locomotive Works for special service.

The Portland Company are building three Nevens snow and ice flanges for the Bangor & Aroostook, now building through Maine.

The Pullman Company are building ten vestibuled passenger coaches and four vestibuled smoking cars for the Maine Central.

The Rodger Ballast Car Co. have just finished the construction of 250 of their cars for the Butte, Anaconda & Pacific Railroad.

The Wilkesbarre & Eastern have just received a new lot of box cars, and they have ordered fifteen passenger cars from Jackson & Sharp.

The Wabash Railroad Company have decided to apply the Gould car coupler and the Westinghouse train signal to all passenger rolling stock.

The Merchants' Dispatch Company are in the market for 300 cars. They will be equipped with all the latest improvements, including vertical plane couplers and air-brakes.

Forty new suburban passenger coaches are nearly ready to leave the Pennsylvania shops at Columbus, O. They differ in a number of details from other suburban cars on this system.

The Fitchburg people are building 150 new cars in their own shops and it is expected that the order will be increased to 1,000. They are to be furnished with all the best modern attachments.

The Paris, Lyons & Mediterranean Railway, one of the most enterprising companies in France, have decided to light fifty new passenger carriages by electricity. A storage system will be used.

The P. R. R compound "1515" has been doing good work for some time, on the N. Y. division. She burns as much coal as the simple engines, however, and is at present laying up with a broken frame in splints.

Work is quite brisk in the Roanoke Machine Works. During last month they built 150 freight cars, three consolidation locomotives and one supply car for the Norfolk & Western. The supply car is illustrated in another part of this paper.

The Lackawanna Refrigerator Transit Company are in the market for 1,000 beef refrigerator cars, and they want them at once. They are ready to contract for delivery by September. There are some peculiarities about the construction of cars and trucks that make delivery on six weeks' notice a difficult job.

Forty Pullman sleeping cars and ten Pullman parlor cars have just been added to the equipment of the Pennsylvania. Twenty of these sleepers contain thirty-six berths and twenty more have thirty-two berths. The average sleeping car has but twenty-four berths. The total length of the thirty-six-berth cars is 70 feet. They cost in the neighborhood of $20,000 apiece. With other cars received beforehand, the new additions to the Pennsylvania's Pullman service number seventy cars.

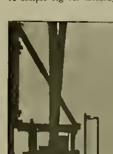
### Home-Made Tool for Grinding Steam-Pipe Joints.

Here is a snap-shot view of a tool got up in the Erie shops at Hornellsville, N. Y., for grinding steam-pipe joints and rings.

It can be seen at a glance that the old drill-press head has a bevel gear on the cone-shaft that meshes into one loose on the spindle that it drives by means of a feather.

The movable arms on the vise allow of the holding of almost any form of steam pipe and bringing the joint face level.

A simple rig for holding the ball joint




rings is fast on the spindle, and when driven at moderate speed with a supply of oil and emery, it is surprising how much sooner a bearing is got than when a man does the soot act in a smoke-box.

The counter weight keeps the spindle up when not in use.

This little tool saves lots of time and trouble, and is shown here solely as a pointer to roundhouse repair men who need something of that kind—and how many of them are there who do not

## Richmond Consolidation Locomotive.

The annexed engravings show two sectional views, of a fine consolidation locomotive built by the Richmond Locomotive Works and exhibited at the World's Fair. The following are the principal dimensions of the engine

CYLINDERS.

Cylinders, 20 in.
Stroke of piston, 24 in.
Piston-rod diameter, $3\frac{1}{2}$ in.
Piston-rod packing, metallic Jerome
Steam ports, 16 x $1\frac{1}{4}$ in.
Exhaust ports, 16 x $2\frac{1}{2}$ in.
Width of bridge, $1\frac{1}{4}$ in.
Slide-valve, Richardson balanced.
Travel of valve (maximum), $5\frac{1}{2}$ in.
Lap of valve (outside), $\frac{3}{4}$ in.
Truck-axle journal, 5 in. dia. x $8\frac{3}{4}$ in. long.
Tank capacity (water), 3,500 gallons.
Tank capacity (coal), 6 tons.
Rigid wheel-base, 14 ft.
Total wheel-base of engine, 21 ft. 8 in.
Total wheel-base of engine and tender, 48 ft. $\frac{1}{2}$ in.
Total weight of engine, in working order, 127,300 lbs.
Weight on drivers, 110,800 lbs.
Weight on truck, 16,500
Weight on tender, loaded, 67,000 lbs.

One of our Western correspondents adds the following postscript to an interesting letter

"Here is something that I think is funny This spring, when business began to get dull, some of the older men on a certain Western road thought it would be advisable to reduce the number of engineers employed. So, as usual, the Grievance Committee waited on the superintendent, and succeeded in having seven of the youngest men laid off. Then the division assessed itself to pay the Grievance Committee, and sent each member, including the seven unfortunates, a bill for \$2.65. Just imagine losing your job, and having also to pay \$2.65 for the pleasure (?)"

## Some Comical Things Seen and Heard at the Fair.

"Jeemses Cripe! pa, look at the spile-driver," said a 10-year-old kid as he caught sight of the great Bethelem steam-hammer, with a hammer-head weighing 125,000 lbs.

There are two German engines in the exhibit, one numbered 1338 and another 1322. The J. P. was tired and he sat down opposite 'em on a Barr contracting chill when two old ladies came along. "1338; dear me, I didn't know they had steam cars so long ago!" said one. "Look here, Mary," said the other, "this one was built in 1322, don't it look funny beside the kind they have now?" Then they both leaned their note-books up against something and made an entry about the "old" engines.

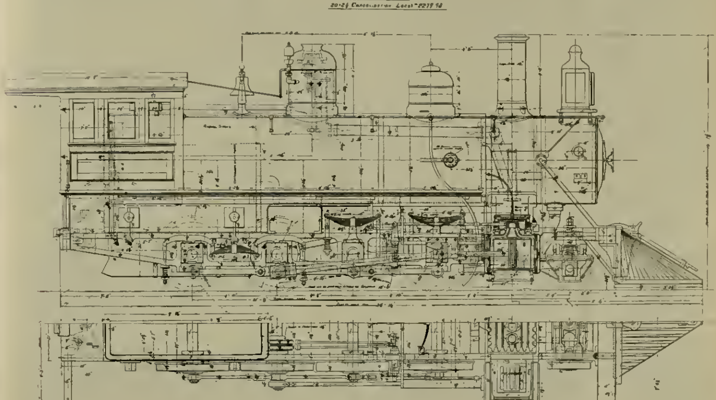
This always attracts attention. One day a little fagged-out man pushed a rolling chair and a 200-pound wife up to the railing and they admired the engine. She was making the notes and the man was doing the sweating.

Nat gave the lady his card and a smile. The lady adjusted her gold-rimmed specs and read the card. "Plug-puller, plug-puller; what's that, James?" "Why, that's what engineers call themselves, dear," said he, "that's the engineer of this engine, he's run 112 miles an hour. Quiet little feller, and I want to call your attention to the fact that he ain't no bigger than me, small men are the real——" "There, there, James," said she, "wheel me away, you're all the time bragging up these little runts to me"

It's always comical to see the inquisitive man "get a shock" at the "999." The draw-bar on her pilot is polished, as is most of the wrought-iron work on the engine, her nose sticks through under the railing, and about one man out of ten wants to heft that bar. This tarnished it, and the cleaners at last daubed the under side with black lead; now when a man lifts it he turns away quickly and hunts his handkerchief, and every half-hour Nat says "Boys, charge that bar again, they've wiped it all off"

The full-sized models in the B. & O. exhibit are such good imitation of iron that most folks feel the necessity of knocking on the sides of the boilers to see if they are iron or wood. R. C. Wright, in charge, is figuring on putting a boy inside each of them with instructions to yell, "Come in!" when they knock. While the J. P. was looking at one of these models, an Illinois Central fireman came along and opened the fire-door, knocked it with his knuckles, and said "Bejazes, that's nothin' but wud, but I suppose it owny timporary like, pwhy the doure on our ingin gets so bloody hot yez can't touch it, but, av coorse, they wurrked these ould pelters aisy to whot we do."

As I went into the Transportation Annex I found a woman and half-a-dozen youngsters in front of a little engine built by H. K. Porter & Co., and numbered 1, and a Brooks eight-wheeler, numbered 210, that stands on the next track. "Now, children," said the lady, "here is where you can see the way things are improved all



RICHMOND CONSOLIDATION LOCOMOTIVE, AT WORLD'S FAIR.

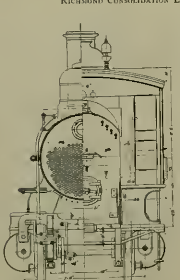
Lap of valve (inside), 0 in.
Lead in full stroke, $\frac{1}{16}$ in.
Valve stem packing, metallic Jerome.

BOILER.

Style of boiler, straight top, radial stayed firebox
Diameter of boiler (outside first ring), 60$\frac{1}{2}$ in
Thickness of shell, $\frac{9}{16}$ in.
Thickness of crown-sheet, $\frac{3}{8}$ in.
Thickness of side-sheet, $\frac{5}{16}$ in.
Thickness of back-sheet, $\frac{5}{16}$ in.
Thickness of tube-sheet, $\frac{1}{2}$ in.
Horizontal seams, quadruple riveted, butt joint.
Circumferential seam, double riveted.
Length of firebox, 103$\frac{7}{8}$ in
Width of firebox, 43$\frac{3}{4}$ in.
Depth of firebox (average), 59 in.
Water space (front), 4 in
Water space (sides and back), 3 in
Diameter of crown-stays, 1 in.
Number of tubes, 238
Diameter of tubes (outside), 2 in.
Thickness of tubes, No. 12 B. W. G.
Length of tubes, 12 ft. 8$\frac{3}{4}$ in
Heating suface of tubes, 1,595 sq. ft.
Heating surface of firebox, 155 sq. ft.
Total heating surface, 1,740 4 sq. ft.
Grate area, 30.8 sq. ft
Makers of firebox steel, Otis Steel Co.

DRIVERS AND TRUCK.

Diameter of driving-wheel, 50 in.
Driving-axle journal, 7 in. dia. x $8\frac{1}{2}$ in.
Engine-truck, two-wheeled pony-truck.
Diameter of truck-wheels, 30 in.



A railroad man was leaning over the railing looking at the great Erie decapod, and wondering if engineers would ever get paid for running engines according to their weight, when a young farmer from Indiana came up the aisle towing his best girl. They stopped before the monster, and the man spoke up: "Say, Sairy, she's some punks, ain't she? Say, mister, how many cogs has she got?" "Ten," said the railroader. "Is she fast?" "Lightnin' on a limb." "Well, a feller back there told us that big wheels was for fast, little ones for slow going. Her'n ain't so all-fired big" "Yes, but she's got ten; she's a multiplier. Supposen she was steamed for ten miles an hour; she's got ten drivers, ten times ten is a hundred—see!" "An' she's got two bilers on a side," observed the rustic, as he noticed the compound cylinders. "Yes, that's another multiplier. The big one catches the water and boils it again, gettin' twict as much power out of it, so, if she was multiplying for 100 miles an hour, that would give her 200" "Do ye mean to say this here engine kin go faster 'n 'lectricity—200 miles in one hour?" "I ain't sure," said the railroader. "We ain't had a chance to try yit, she's new" "Gosh! they air makin' improvements, ain't they, Sairy?" said the boy. Then the railroader went behind the engine and butted his head against the tank and laughed.

Nat Sawyer, in charge of the "999," has a personal card which reads "Nat Sawyer, N. Y. C. & H. R. R. Plug-Puller."

the time. There is the first engine; see the number, Willie? and here is the last—just see the difference in the size." When she got to the engine with the Wootten firebox she stopped. "Now, children, here is a tandem engine—see, one engineer is in one little house and the other one is in the one just behind him, that's tandem, you know."

Some of the locomotives are running by compressed air, and it's comical to see the railroad men feel of the cylinder casing to see if it's hot. One of 'em turned to his companions the other day, after feeling of a head, and remarked "That's the best job of laggin' I ever seen, it's as cold as a ham sandwich; why, my engine cylinder casing gets so cussed hot you could fry eggs on it; that's where half the heat goes to, then they kick about the coal you burn. My engine is a Baldwin, too, and if they'd lag their regular engines like *that* it would pay, pay big."

## BOOK REVIEW.

LOCOMOTIVE CATECHISM. By Robert Grimshaw. Page, $4\frac{1}{2} \times 7$. 362 pages, 178 illustrations and 7 folding plates. Norman W. Henley & Co., publishers, 150 Nassau st., New York. Price, $2.00

This is a new book on the old lines of questions and answers—perhaps the best possible way to instruct the novice. The author here gives some 1,300 questions and answers about locomotives, which are put into attractive book form, and provides a very complete index of subjects. Especial attention is given to compound engines, which are the subject of 18 illustrations and about 40 pages of matter; types being described and illustrated.

While there are probably very few questions in this book that are not asked and answered in other works on the locomotive, there is no doubt that they are well chosen, and make a valuable work for locomotive engineers, firemen, or others interested in the detail of the locomotive. It is, undoubtedly, the best of the series of catechisms written by the same author, and is worth the price asked many times over.

## Biographical Dictionary.

One of the most welcome books which we have received lately is the "Biographical Dictionary of Railway Officials of America," published by the *Railway Age*, of Chicago. The book contains well condensed biographies of all the leading railroad officers in this country and in Canada. The work has been admirably done, the careers of over 4,000 men being outlined. The book will be found very interesting to those who care to reflect on the careers of the men who keep the wheels of railroad progress moving. The student of his fellow-men will here find an amazing record of men whose qualities of self-help have raised them from workmen to leaders. One might read prolonged biographies for a lifetime and not learn about half the men who are mentioned in this single volume as having by their own unaided exertions climbed the ladder that leads from obscurity to celebrity. We heartily commend the book. It can be got for $3.

## A Way Out of the Trouble.

"I remember," said Gleason, thoughtfully, "when I first went running on the Lackawanna. I was stuck on my job, loved my engine, and was twice as jealous of her as I am of my wife. We had a trainmaster that got a notion that we were pulling trains far too light, and he commenced putting on cars. After a hard trip—doubling, running for water and the like—I went to see Bill Halstead.

"'Mr. Halstead,' said I, 'I've come to see you about these heavy trains. They are just pulling the stuffing right out of my engine, I can't take care of her this way. I've got the best engine on the road, and I don't propose to see her overloaded and abused without a kick.'"

"'I'll tell you,' said he, 'the best way to fix that—lemme see, which engine is yours? The 'Anthracite.' Oh, yes. Well, as I was saying, the company want a few engines, supposen you sell her to the road, they'd just as lief pull all the cars with her as not—how much do you want for her?'"


OPERATING AIR-BRAKES ON EQUIPMENT FOR ONE HUNDRED CARS.


WESTINGHOUSE AIR-BRAKE EXHIBIT AT WORLD'S FAIR.

The management of the Erie have announced that they will transport all employés and members of their family dependent upon them, to Chicago and back during the summer, in order that they may have the opportunity of visiting the World's Fair. This road is already doing a heavy passenger business between New York and Chicago.

Subscribe for LOCOMOTIVE ENGINEERING.

## Boilers and Furnaces.

By Angus Sinclair.

CONSIDERATIONS OF THE DESIGNER.

Persons who design boilers for supplying steam to engines follow certain well-established rules in order to make the boiler suitable for its purpose. In the first place they have to calculate how great a volume of steam per minute or hour the boiler will be required to generate, and they arrange the proportions to meet the requirements. With a certain velocity of draft the surface of a boiler exposed to the fire may be depended upon to evaporate a certain weight of water per hour when the grate is large enough to burn the fuel freely. The three leading factors in boiler design are therefore the character of the draft to be employed, the amount of heating surface, as the parts exposed to the fire gases are called, and the extent of grate area.

Besides arranging that a boiler shall be equal to the demands of steam making, there are several other important considerations that demand the care of the designer. Among these are strength sufficient to resist the pressure inside, durability, smallness of bulk and weight, free circulation of the water, ease of access for inspection or good provision for cleaning, and economy of fuel.

REQUISITES OF A GOOD BOILER.

In the Manual of Steam Boilers, by Professor Thurston, published by John Wiley

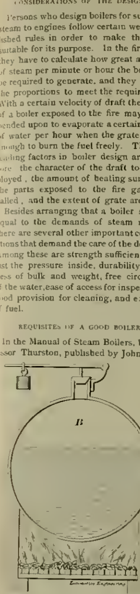



Fig. 1.

& Sons, New York, the following requisites are given as essential in a well designed boiler

1. To secure complete combustion of the fuel, without permitting dilution of the products of combustion by excess of air.

2. To secure as high temperature of furnace as possible.

3. To so arrange heating surfaces, that without checking draft the available heat shall be most completely taken up and utilized.

4. To make the form of boiler such that it shall be constructed without mechanical difficulty or excessive expense.

5. To give it such form that it shall be durable under the action of the hot gases and of the corroding elements of the atmosphere.

6. To make every part accessible for cleaning and repairs.

7. To make every part as nearly as possible uniform in strength and in liability to loss of strength by wear and tear, so that the boiler when old shall not be rendered useless by local defects.

8. To adopt a reasonably high "factor of safety" in proportioning.

9. To provide efficient safety-valves, steam gauges and appurtenances.

10. To secure intelligent and very careful management.

We BOILER EXPLOSIONS.

1845, to.. years after steam boilers came gauge engi..t accidents by rupture and 7-feet gauge. common that a belief by the Railway Com..ysterious agencies engines to be tried," sp.

were at work inside boilers, which no degree of strength could resist. Increase of knowledge concerning boiler construction has eliminated from engineering minds all theories about mysterious causes for boiler explosions. All men familiar with the design, construction and care of steam boilers are unanimous in the belief that explosions happen only when some part of the boiler is too weak to resist the steam pressure within. The weakness may arise from faulty design, deterioration, want of care, or by reckless practices on the part of those in charge. No matter how the weakness may arise, it is agreed that acci-

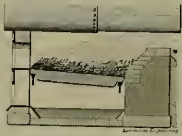


Fig. 2.

dents happen only through *steam* pressure being too great for the plates provided to hold it inside.

SURVIVAL OF THE FITTEST.

There is a great variety of steam boilers in use, and a vast variety of forms have been tried and abandoned as unsuitable. The best known existing forms of steam boilers have held their own through a prolonged process of natural selection, and have been adopted because they were the fittest for their purpose.

GLOBULAR BOILERS.

The globular boiler was the first form employed to generate steam much above atmospheric pressure, and was no doubt chosen because it is the strongest natural form for resisting pressure. With a globular vessel pressure within puts equal strains on the whole of the surface and there is no tendency to distort the contour of the surface. Soap bubbles, toy balloons and numerous other objects supply illustrations of how strong the globular form is to resist inside pressure.

The experiments made with steam engines and boilers during what has been called the "speculative era" of the steam engine, were all carried out by philosophers and scientists, so it was natural that they should cling to the strongest theoretical forms in designing boilers. The globular boiler shown in Fig. 1 was the favorite form in use until the improvement of the steam engine fell into the hands of practical mechanics. The first form of furnace used was a plain hearth made of brick or other refractory material, and the first important improvement effected was the raising of the fire and placing it upon grates, which permitted the air necessary for combustion to enter beneath the fire. This invention was the work of a French scientist.

Although the solid hearth was early abandoned by steam makers, owing to the difficulty of supplying the necessary air to the fuel, its use was several times revived by inventors of smoke preventing furnaces, and it is now employed largely in metallurgical operations.

THE CYLINDRICAL BOILER.

The principal shortcoming that a globular form of steam boiler suffers from is that it provides very little heating surface. When practical mechanics began to work out the necessary appurtenances of a steam engine that would do work more cheaply than other forms of power, they quickly adopted the cylindrical form of boiler, which is strong, of simple shape and provides a large surface for the fire gases to act upon to heat the water within.

In connection with the cylindrical boiler the oblong furnace with a bridge in front came into use. The bridge was not applied for many years after the oblong furnace was introduced, but the combination is nearly as old as the modern steam engine. The arrangement shown in Fig. 2 is that most commonly employed. With slight modifications this furnace is almost universally used except for locomotives, and it was the first furnace applied to the pioneer locomotives. With skillful firing, and with means provided for admitting air over the fire, this furnace can be made to burn coal as economically and as free from smoke as any ever invented. Another good thing about this furnace is, that there is nothing in its construction which a common fireman cannot understand.

THE CORNISH BOILER.

An improvement on the plain cylindrical boiler, which had the furnace outside and had merely the bottom plates for heating surface, was the Cornish boiler, which had a large single flue through the center of the water space and had the furnace at one end of this flue. The next step in boiler development was to put in a return flue, so that the fire gases passed twice through the boiler. The first practical locomotive, or at least the first locomotive to perform everyday work of hauling cars, had a boiler of this kind. It was built by William Hedley in 1813.

An improvement on a single large return flue was two smaller ones, which gave much more heating surface for the space occupied. This line of development gradually led to the modern multitubular boiler. When a boiler flue is smaller than 3 inches diameter it is usually called a "tube." This brings us to the modern locomotive boiler.

DEVELOPMENT OF THE LOCOMOTIVE BOILER.

Those pioneer engineers who gave to the world the high speed locomotive with all the essential parts complete, performed a very difficult problem when they designed a suitable boiler. Before the work was done the difficulties seemed insurmountable. Two conflicting elements had to be harmonized. The problem called for the lightest form of boiler that had ever been used, and at the same time it must generate steam ten times faster than the boilers most commonly in service.

American inventors, whose genius had been stimulated by the demand for fast steaming boilers for river steamers, had made the engineering world familiar with various forms of multitubular and water tube boilers, but neither of these seemed suitable for locomotives, as they required a built-up furnace. To use an internal furnace in a large flue and then small return tubes above, called for a larger boiler than was considered permissible with a locomotive. A firebox seems a simple expedient after we have seen it applied, but it was a tremendously difficult undertaking for those who applied it for the first time.

INVENTION OF THE FIREBOX.

Various inventors and engineers had proposed employing a firebox in combination with the multitubular boiler for locomotives, but there were difficulties of construction to be overcome that the pioneer boiler makers were slow to overcome. The

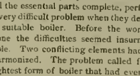



Fig. 3.

first engineer to apply to practical use the combination of a multitubular boiler and firebox was Mr. Marc Seguin, of the St. Etienne Railway of France. In the beginning of 1829, he changed the boilers of two locomotives bought from the Stephensons, and built them in the form shown in Fig. 3. In this the water did not surround the firebox. Referring to the engraving it will be seen that firebox was a detached chamber, so secured that the fire gases passed directly into the boiler tubes. A fatal objection to this form of firebox was that the material soon burned out. When it was lined with brick the rattling of the engine quickly shook the structure apart.

Detached brick fireboxes have been experimented with a great deal at various times during the last sixty years. Not a few modern engineers believe that a firebox made of firebrick would be more economical than the common form, which has plates surrounded by water, because a higher furnace temperature would be maintained. The Verderer boiler, which was tried in Germany some years ago, had a brick-lined firebox. Apart from the tendency of this form of firebox to shake to pieces, a still more serious difficulty arose against its use. The boiler tubes received the fire gases at such a high temperature that no means could be devised to keep them from leaking.

THE MODERN FIREBOX.

Seguin's experiment with the detached firebox with solid sides was a highly important step forward, but the prototype of the modern firebox appeared in Stephenson's "Rocket," which was built in 1829.

Fig. 4

The general arrangement of this firebox is shown in Fig. 4. The furnace is a double box, one inside the other, with a water space separating the two shells. It was secured to the back boiler-head, and had circulating pipes on each side to keep the water moving between the body of the boiler and the firebox. Within two years after this firebox was put into use the locomotive firebox reached its present shape in small forms of engines. Very few locomotives were afterwards built without fireboxes.

No invention connected with improved methods of transportation received such general and cordial adoption as the locomotive firebox. Yet, strange to say, there is no part of the locomotive except the link-motion that has been the object of so much fault-finding. It is reputed to be the worst kind of form to withstand pressure successfully, it does not lend itself conveniently to the putting in of a large enough grate, it is awkward to make and hard to maintain in good order, while its perpendicular sides are a vicious form of heating surface. Substitutes without number have been offered, and the highest engineering indorsements testified that they were likely to be much superior to the firebox, yet somehow this ridiculous paradox on engineering perfection would not be suppressed, and it continues to hold its own, while all its rivals slip one after another into quiet oblivion.

## Invention of the Link Motion.

BY JAMES HEDLEY.

Previous to the link being put in use several valve motions were used, the principal one used by locomotive builders being the gab motion, which was often out of order and required a great deal of repair. About the year 1844, I was at that time serving my time with Stephenson as mechanical engineer. There was also in the shops at that time a young fellow named William Williams, and Mr. William Hutchinson was manager for Stephenson, having charge of the shops at Newcastle. A man named George Howe was foreman in the pattern shop. Williams was the man who invented the link motion. He made the drawings and gave the idea to Howe for him to make a small wood

model from. After Howe had got all the details from Williams he kept Williams at bay, promising daily that the model should be handed over to him; but that time never came. A short time afterwards Mr. Hutchinson called Williams into his office and showed him the model that Howe had made from the drawings that Williams had given him, leading Mr. Hutchinson to believe that it was his own invention.

The result was that Messrs. George and Robert Stephenson were sent for and investigated the matter, the only alteration that Howe had made was—Williams' link was straight, and Howe put the curve to the one that he showed to Mr. Hutchinson. Hence it was that a patent was never obtained for the link.

I took the first engine from the shop that was fitted with the link, and worked the engine for Stephenson during the guarantee mileage, and also put the link motion to several old engines that had been fitted with the gabs and other motions that were used by other engine builders. The year that the link was first put in use, the boiler was loaded 56 pounds pressure. The link was then of little use for expansion, its principal merit being as a reversing gear.

We had an order for several new engines, and the boilers were extra stayed and loaded at 80 pounds; then the link showed what it was capable of doing. We then fixed the catch-plate for the reversing handle, and marked the quadrant plate according to the cut-off.

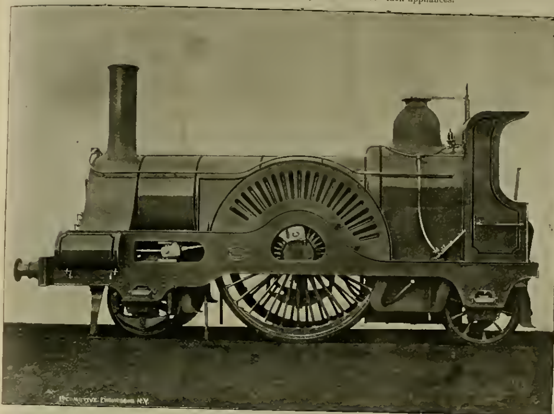
I have given you a correct account of the invention and working of the link motion. Now, what advance has been made in locomotive engineering since the link was first fixed? I cannot see that much has been done. The engines are much larger, stronger boilers and high-pressed steam. "It is the high steam that drives them along." Mr. Webb is the only locomotive engineer that has made a show towards improving the old class of engine, and I am afraid he will have to abandon it. Locomotive engineers are too closely confined to add extra machinery. The gauge is too narrow.

We built an engine, 4 ft. 8½-in. gauge, in 1845, to run against one of the broad-gauge engines, Great Western Railway, 7-feet gauge. It was an order issued by the Railway Commissioners, for the two engines to be tried, "speed, power, and consumption of fuel," for a test to show which of the two gauges, 4 ft. 8½-in. or 7-feet, was best for the service of the country. We had a train loaded with pieces of short rails—coal, coke and water weighed to each engine. The result was the 4 ft. 8½-in. gauge engine showed much better than the Great Western 7-feet gauge, so that all new railways laid down were to be standard gauge, 4 ft. 8½-in.

During my railway experience I have worked engines fitted with all classes of valve-gear, and never saw one that was equal to the link. Some time after the link had become the standard class of slide-gear, the principal locomotive engineers and railway moneyed men presented Williams with a cheque for £1,000 for his invention. About that year I left the shop and engaged with the Southeastern Railway, a road running from the city of London to the port of Dover, the shortest and most direct road to all parts of the Continent.

For eight years I ran the fast mail on that road, the S. E. Company building their own engines for that class of work, fitted with 18-inch cylinders, 24-inch stroke, one pair of drivers 8 feet in diameter. They could make good time, but I had an engine, "Crampton's patent," same dimensions as the company's build, and I could make better time with the Crampton. On some special occasions I have got seventy miles per hour out of that engine with the India overland mail, the weight of train just enough to keep the engine steady. Queen Victoria and many members of the Royal Family have ridden behind me on that road. After eight years, running the express and fast specials, the superintendent of motive power placed me in a better position, giving me charge of two locomotive stations, and a dock fitted with steam cranes for discharging coal from screw steamers for the use of the company's coal station. That position I held for twenty-five years, serving that company thirty-three years.

Now I am an old man, but even now I cannot leave off handling the tools. My locomotive model is getting in a fair way of completion, and should be glad to show it to any gentleman who takes a delight in seeing a nice piece of work. I think you will be able to see that I have had a good sound practical experience in railways and their appliances.



Passenger Locomotive, Egyptian Government Railways. Cylinders 17½ x 24 Inches, 8-Foot Wheel.

Piece of a Clinker Formed in One Trip of 90 Miles on Engine [illegible] Wootten Consolidation, P. & R. R. R. Covered Entire Flue Sheet 1½ Inches Thick [illegible] Buckwheat Coal and Snow.

The locomotives built by the Brooks Locomotive Works for pulling the twenty-hour limited on the Lake Shore & Michigan Central appear to be making a splendid record with those fast trains. In cases where delays have happened that made the train late these engines have demonstrated their capacity to materially reduce the running time. In one case a whole hour was made up between Buffalo and Elkhart, raising the average speed, including stops, to about fifty-four miles an hour. To make up for the delays caused by stopping and reducing speed at water-troughs and crossings, a running speed of sixty-five miles an hour is necessary. There is said to be no difficulty in maintaining this with four cars.

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California redwood has several characteristics that make it a remarkably good lumber for car building. It is the only wood known which will neither shrink nor swell on exposure to the weather after being thoroughly seasoned. Tests have been repeatedly made by immersing redwood in water for days, and it was in no case perceptibly changed. This makes it an excellent wood for window sashes and other parts which cause inconvenience and annoyance by shrinkage or swelling. Another good point about redwood is that it burns very slowly.

## Good Material a Remedy for Broken Stay-Bolts and Exploded Boilers.

An honored correspondent, on reading an article in Locomotive Engineering on broken stay-bolts, was inspired to write:

"The subject of stay-bolts is certainly a very important one, not only to the master mechanic but also to the managers of railroads. In the earlier days of railroading, 80 to 100 lbs. of steam was considered a high pressure, and the speed attained did not exceed twenty miles an hour. At the present day the finger on the dial of the gauge on a locomotive points to 160 to 180 lbs., and the speed attained would reach the average of forty miles an hour.

"With these facts before us, and the disposition of both builders of locomotives and operators of railroads to use cheap (and consequently inferior) material, it does not seem so remarkable that much annoyance is caused by the breaking of stay-bolts. If we increase the demand on our machinery, we ought certainly to increase the power of the machinery to meet successfully the increased demand upon it.

"When we consider that the firebox is one of the most important parts of an engine and the severe strain put upon the iron which holds the firebox in place, we feel convinced that much of the trouble might be avoided if better material was specified when ordering locomotives, or in ordering iron for repairs on this class of work. There is nothing connected with locomotive construction where a cheap article so thoroughly proves itself to be dear than in the selection of iron for stay-bolts. Purchase the best in the market and there will be no danger of explosions due to broken stay-bolts." We heartily indorse these sentiments.

### Lining Guides.

BY G. K. WENTWORTH.

When a locomotive engine receives general repairs, or from any cause, when the guides are taken down and it is necessary to line them up again, they should be straightened and ground, or filed true on the part that wears on the crosshead lugs.

In the four-bar style of guides, on the upper guides, the bottom part should be square with the part that wears on the crosshead; on the lower guides the top part should be square with the side that wears with the crosshead. The guide-blocks should be planed $\frac{3}{8}$-inch less than thickness of crosshead lugs; if guide-blocks are so thin that it will require over ¼-inch liner on top, and $\frac{1}{8}$-inch on bottom of guide-blocks, to have them the thickness of crosshead lugs, then use thin (tin) liners to the thickness of ⅛-inch on top, and $\frac{1}{8}$-inch on bottom, and one thick solid liner for the balance; make all thin liners larger than guide-blocks, cut them so they can be put in from end of guide-block without taking guide-bolt out, then when liners are trimmed off there will be no open space on side of guide-blocks and it will leave a neat job; heavy liners should be just the size of guide-blocks.

I prefer planing guide-blocks instead of planing off end of guides where they bear on guide-blocks.

As the upper guides and top of crosshead lugs that wear on the upper guides wear faster than the bottom guides and bottom back cylinder-head. Get the center of hole in crosshead where piston-rod fits, place the crosshead on two parallel blocks, the parallel blocks should be set on a level surface. With the guide-gauge get the distance from center of hole where piston-rod fits to bottom of crosshead lugs as shown at Fig. 3, then put the bottom guides up, put a large nut about the thickness of top guides on guide-bolts for a washer. It is very essential in lining guides, that guide-bolt nuts be drawn tight every time a liner is changed. Place the bottom guides in proper position by measuring with guide-gauge from bottom guides to line, and from straight-edge placed across the frames to guides, same as done when setting guide-blocks; have both edges of both guides caliper the same from straight-edge in front, and the four points on back end of guides the same, or any place the straight-edge is placed across the frames, but do not try to have the points at $A$ caliper the same as at $B$ in Fig. 4, try the guides by placing a straight-edge diagonally across them from $A$ to $D$ and $B$ to $C$, as well as lengthwise from $A$ to $B$ and $C$ to $D$. When the bottom guides are in proper position they will measure with the guide-gauge same distance from the line at all points; and from straight-edge across the frames, and a straight-edge bears evenly both lengthwise and diagonally when placed on guides, the bottom guides are correct.

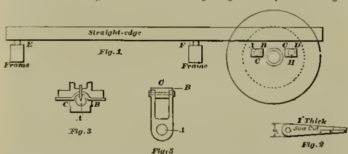
When straight-edge is placed on guide, put a narrow strip of thin paper under the straight-edge at each point on the guides than a linen thread and is much better to caliper from.

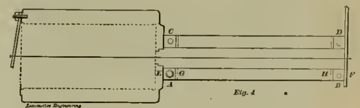
I have got better results from using a straight-edge across the frames and setting guides to it, than with a spirit level.

If the bottom guides are correct on the ends, and low in the middle, they can be sprung by putting narrow strips of paper for a liner at end of guides, between guide-blocks and guides, at points $E$ and $F$, Fig. 4, and tighten the guide-bolt nuts; putting liners at points $G$ and $H$ will spring guides down in the middle. Practice only will tell a person how thick liners to use to get guides correct.

When putting guides up use bolts that fit holes in guide-blocks and end of guides tight; if loose-fitting bolts are used guides move sidewise and are not true to line; it is best to have the bolts that will be used permanently. That cannot always be done, for frequently new bolts are needed. It is best to line guides to proper place, first with temporary bolts, then put clamps across both guides at front and back end, to hold them in position so they cannot move, then take bolts out, ream holes and fit new bolts in holes, then trim all the liners off neatly.

In the two-bar style of guides, the upper one will generally require putting up first, and the bottom of it should be parallel to straight-edge across the frame, and to line through cylinder, and be the same distance from line as distance from center of hole in crosshead where piston-rod fits to top of crosshead, as shown from $A$ to $B$, Fig. 5; put up the crosshead $C$, and close




of crosshead lugs on an engine that runs forward most of the time, the top guides will need closing first, so leave more thin liners on top of guide-block.

Before putting guides up it is best to see that the back cylinder-heads are tight, and all the studs are good, and nuts tight on studs, so cylinder-head joint will not leak. Set the front guide-blocks in the proper place by putting a straight-edge across the frames just back of the cylinder-heads, and caliper from the top of guide-blocks to lower edge of straight-edge, when straight-edge is placed across the frames; if it is below top of guide-blocks, place small parallel blocks on frames as shown at $E$ and $F$, Fig. 1, then place the points $A$ and $B$ on inside of guide-block same distance, and $C$ and $D$ on outside of guide-block same distance from straight-edge across the frames; fasten guide-blocks tight in this position, move straight-edge to back guide-blocks, and place them in proper position same as done by front guide-blocks.

If the guide-blocks are all planed the same thickness from centers $G$ and $H$ the four points $A$ $B$ $C$ and $D$ can all be placed the same distance from straight-edge across the frames, if the holes in the back cylinder-head and guide-yoke are the same distance from straight-edge across the frame. By scribing a circle the same size on each guide-block from the centers $G$ and $H$, will show if the blocks are planed so the two opposite sides will be parallel.

Fasten a board, made as shown on Fig. 2, to one of the top front cylinder-head studs; put a line in the saw-cut at $A$, with end fastened to a small nail or stick placed across saw-cut so line can be moved in saw-cut, fasten the other end of line to board, put tight on guide-yoke; set the line true to center of cylinder by the counter-bore in front end, and stuffing-box in where the straight-edge bears; if the paper is loose that point on the guides is out, and should be changed so straight-edge will bear evenly at all points.

When crosshead is placed on bottom guides, there should be no "rock" in it if crosshead lugs are planed parallel and true; if there is any "rock" in crosshead it should be taken out. It is not necessary that the crosshead lugs be the same thickness, but it is that the bottom of each lug should be the same distance from the center of hole in crosshead where piston-rod fits, when the bottom guides are put up first.

The guides are set true to bore of cylinder sidewise by measuring from center of hole where piston-rod fits to side of crosshead $A$ to $B$ and $A$ to $C$, Fig. 3, then setting side of guides parallel to line through cylinder.

After the bottom guides are in proper position, take the line away, put crosshead on bottom guides, put a block or jack-screw under each end of bottom inside guide, then put upper inside guide in place and close it on crosshead lug; have crosshead move free from end to end of guide, but not so loose that it will shake; put the upper outside guide in place the same way. This is on a four-bar style of guide where the two bottom guides are put up first. On some engines the upper guides will require to be put up first; then it will be necessary to measure from center of hole in crosshead where piston-rod fits to top of crosshead lugs. In these, the top of each crosshead lug should be the same distance from center of hole where piston-rod fits. In these, it will be necessary to fasten straight edge to the lower side of frames, unless there is room for it on top of frames.

I prefer using a small steel wire for a line through cylinder; it is much stronger bottom guide to it, so it will move free from end to end of guide. I have found the four-bar style of guides, when the two upper ones require to be put up first, the most difficult to line up. If guides are put up as they should be, with about $\frac{1}{64}$-inch lateral motion, and free from end to end of guides, and true with the bore of cylinder, they will run cool, and will not need closing for a long time.

I have seen guides put up so a piece of writing-paper could not be put between the crosshead lug and guides, at the same time crosshead moved free from end to end of guide, and engine made about 35,000 miles before guides needed closing, and from the time the machinist began to hang the guides until they were all done, was a little less than ten hours.

This article is not written with the expectation that it will be of any great benefit to all machinists, but for the younger class, as I heard one of them say he would like to see something on this subject in LOCOMOTIVE ENGINEERING.

### Broken Piston-Rods.

There was a most edifying discussion about broken piston-rods at the last Master Mechanics' Convention. We believe there is scarcely a railroad in the country that is not suffering more or less from the breaking of piston-rods, and this element of trouble has been greatly on the increase since the Laird guide came prominently into use. The consensus of opinion, as expressed by the members of the association, was that breakage is due principally to the action that comes from lost motion between guide and crosshead. The true remedy, of course, would be to make sure that no locomotives run with lost motion on the crosshead. The manner in which railroads are operated prevents this remedy from being generally adopted, so it is well to mention the precautions which members had found successful in preventing breakage.

Mr. David Brown, of the Delaware & Lackawanna, considered that a good remedy was to examine the piston-rods occasionally. Then he proceeded to outline a system which he had adopted of examining the piston-rods periodically. This close inspection generally leads to the detection of cracks that would become breakages if not taken in time.

Mr. John Mackenzie attributed breakage to the piston-rod being too much reduced in strength where it fits into the crosshead. He had adopted the practice of using the full thickness of the rod in its crosshead fit, or as much of the thickness as practicable, and it entirely stopped breakage in a class of engine that had been noted for this form of accident.

Mr. Wm. Smith, of the Chicago & Northwestern, believed in long crosshead bearings and in watching to prevent the growth of lost motion. By following this practice he is able to run Laird crossheads very successfully, and has no more breakage with them than he has with the crosshead held by four-bar guides.

Pistons are becoming so heavy, that we think the practice adopted on many foreign railroads of using tail-rods for pistons would be of great benefit in preventing breakage. When a heavy piston-head is carried by one rod, there must always be more or less of a tilting motion which causes breakage in time. The real remedy for this line of weakness seems to be something which will tend to carry the piston from both ends, holding it central in the cylinder. The reduction of wear alone and the prevention of steam leakage would be sufficient, we consider, to pay the expense of applying tail-rods to heavy pistons.

### The Compound a Good Spark-Arrester.

During the discussion on Compound Locomotives at the last Master Mechanics' Convention, Mr. John Medway, of the Pittsburgh, said "One very important matter to me has been omitted—that is, the capacity for throwing sparks. I would say that in our case we have good results from the compound in regard to that.

Thereupon Mr. Mitchell said "In regard to throwing the sparks, I had occasion a few days ago to send my man on the hill, and in talking with the track sub-foreman, he said, that with the consolidation engines formerly used on that hill for pushing trains, it required one or two engines, in the dry season, to watch the sparks and put the fires out. Since the compounds have been used there, a fire was something never known. I think that speaks very well for the compound."

An exceptionally quick run was made between Denver and Pueblo, on the Denver & Rio Grande, on June 6th. One of the express companies desired to take a large sum of money to Pueblo for the use of a national bank that was in jeopardy, and they engaged a special train for the purpose. The run was made in two hours and forty-three minutes, including one stop for orders and two for water. No special arrangements had been made for the train. The engineer was Jakey Brown, and Joe Brandt, fireman.

# Practical Letters from Practical Men.

Facts Wanted. There's a glut of Opinions.

Write on one side of the paper, state your point plainly and briefly, and then quit. We supply the generalities. No letters noticed unless name and address accompany.

## War Badges and Ironclad Cabs.

*Editors:*

My attention was called to an article in your July issue concerning engineers' badges on the military roads. I have heard that such badges were issued in Virginia, and I have also heard that there were ironclad cabs in that State.

I ran a locomotive about two and a half years for the Government, but in all that time I never saw an ironclad cab nor a military engineer's badge. I was in the Army of Tennessee and the Cumberland, and was for four years in Government service.

Say, Mr. Hill, tell John Alexander to go to the World's Fair and write it up for your subscribers. I spent seven days there, and I saw so much that I got muddled, and can't tell anything about it except I saw the Infanta Eulalie.

I feel sure that if Alexander and Shandy McGuire had been there they would have made eyes at her. I didn't.

There is no value to the engineers' military badges that I know of.

E. A. CAMPBELL,
Supt. Motive Power and Machinery.
*Houston, Tex.*

## Theory and Practice.

*Editors:*

It seems to be quite a fad in general among railroad master mechanics and traveling engineers to have examinations in regard to air-brake practice, engine management, repairs, etc. And, of course, every one will admit that it is a good thing for a person to thoroughly understand his business and to pass a satisfactory examination by answering all the questions given him out of the little Sunday-school catechism that the company furnishes. But suppose he does, what of it? Does he understand the practice that is expected of him on the road, or has just an inkling of what other people's theories are? I believe that there are many engineers and firemen who could recite both questions and answers, word for word, without the slightest idea of what it meant. I think this is Darwin's theory reversed (aping after)—that is, the man turning to monkey.

While it is all very well to pass such an examination, yet, it seems to me, to illustrate by actual practice in the shop or roundhouse is of far more importance than answering the little catechism questions.

Don't understand me as having an idea that reading mechanical books and papers are not helpful to one. Far from it. They are as essential in my opinion as the actual practice. Theory by itself is of no importance without being mixed with practice (half of each). I remember a case of a mechanical school graduate who went to work in a railroad shop, and having a head chock full of theory was ready to work out on a piece of paper a broken stud, when an apprentice with ratchet and drill would have accomplished the aim in far less time. It is a fine thing to know theory, but to practice it is more desirable. Seeing is a great aid to the catechism question. Assisted by a steel scale and a look down into the steam-chest and valve-seat of a locomotive, you may perhaps, if the valve is around, find out the inside and outside lap and get ideas that the little catechism won't give. And in leisure time by watching some machinist in the shop, find out the best way to get a dead center and set a valve. You won't catch on so quick in the catechism.

I am glad to learn that the tendency now is to equip the front trucks of the engine with brakes. It looks possible to retard the train as much with front truck as with tender-truck. While writing about front trucks it occurs to me that if you look at it right, the front truck gets a good deal of petting. In some shops the brasses are scraped and fitted, and cells packed after each trip. How about an old box-car truck loaded to its fullest capacity, never properly oiled, traveling thousands of miles and seldom hot? Perhaps the front truck becomes spoilt. The style of putting brakes on drivers between the wheels of eight-wheelers ought to be condemned according to the way one would look at it. The wear is on the shoe in front pair and wedge behind and will eventually cause the rod brasses to stand open. What is the matter with putting both brakes in front of drivers? Mr. Hill has done much to give the readers of LOCOMOTIVE ENGINEERING an insight into the mechanical department of English railroads, and is now showing us the World's Fair in a manner that is quite to our taste. One can almost imagine himself within the Transportation Building gazing with open-eyed wonder at the scenes around.

The wrapper on your paper I think is the only objection to it. It won't come off quick enough.

ERNEST MARTIN.
*Raleigh, N. C.*

## Broken Stay-Bolts.

*Editors:*

I read your criticism on hollow stay-bolts in the July number, and coincide with your views in the matter of hollow stay-bolts. I believe some twenty-five years ago, more or less, there was a law passed in the State of Massachusetts, that the four top rows of stay-bolts on all locomotives should be drilled in from outside, a suitable distance, to show if they were broken off. We found quite a number of stay-bolts broken by complying with this law, that we should not have detected in testing them the old way, by sounding them with a hammer. I have all stay-bolts put in our boilers, drilled in 1¼ on outside, $\frac{3}{16}$ hole. I do not consider that this weakens the bolts anything to speak of.

W. A. FOSTER,
Supt. Machinery.
*Corning, N. Y.*

## A Reliable Draw-Bar Attachment.

*Editors:*

During the existence of this company we have never deemed it necessary or advisable to publish any statistics concerning the use of the Butler draw-bar attachment.

When contracts for cars have been let on which our device was specified, we refrained from making it publicly known. In the face of recent events, however, and in view of the importance given to "attachment of M. C. B. couplers," we will give figures showing our position in the trade. Railroad and car companies using our device represent 28,000 miles and 265,000 cars, all of whom are well satisfied with the service of the device.

In the report of the committee, which was made at the recent Master Car Builders' Convention at Lakewood, the total draft-gear defects were appalling to any who desire to keeping their rolling stock in motion, most of which was caused by old style and inferior attachments, the cost of which, considering repairs, is greater than the device we offer and guarantee to give entire satisfaction. We have numerous customers who report that the total cost of repairs to Butler draw-bar attachments does not exceed 5 per cent. of their cost per annum, and we are prepared to enter into contracts with any of the railroad and car companies to maintain our attachment for $1 per car per year, if manufactured by us and applied as we direct.

Our claims for superiority are based upon simplicity of construction, fewness of parts and absolute protection to draft springs, and our reference to sustain these claims are the users of our device.

In the earlier days of this company some light castings were sent out, which did not stand the required service, but these have been recalled and replaced, and new strengthened castings made, which are now equal to the service required.

With these facts before you, which can be substantiated, we solicit your patronage.

BUTLER DRAW-BAR ATTACHMENT CO.
*Cleveland, O.*


ONE ENGINEER FORGOT HIS ORDERS.

## An Erratic Triple-Valve.

*Editors:*

The writer recently had a little experience with a plain triple-valve used for tender-brake, in which the aforesaid triple was guilty of conduct entirely unbecoming to a well-ordered and self-respecting triple. As air was turned into the train-pipe the triple did its duty properly until the auxiliary reservoir and train-pipe pressure equalized at, say, 70 pounds, but as soon as such equalization was effected, this erratic triple got in its queer work by immediately applying the tender-brakes, although the train-line pressure was maintained so that no other brakes applied. This triple having been put into a school system with gauges showing pressure in auxiliary reservoir and brake-cylinder, it was found that when the tender-brake was applied as above, the pressure in reservoir and cylinder was not reduced by the application, but, on the contrary, remained at 70 pounds. On taking the triple down the trouble was easily located. As a pointer, I will say that this could not have happened with a quick-action triple.

CLARK L. PIERCE.
*St. Albans, Vt.*

## Wants a Better Angle-Cock.

*Editors:*

In reading over LOCOMOTIVE ENGINEERING, the last issue, I notice that engine "999" made 112½ miles an hour at one time. I would like to ask if, at some place where that train stopped, some miscreant or bum had shut off angle-cock behind first car; how long, and what distance would train have gone before engineer could have stopped it with only one car and engine?

Westinghouse has a good, reliable and safe brake, and has made many improvements on it, but I think the angle-cock is one of the most important parts of the brake which has not been improved. Any boy knows how to turn an angle-cock, and

in its present form it is unsafe. Engineers who start out on a run, say with a stock train of eighteen cars, all working and good air, after making a few stops, can see about how to handle train and how to depend on brakes; but at some stop, air is cut out on him, and when he goes downhill into some station, he applies brakes, and they do not stop train and probably there is an accident. There have been enough accidents on account of angle-cocks being shut off to equip a road with air-brakes or safety angle-cocks.

I would suggest that some brake company get up a safe angle-cock. If the handles were taken off all of them and only allow car inspectors, conductors and brakemen to carry a handle, so as to turn them off, that would be some safer, because a bum or boy would not hardly go to the trouble of getting a wrench to turn them. There is an instance where a stockman going over train and punching up his cattle, accidentally put his foot against angle-cock to climb up and turned it off, which nearly caused a head-end collision. I say, take all the handles off angle-cocks anyhow, and only put them on when using to open or close. Someone invent a better method, by which engineer can tell when train is all cut in.

When I get ready to start after being stopped at places, I always make a 5-pound application on brakes before I start, and with a train-line of over seven or eight cars I could detect from the amount of air exhausted from train-line if any have been cut out, and several times I have tried this plan, and went back and found the tenth car cut out, and, of course, all cars behind it out, too. But how many engineers do this when they start? Very few. It causes delay to do so sometimes, but I think it prevents accidents sometimes also.

If I was running a fast train, engine like "999," I would want angle-cocks locked open and examined every start. Angle-cocks have cost railway companies more than anything else in accidents, besides good engineers their jobs. Here is a train going out: engine, eighteen cars and caboose; engine and fourteen cars working air, four cars and caboose non-air; it's a dark, rainy night; engineer makes a stop at water-tank where it's down-hill; four cars and caboose crash into rear end of fourteen air ones, turn one over and delay stock trains, fast vestibule trains and everything for several hours. As an experienced man and close observer, I say that this wreck was unavoidable as far as train crews and engine crew are concerned, because they could not discover on either end that train had parted, so bad was the night. Probably some one is discharged for it, but it could not have been avoided by any crew or set of men, but the company has been damaged and had quite a delay and loss, and censure the employees. What could have prevented this accident? A piece of bell-cord four car lengths long, fastened to last angle-cock on air cars and tied to caboose over or around four non-air cars. That accident would have bought enough bell-cord to equip every train. That seems like a better way than having so many break-in-twos and running together, and all railroads have them every week. With a long train, part air and bad nights, are when they happen. Anyone can see how the bell-cord attached to rear angle-cock handle can prevent this.

If triple is out of order on an air-brake, and that brake is cut out, the hose and train-line is valuable in case of train parting.

Young engineers, read LOCOMOTIVE ENGINEERING, and get other men's experience and be prepared for an emergency. The old engineers think some of us young ones are most too smart; but let them think what they please. I, for one, appreciate anything I learn from our old ones. They all have the practical experience, and we get it through LOCOMOTIVE ENGINEERING—which is about the same.

Would like to see something in your paper from our master mechanic at Denison, he is a No. 1 mechanic and all-round engineman, and could give us some puzzles, I think. And for machine shops, roundhouse and sandhouse—well, come to Denison, and take a look around and see the improvements.

W. M. PIRKIN.

*Denison, Tex.*

### Defective Air-Brakes.

*Editors:*

I saw an item in your June issue in regard to defective air-brakes by Fred S. Lee, and think he is right on that question, as I have had three or four trains in the last month with bad, leaky train-pipes and hose, that it was impossible to get over forty pounds train-pipe pressure with twelve to fifteen air-brakes in train, and the trainmen expect you to do all braking just the same as though the air was in good condition.

I understand Mr. J. F. Deems, master mechanic at Ottumwa, has introduced a form or plan which, if adopted, will, no doubt, be a good thing. It is to furnish trainmen with blank cards, so when they find defective brakes they can state the defect on this card and tack it on car or leave with their bills at destination. If this is kept up and air-brakes are repaired, it will not only save some of the sudden stops between stations, with the probability of a rear-end collision, but will save the air-pumps to a great extent and make it more convenient to stop on your own account when desired.

*Chariton, Ia.* THOS. WENDELL.


BALDWIN COMPOUND ON A 25 PER CENT GRADE—PIKE'S PEAK RAILROAD.

### On the Criticisms of the Engine "James Toleman."

*Editors:*

In your description (June number) of the "James Toleman" express passenger engine, I respectfully wish to draw your attention to some incorrect measurements which materially affect the comparison you make between various engines.

The outside cylinders are $10\frac{1}{2} \times 24$ inches, not $12\frac{1}{4} \times 24$ inches as stated.

The four cylinders of this engine you give as equal to a single pair of about $20\frac{1}{2} \times 24$ inches. Now, the cubical capacity of the four cylinders of the "James Toleman" are equal to 20,246 inches, whereas the cubical capacity of a pair of cylinders, $20\frac{1}{2} \times 24$ inches, is equal to 15,840 inches.

Now, as to tractive power.

Is it not rather unreasonable to draw up a comparison between such an engine as a six-wheel coupled, having wheels 66 inches in diameter—in other words, a freight engine—and one, such as the English locomotive, having non-coupled wheels of 90 inches in diameter, one specially designed for high speed?

I should certainly look upon the New York Central's "No. 999" engine as a better sample for comparison, both this and the "James Toleman" are designed for the same class of work, namely, express passenger traffic.

Tractive power of "999" engine stands at 111.62 pounds per pound of effective steam pressure.

Tractive power of "James Toleman" engine, 143.24 pounds per pound of effective steam pressure.

Further, the designer of this four-cylinder English locomotive is accused of never having considered that repairs were necessary in a locomotive for express work, and yet your article states that the bearings and connections are large and strong, which is the case, and very much in excess of the usual practice. This was done with the object of keeping the engine out of repairing shops for a long period.

Yours faithfully,

For Westwood & Winby,

ROBT. CHAPLIN.

*British Section, World's Columbian Exhibition, Chicago.*

### Pierce's Pump Governor Puzzle—Difference Between New and Old Equalizing Discharge-Valve.

*Editors:*

The problem sent in by our St. Albans friend is comparatively new, and as there will probably in the near future be a great many questions referring to this valve, perhaps it would be well to endeavor to bring out the points most likely to give trouble to those not familiar with it, and to start the ball rolling I will try to trace the difficulty, and instruct those not posted, as near as possible in writing in the style used here in regular practice, and invite criticism both on process of reasoning and manner of instructing, promising to learn all I can from those not in sympathy with my system, and agreeing to kick back according to what ability and spare time I may be possessed of.

The Westinghouse Instruction Book, page 21, referring to small diagrams, speaks of position of handle for releasing brakes, and shows that air, then, has free passage through supply ports *I* *B* and cavity *C* to train-pipe, and by becoming slightly familiar with this diagram, and tracing the passage of air as per plate No. 2, it will be seen that in release position (if the apparatus is in good working order) the main reservoir and train-pipe pressure must be equal, and that whichever has the governor attached must regulate the other, shows on page 22, after placing handle in running position, that direct communication is interrupted by bridge in rotary-valve covering solid edge of valve-seat, and then main reservoir pressure flows through ports *I* and *F* by feed-valve 21 to train-pipe, and whatever may be the strength of feed-valve spring, just that amount of air will have to accumulate in main reservoir before train-pipe can receive any. It is then evident that it would be a very risky business putting governor on main reservoir and depending on such a valve to furnish a stated quantity of air to train-pipe, consequently the governor is connected to train-pipe, and by backing up to main reservoir from feed-valve the most uncertain feature of reserve pressure is placed where it will do the least harm in case it varies from its predetermined supply. But it should be thoroughly understood that by returning handle to release position this reserve or excess pressure feature is cut out and inert, as ports *I* and *F* do not match, the pressure in main reservoir being then controlled by train-pipe governor direct. And, again, that whenever train-pipe pressure falls below what governor is set at, the pump must keep going, and will (power being sufficient) until this pressure rises again and shuts governor off, no matter what position the handle may be in, because in this style of valve the maximum train-pipe supply controls the air governor.

This settled, let us go to Supplement No. 1, Catalogue 1891, and examine the Plate D 5 valve. By making a transparent tracing of Fig. 4, and after reversing it, working it on the valve-seat Fig. 2, it will be seen that so far as admitting air to train-pipe, the rotary valves are alike, and with the Fig. 5 excess pressure-valve attachment there is practically no difference between the two valves, the reducing-valve attachment is then where the difference is. It will take but a moment to ascertain that this feed-valve No. 63 is held away from its seat by feed-valve piston No. 66 and piston spring No. 65, and will stay open till the pressure in both main reservoir and train-pipe is sufficient to force feed-valve piston down and let feed-valve seat itself, after which the pressure on top of feed-valve and communicating with main reservoir (only when handle is in running position) is not off from train-pipe, and, except when train-pipe pressure is reduced enough to let feed-valve piston lift feed-valve off its

... it has no escape. Therefore, unless there is something on main reservoir controlling the pressure in this now separate apartment, it will rise as far as steam will carry it, hence a demand for a governor for this purpose, which is set at a maximum pressure, and the air is reduced down to train-pipe pressure. Of course, no matter where the brake-valve handle is left, the pressure in main reservoir would not vary provided the pump could keep it up.

This, then, is the difference between the old and the new brake-valve, the old one has its feed-valve closed to train-pipe till ... pressure has accumulated, when it opens. The new one has its feed-valve open to train-pipe until pipe is supplied, then valve closes. When the new valve handle is in release position, the reducing-valve is cut out and train-pipe connected direct to main reservoir, and it having the governor, of course, and set at, say 100 pounds, puts that amount in train-pipe before it stops. Now, the pump in question started all right in running position, the reducing-valve stopped pressure to train-pipe at 70 pounds while the main reservoir pressure rose, and when it came to the 90-pound mark would have stopped the pump had the air got to the governor.


WORK OF DRIFTING SAND

Remember, the reducing-valve then controlled the train-pipe pressure. When handle was in release position the reducing-valve was cut out and did not control train-pipe pressure, but as the pump stopped at 90 pounds, there can be no doubt that the air from main reservoir flowing through to train-pipe charged it to 90 pounds and stopped the pump. It is plain, then, that the governor was connected to train-pipe instead of main reservoir, probably after the style of the Plate D 8 valve. Imagine, then, a train-pipe to which only 70 pounds of air could be admitted while handle was in running position trying to shut down an air governor set at 90 pounds.

These valves will not act like this all the time, as it depends on the manner in which the balance is maintained between the governor and reducing-valve, and when the valve goes crazy, it will pay if there is not evidence in sight sufficient to determine where the fault lies, to examine, first, the feed-valve No. 63, to see if it leaks or has not been turned upside down, then the feed-valve case gasket No. 56, next, examine the lower gasket No. 61, for a rupture between main reservoir and train-pressure.

WALKER'S PUMP GOVERNOR

As for Brother Walker, I wish he had shut off the drain-cock, put a lever against piston in brake-cylinder and tried to push it back I have found a few cases similar to this, except that I could not hear the piston rise when I put my ear to the valve, neither could I see that the exhaust port was cut out. I have taken all down that I found, and in the brake-cylinder the old oil had gummed so bad that the piston stuck and jerked by turns. Cleaning the cylinder and valve in each case overcame the trouble, and I do not think the air between the stop-cock and triple-valve ought to take five seconds to exhaust, while keeping up its proportion of pressure as against an open drain-cock in auxiliary reservoir.

AIR-BRAKE DEFECT CARDS.

I like our friend Lee's plan of reporting air-brake repairs on trains. I keep a lot of tags stamped on the back as follows: "When repairs are made, return this card to George Holmes, Air-brake Inspector, Western Gen'l Div. N. & W. R. R., Roanoke, Va.," and when a defective car is caught, tie on the tag where it may be easily seen, with the defect written on the face of the tag. Why could not train crews be supplied with some such card, only have them finally turned in, say, to general superintendent? Perhaps there was a leak in auxiliary reservoir under that tender, or some obstruction between it and triple-valve; maybe it was in such shape, it took the two-sevenths more air given by straight air to set the brakes.

GEORGE HOLMES.

*Roanoke, Va.*

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## Straight-Air at One Triple and Automatic at the Other.

*Editors*:

In July number of the LOCOMOTIVE ENGINEERING, C. C. McMullin says he recently took out an engine and when he cut the brakes in to work automatic the driver-brake would work automatic, but the tender-brake would not go on automatic. He says he cleaned tank-triple, but still the tank-brake would not go on automatic. Changed the tank triple-valve with same result, yet worked straight-air all right. What was the matter? I will give my reason why the brake would not apply automatic on tank, and that is, the piston packing leather leaked, the air passed around the piston and through the leakage groove together as fast as it went into the brake-cylinder. I have often had the same experience.

That the leathers will leak when they get worn through, we all know. But often the leather becomes dry and stiff so that it will not expand outward against the cylinder, and when this is the case, the air passes around it and out of the back-head. I often take packing leathers out of both tender and driver-brake cylinders that have been in but a short time and soften them, and chamfer the inside corner off so that the air strikes the leather on the chamfer and presses it outward against the cylinder body. I will state here that cutting this inside corner off the leather does not shorten the life of the leather, as the leather always wears through at the corner where the expander presses it hard on one side and cylinder body on the other.

I often take out leathers that engineers report as being worn out, and find them square on the edge, and, in many cases, drawn in toward the center, allowing the air to pass around them. Where the leather has only been in a short time, and not worn much, I chamfer the edge, put it back, and that will be sufficient for months, until it is worn through in the corner by expanding ring. I would recommend air-brake men to try this, as it only takes a minute or so, and it saves a great deal of work, especially on driver-brakes, where a pull-up brake is used and the cylinder sets in over the engine frame, necessitating the taking down and lifting up the cylinder every time a new leather is put in.

I should have said before, if Brother McMullin had held his hand or a torch at the back-head of tank-brake cylinder when the brake was applied automatic, he would have been very likely to have felt the air leaking through back cylinder-head around the piston-rod, and then he might have tried it with triple-valve handle down straight-air, and if there was no leak then, he would have been satisfied that the leather was dry, and would not expand only with a heavy pressure against it. In the front cylinder-head there is generally a plug, which can be removed and oil put in to soften the leather, which should be done once in a while. I should like to hear from some air-brake men or anyone else what sort of oil or liquid is best to use on leather to keep it soft where it is subject to great heat alongside of fireboxes, as it is in driver-brake cylinders.

I don't see any reason why we should not have more iron packing rings in driver-brake cylinders. It seems to me that leather is a sort of nuisance. Engineers know that. As their brakes give out on them so often, at least they are unable to make an ordinary service stop. Their brake will apply in emergency notch, or straight-air, but on account of a hard, dried-up leather they cannot lift the driver-brake pistons even, only by a rapid discharge of air, as in emergency or straight-air application.

Here is a chance for some one to invent a piston packing that will be more durable and cheaper in the end than leather.

F. B. ARMSTRONG.

*Camden, N. J.*

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## Recharging the Auxiliary Reservoir with the Brake Applied.

*Editors*:

Every little while some brilliant inventor rises above the air-brake horizon from out of the depths of obscurity and starts out to astonish the world with his wonderful scheme, warranted to absolutely prevent runaways on mountain grades. There is no doubt but all, or nearly all, of them are perfectly honest in their conviction that such a thing has never been tried before, and they are astonished to find when they apply for a patent that the same thing *had* been thought of before, and not only thought of, but *patented* in a number of different forms. In fact, this idea was embodied in some of the first triple-valves ever designed, just about the time that Westinghouse was perfecting his first valve. The general scheme of all the devices is about the same. They are designed so that a more or less sudden increase in train-pipe pressure is necessary to move the triple-valve to release position, a slight gradual increase simply equalizing with the auxiliary reservoir through a small feed-groove or port. This, it will be noticed, is to a certain extent an interference with the release function of the brake, and it is on this account that the scheme is impractical On a long train, after some of the brakes have released the train-pipe, pressure increases very slowly, and a brake which cannot be pumped off cannot be used with satisfaction in such service, as it will have to be bled occasionally by the trainmen. The condition of such valves would be the same as that of a triple-valve in which the main piston was a poor fit and leaked badly. Such a valve placed near the end of a fifty-car train is almost impossible to release without bleeding.

In 1883 Buyden patented a valve embodying something of this idea It had a side passage around the main piston, through which air could feed into the reservoir and cylinder while the brake was applied, provided the increase in train-pipe pressure was not made too suddenly. This is claimed by some to embody the first idea of "quick action," as there was a communication from the train-pipe to the cylinder Not being a lawyer, I do not wish to express any opinion as to this further than to note that there is quite a difference between a valve for holding a train down a long grade and one for making a very rapid application on a long train.

Some of Dixon's valves, patented about 1888 or 1889, were designed so as to accomplish this recharging of the auxiliary reservoir.

One patent was issued about this time to Moore and assigned to Westinghouse, showing the application of the scheme to the Westinghouse standard quick-action valve. It was simply a small feed-groove or by-pass in the main piston bushing, located just at a point where the main piston would stand right over it when in application position. In 1888, Williams, of Lacrosse, secured a patent on a triple-valve embodying still another form of the same idea, and in 1891 Riggs patented still another triple on the same lines. There were a number of other devices of the same general nature, but time and space will not permit a review of them here.

This article is not written to discourage struggling inventors, but to impress upon them the fact that when a new idea is con-

ceived it is a good plan to try to find out what has been done previously by others in the same line, before spending much time and money in pushing an application for a patent. Patent litigation is slow and expensive, and, besides this, extremely discouraging, and anyone embarking on such a sea of difficulties should take good care that their boat is one that will hold water.

PAUL SYNNESTVEDT.

*Chicago, Ill.*

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### Why the Pump-Governor Would Not Act.

*Editors:*

In answer to Clark L. Pierce, St. Albans, Vt., why his pump-governor would not work, I would say that the governor was connected up to the train-pipe instead of the reservoir pipe. If it was connected to reservoir, the little stop-cock must have been shut. In the 1892 pattern of brake-valve, main reservoir pressure is regulated by the governor, while train-pipe pressure is regulated by a spring. If the spring was set at 70 pounds, and the governor connected to the train-pipe, the 70-pound pressure would not affect the governor, and it would allow the pump to keep right on working, as he says it did.

The governor being set at 90 pounds, when the handle was thrown to release position it would stop the pump, because the main reservoir pressure rushes in to the train-pipe and thence to governor, and when this takes place the pump stops, because the pressure is equalized. Black and red hands are together.

Mr. Pierce does not state what kind of governor was used, whether it was an improved Westinghouse-Mason, or what style or make. I have often noticed that, with the latest improved valve, when the brake is released, reservoir pressure is admitted to train-pipe, and when the handle is put in running position you will see black hand falling back. I don't like this part of the valve. I recently had an engineer tell me he was not stuck much on the 92-valve for the reason that the governor would only allow 90 or 95 pounds pressure on main air reservoir, and when you stand with the brake on, you don't get any more air to recharge the auxiliary reservoirs under the train; while the old brake-valve would not recharge a train-pipe, until the 20 pounds excess was obtained in main air reservoir to open the feed-valve, and the brake were liable to leak on. With it, you can, while standing with the brake on or with the valve on lap, pump up about as much air as steam, and when you release the brake or throw handle to release position the extra amount of air accumulated in main air-drums will recharge the auxiliary reservoir under a long train much quicker. You can see why this is so, I think. With the new valve, reservoir pressure is limited at all times to what governor is set at, while on the old valve you are not limited, only when the air is feeding into train-pipe and thence to governor.

For the benefit of Clinton B. Conger, I will say that Phelan's "Air-Brake Practice" has a rule for calculating driver-brake power or leverage.

F. B. ARMSTRONG.

*Camden, N. J.*

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*Editors:*

In regard to pump-governor spoken of by Clark L. Pierce, I would say that it was connected to gauge-pipe indicating train-pipe pressure, instead of the one indicating main-reservoir pressure. Therefore, when valve-handle was in running position, the valve allowed 70 pounds to escape into train-pipe; the governor being connected with train-pipe, and set at 90 pounds, became inoperative while valve-handle was in running position.

When valve-handle was placed in release position, the pressure in train pipe was increased to 90 pounds, and governor then cut off supply of steam to the pump.

WM. N. SHEPHARD.

*Philadelphia, Pa.*

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*Editors:*

Brother Pierce, on page 317, wants to know why his pump-governor did not act. From his explanation, it would seem the governor did act, but it was not piped right. It was set at 90 pounds and connected to the train-pipe. It could not shut off at 70 pounds, but when the train line was charged up to 90 or more, by placing the brake-valve handle in full release position, the pump would stop and stay stopped till handle was put in running position, and pressure in train line reduced to less than 90 pounds by leak under tender. After the difficulty was corrected, the governor took air from reservoir line.

Here is a puzzle that caught me for a while. Am not quite sure it is right yet, but it works O. K.; that is all I want.

Some weeks ago a new ¾-inch governor would not shut off steam at any pressure of air, even after the screw-plug over coiled spring No. 18 was taken out. It was piped right, piston 5 worked steam-valve 9 O. K.—all holes open for air and steam. It was clean and in good order. After monkeying with it for quite a while got it to work, so it shuts off at the required pressure and goes to work on 2 pounds reduction in three seconds. The remedy applied was a little work with a fine file.

What was the matter with it?

If a ¾-inch governor keeps the steam shut off too long after pressure is reduced 2 or 3 pounds below what it shuts off at, cut a small crease crossways of the threads in No. 12 or air port of governor, where it screws into No. 4, or top of steam port of governor, so a *very little* air will leak out when governor shuts. This can be done with a jack-knife blade with a nick near the point, or a very small half-round file. Do not make the notch too large or very much deeper than the bottom of threads, or too much air will leak out. The new 1-inch Westinghouse governors have a small hole drilled in them for this purpose. A notch made this way does not stop up very easily, as we have some governors in service two years with this "bleeder" in, which start up on 1 pound reduction in two seconds.

CLINTON B. CONGER.

THE ANSWER.

The air-pipe from pump-governor was connected to train line, as in the old style valve, instead of to the T taking pressure from main reservoir.

CLARK L. PIERCE.

*St. Albans, Vt.*

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### A Whistle Signal Difficulty.

*Editors:*

Much has been said in "our" paper about testing train signal-pipes and valves. Now, I think my way is as good as any that I have read about. I have a whistle hose-coupling, with short piece of pipe attached to the end that goes into the hose. I have a small gauge about 2 inches in diameter, which I screw into the end of the pipe, then I couple this "combination" on to signal-hose at back end of tender and open stop-cock. I note pressure on gauge; if 25 or 30 pounds is indicated, I test the signal by the use of a small air-cock screwed into short air-pipe under gauge, this is done, as you will understand, by opening and closing small air-cock. To find leak in pipe, if any, I close stop-cock, which is located between the pressure reducing-valve and drum, and if there is a leak, the gauge will show it very quick. Now, if the gauge shows the same pressure on signal-pipe that there is in the drum (after stop-cock between pressure reducing-valve and drum is open), I take the cap off of pressure reducing-valve, and with screw-driver turn valve 5 around a few times as if grinding it in, and by pressing the valve, the pressure will blow out all the loose matter and let the valve come to its seat most always; if it don't, I take off the "pesky" thing and grind it in. Right here is where the advantage comes in of placing a stop-cock between pressure reducing-valve and drum, because you can take off the valve without letting the air out of the drum.

A short time ago I tested the whistle signal apparatus on an engine which was coupled on to five coaches. The whistle would blow all right before the hose was coupled to train, but when coupled to train, I could not give a signal by pulling the cord in coaches anywhere throughout the train, but when I put my gauge "combination" on the hose of the last car, I could give a signal perfectly by opening and closing the small air-cock under the gauge. What was the trouble?

W. P. RELYEA.

*Syracuse, N. Y.*

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### Hamar's Whistle Signal Puzzle.

*Editors:*

Whistle signal that would blow perfectly when engine and train was standing still, but would not sound when train was running. Everything about the engine was examined and found to be in the most perfect condition. Car discharge-valves were perfect; no leaks in any part of the equipment of engine or train.

This is a "corker." Who can tell where the trouble was?

W. T. HAMAR,
Road Foreman Engines.

*Atlanta, Ga.*

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### That Whistle Signal Puzzle—Hamar's Answer.

*Editors:*

The signal whistle was located on the fireman's side of cab, the signal pipe running up alongside and at the right of front cab window, whistle extending above top of window. The signal pipe when first put up was found to be too short, and in order to save piping was spliced at the top. Later on this splice became bursted, and was taken off and the whistle attached to the original pipe, which was then shorter, which brought the whistle down below the top of cab window, and in such a manner that when the engine was running and with front cab window open, the strong current of air blowing through the window affected the sounding of whistle. When the window was closed and engine running, whistle worked perfectly.

W. T. HAMAR,
Road Foreman.

*Atlanta, Ga.*

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### To Calculate the Power of Cam Brakes.

*Editors:*

Mr. Conger asks for a rule in calculating the power of driving-wheel cam brakes. The following is an extract from the New York Air Brake Co.'s instruction book, page 50:

"Where the stems of the cams are attached directly to the brakeheads, the total power on the engine is equal to the pressure developed by the piston multiplied by the distance between the pins that connect the stems to the brakeheads and divided by the height of the point of contact of cams above a line joining the centers of the brakehead pins. As the power is usually connected to the cams by pins three or four inches apart, this distance should be deducted from the distance between the pins used as multiplier.

"Where the stems of the cams are attached to lever below the brakeheads, multiply the power found by the above rule by the length of one lever, and divide the product by the distance from the brake-head pin to the pin on which the lever hangs. The above rules give the total power on both sides of the engine."

I think Mr. Pierce's pump-governor difficulty was the result of connecting the governor air-pipe with train line instead of main reservoir.

With the Westinghouse brake-valve of 1890, an "excess pressure-valve" is used to create the differential pressures of main reservoir and train-pipe, and the pump-governor receives its air from the train-pipe at the union stud in lower case of the brake-valve. The new brake-valve of 1892 has a "feed-valve attachment," instead of an excess pressure-valve, and with it the main reservoir pressure should govern the action of the pump. If desired, the Westinghouse Company will furnish an excess pressure-valve with their latest brake-valve, instead of the feed attachment, and as this would require that the governor's air be supplied from the train-pipe, the lower case of the brake-valve of 1892 has a threaded and plugged hole, in which the governor-pipe union stud may be fitted same as with the old valve. The subject of Mr. Pierce's article was an equipment of the latest brake apparatus, feed-valve attachment, etc., but with the governor-pipe connected at this hole in the lower brake-valve case, instead of with main reservoir connection.

WILL W. WOOD.

*Terre Haute, Ind.*

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### Ancient Financial Difficulties of the Reading.

The poor Philadelphia & Reading Railroad seems to have suffered from impecuniousness at brief intervals ever since the first spike was driven, but it never got down to hopeless poverty until that brilliant financier, Franklin B. Gowan, loaded it up with obligations which are not likely to be discharged for several generations to come.

Mr. James W. Holmes, a resident of Reading, now 72 years old, who was many years employed in the Reading Railroad shops, writing to the *Sunday Eagle*, a local paper, has this to say about a financial stringency of long ago:

"The present financial straits of the Philadelphia & Reading Company remind me of the same condition of affairs fifty years ago, last winter. The road having been built and opened to Pottsville in January, 1842, the company was put to great expense to operate it with satisfaction to the public. The consequence was it was unable to pay its employés their regular monthly wages, and in order to pay them up (as some of them had from three to six months' pay to get) the company, about the 1st of January, '43, issued notes (the employés called them 'slow notes'), bearing interest at the rate of 6 per cent. per annum, payable in three, six, twelve and eighteen months.

"The men accepted them with the understanding that thereafter they should receive their pay regularly every month, which promise was kept up for several years afterwards. These notes were the most beautifully engraved that I ever saw. Some were issued for as much as \$50. They were generally accepted by the public as bank notes, but some of the employés retained them until they were redeemed, receiving the interest and all. I saw some of the holders of them long before they were due offered change for 50's, but the answer of the holder was: 'No, it is too pretty to part with.'"

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An order has been issued by the management of the Missouri Pacific and Iron Mountain system of railroads for the reduction of expenses wherever retrenchment can be made. The order has led to material decrease of the clerical force and the number of workmen employed in the shops and on the track will be reduced as much as possible. This is the season when the working staff in shops and on the track can be used to the best advantage, but considerations of this character have little weight with those who control Wall Street railroads.

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## Some Figures on the Magnitude of the Engineering Work on the Gothard Railroad.

BY HENRY GRETENER.

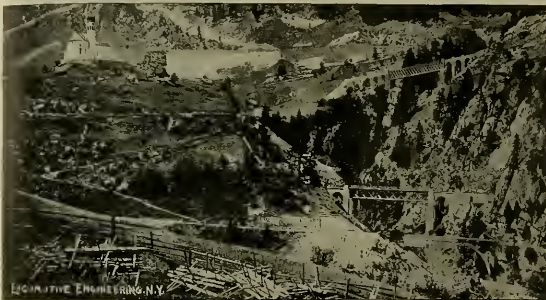
Thinking your readers would be interested in some account of the great Gothard Railroad from the spot, I send you herewith some photographs of the most interesting parts of the line.

The idea of building such a road dates back to between the years 1830–1840. Opinions were divided as to which of the following mountain passes, Simplon, Gothard, Lukmanier or Splugen, would be the most suitable for such a railway. Finally the Gothard was decided upon. The man whose efforts had principally brought about this decision, was Dr. Alfred Escher, of Zurich, who, later on, was elected president of the company.

In 1869, a treaty was signed between Italy and Switzerland, in which the former agreed to pay 45,000,000 francs (or $9,000,000) and the latter 20,000,000 francs (or $4,000,000), à fond perdu. In this treaty it was agreed that the line should be built and the traffic carried on by a private company under control of the Swiss government. In 1871, the then newly created German Empire joined the two other States and promised to pay 20,000,000 francs, à fond perdu. In the same year the company was formed and shares given out, and in 1872 the work on the great tunnel began from both entrances, from Göschenen on the north side and Airolo on the south side. The contractor, who undertook to bore the tunnel, was L. Favre, of Geneva, who had made himself a good reputation for this kind of work in France. He had originally been a simple joiner with hardly any education, and though he committed some grave errors in the construction of the gigantic tunnel, it cannot be denied that a great deal of the final success was due to the restless energy displayed by this man.

A great many unforeseen difficulties, however, arose during the construction of the line. The original calculation of expenses of the international committee proved to be insufficient. Especially the so-called Tessin-Valley lines, from Biasca to Chiassa, cost 33,000,000 francs instead of 14,500,000. There were also troubles with Favre, because the stone formation in the tunnel made it necessary that the latter road be built up with masonry almost throughout its entire length, which was quite an unexpected feature and certainly a very unpleasant one for Mr. Favre. By-and-by, however, this crisis was passed through, the original plans modified, so that the first estimate was exceeded only by the sum of 46,000,000 francs. Of these, 28,000,000 were again paid by the three governments, à fond perdu, Germany and Italy 10,000,000 each, Switzerland 8,000,000 francs, the rest by the company and the shareholders.

During a visit in the tunnel Favre died suddenly, but his heirs were willing to carry the work on, so that Favre's death caused no interruption, and on the 29th of February, 1880, the first drill went through the narrow partition of rocks which was then left.



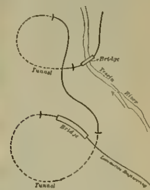

STATION OF WASEN ON THE ST. GOTHARD SPIRAL.


SOUTH SIDE OF ST. GOTHARD, LOOKING UP.

The total length of the tunnel is 9.25 miles, the cost of building it was 65,000,000 francs ($13,000,000). Height above sea level in the center, 1,154.55 m. (3,275 feet); height of north entrance, 1,109 m., south entrance, 1,144.85 m.; incline towards north is 5.8 (30 feet per mile); towards south, 2.

During the construction three high-pressure turbines were used in Göschenen for compressing air to about 12 or 14 atmospheres (180 or 210 lbs. per square inch), which was conducted to the rock drills in the tunnel. Towards the center of the tunnel that pressure diminished to about 7 atmospheres. Similar arrangements had been made on the south side at Airolo. From six to seven rock drills were at work continually from either side. They were mounted on a traveling frame, and each drill made a hole about 1.20 m. long (47 in.) The firing of all six or seven holes was simultaneously, and about 1 m. (39 in.) of rock would be blasted at the time. After that the debris was removed, the track for the drill-frame laid and the latter advanced correspondingly. The average was three shots every 24 hours, equal to an advance of 3 m., or 117 in. a day. Sometimes not more than 2 m., sometimes as much as 5 m., a day would be blasted, according to the quality of the stone. The latter was mostly granite, the formation of it showed vertical layers. This caused many inconveniences, because the water would flow down between the layers, and sometimes submerge almost the whole boring plant. At an average, about 3,400 men were employed daily in building the tunnel.

The total length of the main line from Lucerne to Chiassa is 232 kilometers (144 miles). The mountain line, from Erstfeld to Biasca, 90 kilometers (56 miles), has two tracks. Part of the second track has only been in use for a few months. The cost of the total length of line (not including the cost of the second track) was 238,000,000 francs, or $47,600,000. The average grade is 25 ft. in 1,000, the maximum grade 27 ft. in 1,000. The smallest radii are 280 m., or 910 feet. Photograph No. 12131 shows the bridge across the Kerstelen river, which comes down from the




Maderaner valley, just above the station of Erstfeld, where the mountain line begins on the north side.

Small photograph shows the station of Wasen, twenty-one kilometers from Erstfeld, where height had to be gained with circular turn tunnels, by means of which the line is carried down the valley for some distance, though, of course, always climbing up along the side of the hills. The entrance to the second turn tunnel is shown to the left above the little church. The uppermost portion of this great zig-zag line is shown just where it crosses a little stream on an iron bridge. Lower photograph on page 369, shows the same portion of the line, but looking up to it from the bottom of the valley below the church.

There are, altogether, three circular

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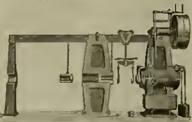

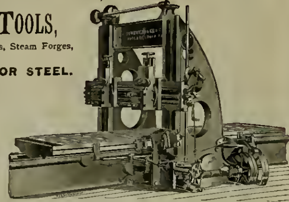

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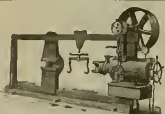
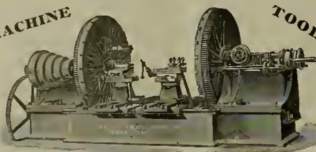
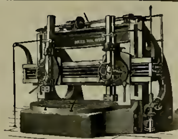


HYDROSTATIC WHEEL PRESS.



DOUBLE DRIVING WHEEL LATHE.



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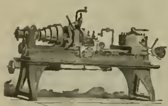

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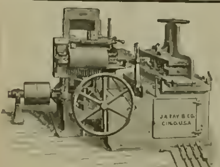

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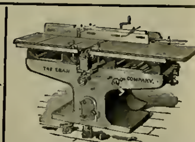

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tunnels on the north side, two at the station of Wasen and one below, near the station of Gurtnellen. The radius of each is from 280 to 300 m.; grade, 23 feet in 1,000. The length varies from 900 to 1,300 m. The maximum difference of level between the two entrances is 35 m., or 113 feet. On the south side, there are four circular tunnels, two just above the station of Faido and two above Giornico. The latter section of the line is shown in the two photographs, Nos. 12898 and 154, the first number giving a view from up above, the second from down below. The sketch gives you an idea of how tunnels are arranged.

As you see, the photographs have been taken before the second line was started.

The fare for second-class passengers is seven centimes per km., or 2 4 cents per mile, with an addition of 15 per cent. for the mountain section of the line. The rails weigh from 38 to 46 kg. per m., or from 77 to 94 pounds per yard.

The total number of tunnels on the whole line is fifty-six, twenty-seven north of the great tunnel, twenty-eight south of it, total length of tunnels is 41 km., or 25½ miles, which is as much as three-fourths of the length of all tunnels in the German Empire.

The bridge over the Kerstelenbatch at Amstey is 138 m. long (including two stone viaducts). Height is 54 m.

HENRY GREFFENER.
*Zurich, Switzerland.*

ON THE SOUTH SIDE OF ST. GOTHARD LOOKING DOWN.


BRIDGE ABOVE WASEN, UPPER TUNNEL.

### An Electric Locomotive.

An electric locomotive has recently been built in the Lynn shops of the General Electric Company, and is on its way for exhibition at Chicago. The builders thus describe the engine:

"The locomotive weighs 30 tons, and compactness of machinery is at once apparent in its build. It is 16 feet 6 inches long, 11 feet 6 inches high, and 8 feet 4 inches wide. The draw-bars are set 2 feet 6 inches from the top of the rail, while the whole rests on four 44-inch wheels.

"Two electric motors, one at each axle, provide the power, the motors being gearless and supported upon spiral springs having their base on the side frames of the truck. This arrangement gives the wheels a certain freedom of movement irrespective of each other, which permits them to adjust themselves to any unevenness of the track, making the locomotive ride easier and diminishing the wear and tear upon the tracks and the motors.

"The motor fields are solid iron castings and the hollow field spools are bolted to them. The iron-clad armatures have each separate windings, embedded in a mica-lined slot in the curved surface of the laminated iron armature body.

"The locomotive axles pass through the hollow shafts upon which the armatures are mounted. They rest in bearings of the motor frames, and are connected to the axles by universal couples, which allow of considerable freedom of motion. The commutators are of substantial construction, and each one has four sets of brushes.

"It is claimed that the series parallel controller, which takes the place of the throttle in the ordinary locomotive, makes it possible to start and stop the motor easier and with less straining than is needed for the steam locomotive, while the speed, by this arrangement, can be more readily controlled.

"The truck, suspended from the journal-boxes, is constructed of heavy I-beams, and forms the foundation for the locomotive cab, of sheet iron, of symmetrical design, and so curved off as to diminish the atmospheric resistance as far as possible.

"The interior is finished in hard wood. Two sliding doors are placed at each side of the cab, and the windows are so arranged as to permit of an unobstructed view in all directions. There is ample space in the cab for the motorman's movements, and it affords him considerably better protection than that usually vouchsafed the steam locomotive engineer.

"The use of these locomotives over very long distances is at present limited only by the cost of long lines of electric feeders, and until the problem offered by this condition is solved restriction of its employment must necessarily exist.

"But for places comparatively near each other, and where traffic is dense, the denser the better, the electric locomotive is peculiarly adapted, for here all the advantages of electric propulsion are available, unhampered by the extreme expense involved in long feeder lines."

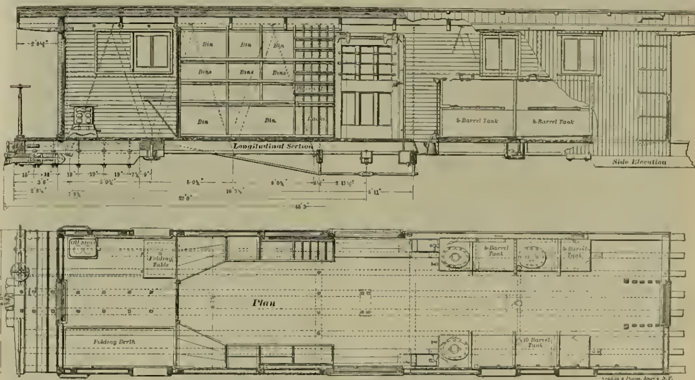
Serve-ribbed tubes are coming into common use on locomotives in France. These tubes are said to increase the evaporative efficiency of the boilers so much that much smaller boilers can be employed for a given size of cylinder.

There is competition between several Canadian cities just now to secure the location of the Grand Trunk shops. General Manager Seargeant has written the corporation of the city of London, Ont., in which he reviews the negotiations in the past between the company and the city of London, Ont., in regard to the shops, points out that Sarnia is willing to give $100,000 for the shops, and that the council of that town will make an agreement free from the many objectionable conditions suggested by London. There are advantages offered by Sarnia and Point Edward as points for location of the shops.

# Car Shops and Car Builders.

## Norfolk & Western Supply Car.

The annexed engravings show a novel form of car used by the Norfolk & Western for conveying stores to the different stations on the line. In fact, it constitutes a traveling store-house and is regarded as a great convenience The details of the car are seen so distinctly in the engraving that no detailed description is necessary




NORFOLK & WESTERN SUPPLY CAR.

## Norfolk & Western Freight-Car Truck.

The truck shown in the annexed engraving has lately been designed by the mechanical department of the Norfolk & Western for use under cars of 60,000 pounds capacity. The principal particulars are

Bolster composed of two steel I beams weighing 21 lbs. to the foot and 9 inches deep, separated by four castings, each taking two horizontal ¾-inch bolts.

Wooden blocks on outside of I beams filling out the space between the web and the column guides, which also give elasticity and prevent the nuts rattling off, and wooden plank on top of I beams under center plate and side bearings to deaden vibration.

Springs consist of six standard coils. (The number of coils may be varied to suit the weight and capacity of car body). The springs rest in pressed-steel plates, but these plates are not bolted together, but simply rest on the springs and spring plank.

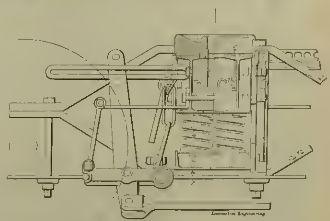
Cast-iron center plates.

Arch-bars Top, 1¼ x 4 inches; bottom, 1 x 4 inches, tie-bar, ⅜ x 4 inches

National hollow brake-beam.

Malleable-iron brake-lever connector and dead-lever guide.

Truck weighs about 5,600 lbs.



NORFOLK & WESTERN CAR TRUCK.

## Danger of Mixed Draw-Bars.

A very desirable change was made in the Rules of Interchange of Cars at last Master Car Builders' Convention, when Rule 16 was made to read "Any company finding a link and pin draw-bar in a car originally equipped with the M. C. B. type, and so marked and carded for wrong material, may replace the link and pin draw-bar with a M. C. B. draw-bar, and bill upon the card to the railroad company carding the car for the wrong draw-bar."

This indicates a disposition to maintain uniformity of draw-bars, which is a move in the interest of safety. Coupling a standard draw-bar with a link and pin coupler is a dangerous operation, and every effort should be made to prevent the practice It is understood that the officers of the Vanderbilt lines are opposed to the practice of substituting a link and pin coupler for one of the M. C. B. type and carding for the defect. They would prefer that the putting in of a standard draw-bar should be absolutely prohibited, and many railroad men sympathize with these inclinations.

Every year will see a large percentage added to the number of standard draw-bars in use, and it seems to be the right practice to prevent the mixing of draw-bars since it greatly increases the danger to trainmen. Should a brakeman or switchman get injured coupling a car that is carded for a wrong draw-bar, he would have a good case against the company for using a dangerous attachment. The fact that the mixed draw-bars are dangerous ought to be sufficient reason to induce railroad companies to oppose the practice. The self-interest, however, that makes them more liable in a suit for damages is likely to have more influence in rooting out the practice than mere humane considerations.

## To Abolish Obsolete Standards.

A circular has been issued by Secretary Cloud, of the Master Car Builders' Association, relating to letter ballots, in which the recommendation of a committee to abolish certain standards is repeated. The standards referred to are

Diameter testing gauge, flange and journal gauge, wheel-bore testing gauge, journal length and diameter gauge, guard-rail gauge, centering and journal shoulder gauge, journal distance gauge boring wheels (the use of six dogs), attachments and dimensions of draw-bars, train-pipe fitting for steam heat

The reasons for the proposed change are thus explained:

"It is proposed to retain the wheel circumference measure as a standard, but it is believed that the form of gauges to be used to produce certain standard dimensions in standard parts is purely a matter of local shop practice which should not properly be legislated upon by the association. Similarly with the question of chuck-jaws or dogs for centering wheels on the table of a wheel-boring machine The standards governing the attachments and dimensions of draw-bars are very old (established in 1876 and 1879), and do not command any respect at the present time, are but seldom observed or conformed to, and have been in part superseded by the present standards governing the proportions of vertical plane couplers The standard train-pipe fitting for steam heat is practically a dead letter, which is our justification for recommending its abolishment

"The present standards of the Master Car Builders' Association are the result of their deliberations through a long period of years. Many of the earlier standards were adopted when the association was in its infancy, and there has been a great deal of legislation under the general heading of standards, which has resulted in the acceptance and promulgation of certain forms of construction or forms of practice, which, in our judgment, ought never to have been classified as standards It is the opinion of the committee, therefore, that what are now comprehended under the general category of standards of the association should be divided into two groups, the first group to be continued and maintained as the standards of the association, the other group to be rescinded as standards, but to be established as recommended practice"

## Weak Draft-Springs.

In a paper on "Draft-Rigging," by Mr. Geo W. Morris, of the French Spring Works, read at the Southern Railroad Club, attention was directed in a striking manner to the weakness of springs used in the draft-gear of cars. He said that English cars carrying 9 tons have about 400 pounds of steel per car for draft-springs, and American cars carrying 30 tons have about 70 pounds of steel for the same purpose

A curious case of ignorance was mentioned Years ago Mr Kirby, of the Lake Shore, designed a draft-gear that had two sets of springs side by side A master car builder of a prominent road hearing of the advantage of Mr. Kirby's plan, sent for blue-prints with the view of adopting the improvement. Like many others, he wanted to put his own improvements upon the improvement, so instead of putting the springs side by side he put one behind the other When the uselessness of putting one spring behind the other was pointed out to him he could not see but what it was all right, and an actual test was necessary to convince him that the two springs so

arranged did not offer more resistance than one.

Mr. Morris agreed very strongly in favor of greatly increasing the strength of draft-rigging springs. The draft now most generally used, he said, by the most ad-

First-Class—Intercommunicating.

vanced officials in their specification is $6\frac{1}{2}$ inches diameter by 8 inches long, two-coil, and $2\frac{1}{8}$ inches hole, made of $1\frac{1}{4}$ and $\frac{3}{4}$-inch steel, and weighing about 35 pounds, with a total action of 2 inches, and with a total capacity of 20,000 pounds. This I consider is not of sufficient capacity for the draft-spring, considering the increased power of the engines now in use. Take the heavy freight engines of to-day, say a 22-inch cylinder by 24-inch stroke, and 50-

First-Class Coach—Intercommunicating.

inch driving wheels, and a boiler pressure of 180 pounds steam, and say we allow 85 per cent. of the boiler pressure, which brings the figures within the power of the engine, we find the traction to be over 35,000 pounds; while on the largest engines formerly used, say 16 x 24 inches, 50-inch driving wheels, and a boiler pressure of 130 pounds steam, and following the figures as before, we have a traction of the engine to be only about 13,000 pounds.

Second-Class—Compartment System.

Therefore, there is not sufficient capacity in the draft-springs, nor sufficient resisting power for the buffer, as the maximum of the blow is enormous, contingent on the velocity, weight of train imparting the blow, etc., and the spring referred to is, in my judgment, the maximum in capacity that can be produced for a durable spring.

### New Policy About Standards.

The Master Car Builders' Association at last convention inaugurated a new policy in regard to standards of the association. They recommended that a number of obsolete standards should be abolished, and adopted the following policy in regard to new standards:

"Those forms, parts, constructions, units, measurements or systems in which it is desirable to secure not only sound construction, good practice and safe operation, but which also promote quick and cheap repairs, and, consequently, free interchange of cars.

"Those forms, parts, constructions, units, measurements or systems which are conducive of sound construction, good practice and safe operation, but which do not affect either interchangeability of parts or interchangeability of cars as a whole."

### Some Spanish Rolling Stock.

The eleven little pictures shown herewith will give the reader some idea of the kind of cars he might expect to see in Spain. Some of them are quite American

Royal Mail Car.

in appearance. These all belong to one road; the odd ones are from several lines, the names of which appalled the writer when he tried to put them into English—but it's just as well for the reader that he don't know.

Some of the cars with the dog-house on top for the "gafter" are odd but not uncommon in all European countries, in Spain this is called some Spanish name that means a "perch"—as if the brakesie were a canary or a poll parrot.

Second-Class—Intercommunicating.

People who have been in New York City are not likely to forget that Broadway is the most crowded street they had ever seen, for there is nothing like it to be seen anywhere else. After a long fight, some years ago, a street railroad company obtained a charter to lay tracks on Broadway. Those familiar with the blocks of vehicles, which were of hourly occurrence, predicted that street cars would be useless on this street, since they would be blocked most of the time. A strange effect came

Freight Car with Brakeman's Box.

from their use. It seemed that they regulated the movement of other vehicles, for the street was never for years so free from blockades as it has been since the cars began running. Lately, they have put cable cars upon the street. One day, shortly after these began running, a wire of the cable got tangled in the grip, and the car could not be stopped. It rushed along the street like a battering ram, overturning wagons, cabs, hucksters' carts and everything that came in the way. The street looked like a lane of wrecks before the cable was stopped.

The J. A. Fay & Egan Co., of Cincinnati, O., have a display of over fifty different wood working machines at the World's Fair. They are all finished in a very perfect manner. They are fine examples of wood-working machinery and attract a great deal of attention. We are informed by the makers that these machines will be sold after the exhibit is finished, at the same price as the ordinary machines. Any concern or individual making a purchase can obtain good free advertising now, for the name of the purchaser, place and style of business will be placed on the machine.

We have received from the Patent Safety Railway Car Co., of Kansas City, illustrations and description of an invention made for the purpose of preventing cars telescoping when passenger trains come in collision. The mechanism employed is very simple, considering what it has got to do. The body of each car is separate from the truck. In fact, it is an arrangement of flat cars for carrying the body of the pas-

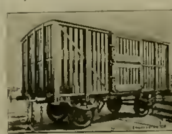
Accommodation Car with Closets and Passenger Accommodation.

senger car. When a collision occurs, mechanism provided on the flat car turns the body of the car round on a pivot, so that, instead of telescoping, the cars slip past each other. The idea is not notable principally for its boldness and freedom from what are regarded as established rules of designing. We have no doubt that it would work all right if put in practice. The great difficulty about making a

Three-Story Fruit and Fish Car.

success of this kind is that railroad companies do not build their rolling stock with a view of preparing for collisions or other accidents. The tendency of to-day is to perfect details of train operating, so that special provision against accidents will not be necessary in the designing of rolling stock.

The Safety Car Heating and Lighting Co. of New York, have sent out a circular cautioning patrons and others against anonymous assaults made upon their

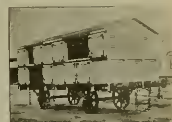


Two-Story Stock Car.

lighting system by unscrupulous rivals. We understand that the company has very good reason for complaint about secret misrepresentations. There is no system of lighting ever tried that has given such thorough satisfaction as the Pintsch, and it is too late in the day to try and injure the system by underhand means. There are now more than 200 gas plants in daily operation supplying this illuminant, and there are more than 100,000 cylinders, an equal number of regulators and over 500,000 lamps applied to 54,000 cars for illumination by this system daily demonstrating its safety, reliability and superiority.

### Value of Water as a Lubricant.

On the car and locomotive journals of a great many railroads and on the heaviest bearings in steamers, water is used as an aid to keep the bearings cool. The fact that bearings can be kept running cool by the use of a stream of water applied to them has lately raised a discussion of the question, "Is water a lubricant?" There is no doubt that water is a lubricant to a limited extent, but as a means of lubricating heavy bearings it is liable to be very unsatisfactory. We are informed that a New England Railroad Company some years ago made a practical experiment with journal boxes for cars in which nothing but water was used to lubricate the journals. The boxes were made watertight and filled with water. They ran cool but the cars were extraordinarily hard to pull and the journals wore very rapidly.



Fruit Wagon—Ventilated.

For this reason it was considered that water as a lubricant was not a success.

In the lubrication of journals there is always more or less friction which causes heating. If the bearing is too small for the weight placed upon it the mechanical work converted into heat is liable to increase so greatly that the bearing will become too hot for safety. If means can be provided to carry away the heat as fast as it is generated the journal will remain

Mineral Wagon with Brakeman's "Perch."

at a safe temperature. The air is not sufficient sometimes to carry away the heat generated, but a stream of cold water will do so, and that is where we consider there is an advantage in using water on bearings. As a lubricant, water is worth very little, but as a means of carrying away the heat from a journal, it is likely to be a decided success.

We have received from Mr. Jew Gathek, Paterson, N. J., an illustrated catalogue of miniature steam locomotives and cars. The little engines are working models and vary in price from \$6.50 to \$18. People wanting to make a present to a boy of mechanical taste will find these locomotives certain to give satisfaction.

Send for our Premium List.

### Brooklyn Elevated Engines.

The annexed engraving represents an improved type of Forney engine, designed by Mr. E. M. Hedley, master mechanic of the Seaside & Brooklyn Elevated Railroad Company, and built by the Rhode Island Locomotive Works. The cylinders are 13 x 18 inches, and the driving-wheels are [illegible] inches diameter. The total weight of the engine, in working order, is about 56,000 pounds, of which 40,000 are in drivers. The engine is remarkably well proportioned throughout, the bearings being unusually large. The parts most liable to give out in this class of engine have been materially strengthened. First-class material is used throughout.

Several important changes have been made in the boiler and firebox. The firebox has been shortened, and the barrel of the boiler lengthened. The boiler is 44 inches diameter, in front. A wagon top is employed, and the firebox is secured by radial stays, the dome being placed in front of the firebox. The length of the firebox, inside, is 50 inches, and the width 42⅛ inches.

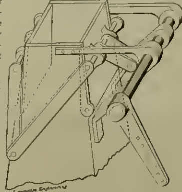
These engines are now in service, and show a decided saving of fuel over those that have longer fireboxes and shorter tubes.

To the many subscribers who have written us asking why planished or Russia iron is almost invariably buckled or kinked, and a remedy therefor, we have to say that diligent inquiry develops the fact that this trouble is well nigh universal. Russia iron is polished by hammering; a number of hammers striking very fast do the business, and it is very likely a hard matter to keep them from stretching the sheet unevenly. It is customary to use the best pieces on the sides and put the worst buckled ones out of sight as much as possible.

### Variable Exhaust Nozzle.

The engraving shown herewith illustrates a form of exhaust nozzle recently patented by two engineers of the C., St. P., M. & O. road, Messrs. Wallace and Kellogg, of Altoona, Wis.

The nozzle is square and the two movable sides are hinged at the bottom, and each time they are moved they shear off any accumulation that has adhered to the sides of the pipe, and its inventors provide for their being moved regularly by connecting the device direct to the reach-rod, so that every time the lever is moved the "variable" is adjusted, being largest when cutting off full stroke and getting smaller as the cut-off becomes shorter, the amount of this adjustment can be changed to more or less by adjusting the connections on the operating lever.



Variable Exhaust Nozzle.

This device has been in use some ten months, and those who have watched it claim that it saves fuel and requires no care more than an ordinary nozzle.

Those interested can learn more of the device by addressing the inventors as above.

Business generally appears to be getting very flat in the Southwest, but the business of train-robbing seems to flourish like a green bay tree. No sooner does one gang of ruffians who follow this line of light industry get exterminated than others are ready to take their place.

For a fibrous packing the brand known as Asphaltum packing has some properties not usually found in rope packings. It keeps soft under steam pressure, and does not bake or harden into an iron ring, as most packings do. For air-pumps, pistons and valve-stems it seems to give excellent results without scoring the rods—the trouble with most packings of the fibrous order.


Brooklyn Elevated New Locomotive.

The Official Railway List for 1893 is out. It is getting thicker every year, but whether because there are more names or more advertising it is hard to tell; in either case there is nothing to complain of. The Official List is the best list of railroad officers, but, appearing but once a year, gets considerably out of date along about the holidays. It is published by the Railway Purchasing Agent Co., Chicago, and is worth $2 of any man's money who wants to know who is purchasing agent or general manager of the Baffin's Bay & Patagonia Ry.—or any other line in North America.

Mr. James Dredge, writing to his paper, *Engineering* (London), from the World's Fair, says of the Pullman train: "* * * As for the internal fittings and arrangements of the cars, they, of course, go far beyond anything that has yet been attempted, and no royal trains of Europe will bear comparison with them. Yet they will no doubt set the standard for the better class of American travel before long * * *."

We are informed by Jenkins Brothers that they have adopted a new form of holding the disc-holder in place, having increased the number of bolts in valve-bonnets, and the thickness of flange has been increased, so that high pressure can be used with safety. It is the intention of the company to manufacture but one grade of valve, so that it will not be necessary for customers to mention "valves for high steam pressure." Mention is made of the wonderful improvement in the manufacture of a rubber compound on high-pressure steam. They have been working on this compound for a long time and now find it entirely satisfactory, and are offering it to the trade without increasing the selling price.

The Falls Hollow Stay-Bolt Co. wish to remind their friends that they have increased their capacity lately and are in a position to fill all orders promptly.

Reeves' American Band, that dispensed music at the last M. M. and M. C. B. conventions, were from Providence, R. I., and their music was so far superior to anything the conventions have ever had that there is a movement on foot to secure their services for every year. They certainly were artists.

A guard on one of the Indian railways has invented a method of cooling cars by means of compressed air. The air is compressed by a pump worked from an axle, the heat generated by compression dissipated by exposure, and then the compressed air is permitted to escape into the car. It cools in expanding, and lowers the temperature of the car. Those attending the Chicago Exposition can see a good illustration of how expanding air cools by watching the exhaust of the locomotives that are run by compressed air. The air in escaping from the smokestack looks like steam, but it is the cooled air converting the moisture of the air into mist.

Times are getting dull in locomotive building. Most of the shops are laying off hands.

# ? A. What You Want to Know. ? A.

**Don't ask questions that simply require a little figuring to determine; make each question separate. No notice taken of anonymous questions.**

(79) J. S. M., Danville, Ill., writes:

Will eccentrics of a Schenectady engine, packed with wool waste within an inch of the top, run fifty-five miles safely with one oiling, pulling five vestibule cars and make eight stops in 100 minutes? *A.*—Yes, easily, if the oil is good and the packing kept fairly clean.

(80) F. W. P., Boone, Ia., asks:

1. Why are the top rows of stay-bolts on the sides most given to breaking? *A.* The upward and downward movement of the inside sheet due to expansion and contraction, appears to be greater there than at other points. This would put greater stress on that row of stay-bolts. 2. Why do stay-bolts invariably break off next the outside sheet? *A.* The inside sheet moves up and down, and the part of the bolt secured to the outside sheet becomes the fulcrum of the stay-bolt movement.

(81) Fireboy, East Grand Forks, Minn., writes:

1. There is a difference of opinion among our engineers, as to the proper way to change the lead on a locomotive. Some say it should be done with the blades, others that it ought to be done by the eccentrics. *A.*—If, in running over the valves, it is found that there is more lead on one end than on the other, that can be equalized by the blades. But the blades cannot be used to change the total lead, the eccentric alone can accomplish that. 2. If an engine is being run on one side, and happens to stop on the lower quarter, would she have the same chance to start herself as if stopped on the upper quarter? *A.*—Yes.

(82) T. J. McD., New York, says:

I find the horse-power of "999" is 419¼, taking 32 circular inches as a H. P. I find the H. P. of the boiler 138, taking 14 square feet of heating surface as a horse-power. Now, I want to know how a boiler of 138 H. P. can supply steam to cylinders of 419¼ H. P.? *A.*—Horse-power of locomotive boilers and engines cannot be found by the rule you use. The proper rule for the engine is, multiply the area of the pistons in inches by twice the stroke in feet, multiply the quotient by the revolutions per minute, and that by the mean effective pressure in the cylinders. With the forced draft employed in locomotives, from 1½ to 2 square feet of heating surface will generate steam for a horse-power.

(83) J. A., Houston, Texas, writes:

1. With an eight-wheel Baldwin engine, I stalled on a hill. Just got the first cut put away and was returning with the engine in back motion when the reach-rod broke. Do you think that the back pressure would keep the links raised in back motion? *A.*—No. Unless the counterbalance spring was stronger than it usually is, the links would drop with forward motion. 2. Suppose I was running an engine that was the only one on a road with a Sellers injector on one side and a pump on the other. Suppose the injector failed, and a main-pin broke on the side the pump was on. How could I bring engine in and keep water in her? Could I use a scantling to pump up by hand? *A.*—This has been done, but is no easy job. You would probably have to let the boiler pressure get low before using the pump.

(84) R. P. M., Bloomington, Ill., says:

Please give me a simple rule for calculating the velocity of steam. For instance, what fraction of time does it take steam to pass from the dome to the cylinder? *A.*—It is not practicable to find any easy rule for this. The theoretical velocity of steam flowing into a vacuum is equal to the velocity a falling body would acquire in falling freely by gravity from the height of a column that would equal the steam pressure. The theoretical velocity of the steam escaping into the atmosphere or into a vessel having some pressure inside would be that equal to the difference in height of the two columns. To find the velocity of steam at, say, 150 pounds gauge pressure, the rule is: From 13 subtract .005 of the gauge pressure. Multiply the remainder by square root of the gauge pressure minus 7. To the product add 1,890. This subject is very clearly treated in "*The Engineer's Epitome*," published by the Mason Regulator Co., Boston, Mass.

(85) G. H., Laurenburg, N. C., writes:

1. Steam gauge when cold shows 15 pounds. Would you call it light or heavy? *A.*—It is light. When it shows 140 pounds pressure, the real pressure would be 125 pounds. 2. What causes the air-pump to flutter when starting? Several things may cause this. Wear of air-pump valves, a bent reversing valve-stem or a broken main steam-valve ring are among the most likely causes. 3. Does the exhaust from right side of cylinder go up right side of stack when double nozzles are used, or does the steam cross over and pass out at the opposite side of the stack? *A.*—If the nozzles are set straight the steam will pass through the stack on the side from which it escapes through the nozzle. If the nozzles lean inward the steam will cross to the other side of the stack. 4. I have seen no answer to the question, What knocked the cylinder-head out when the lower rocker-arm broke? *A.*—We can give no positive answer to this. The valve probably closed the steam in the cylinder and did not rise off the seat quick enough to relieve the pressure caused by the advancing piston.

(86) F. O., Waltham, Mass., writes:

1. What is the idea and advantage of having the piston-rod of the low-pressure cylinder of the Pittsburgh compound locomotive extended through the front cylinder-head, as shown in LOCOMOTIVE ENGINEERING for July? *A.*—It is to act as a guide and support for the heavy piston-head. 2. In one issue of LOCOMOTIVE ENGINEERING I read a statement to the effect that a locomotive could pull a light train with the reverse lever in the center notch. How can you throw such an engine out of gear? *A.*—Putting the lever in the center notch is the best that can be done. 3. What is the greatest distance that the drivers of an eight-wheel engine can be placed apart? *A.*—About nine feet. 4. Do engines with sight-feed lubricators feed oil when the engine is working steam? *A.*—Yes. 5. Two classes of locomotives were tried on fast passenger trains here. One class had driving-wheels 60 inches and the other 69 inches diameter. The engines with the small wheels did not make the time, and some of the engineers say that at high speed the counterbalance of the drivers kept the speed down. I said that it would be the compression and back pressure that would prevent the engines from running faster. Who is right? *A.*—You are likely to be right.

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The New York Central Railroad Company are not only giving all their employees leave of absence to attend the World's Fair, but they are giving them passes to and fro for the whole distance. The company have also arranged for hotel accommodations for the visitors at rates which are so low that a man may spend a week in Chicago without incurring more expense than he would have to meet in an ordinary boarding-house.

## A Practical Man's Views of Compound Locomotives.

At the last Master Mechanics' Convention a very edifying speech was made on the subject of compound locomotives by Mr. G. R. Joughins, master mechanic of the Norfolk Southern. Mr. Joughins said:

"Last year we commenced to think about compound engines, and in looking over the question we concluded that we might reasonably expect a saving of 15 per cent. at least in freight service. On that conclusion we ordered from the Baldwin Locomotive Works one freight and one passenger compound. Those engines have been running about eight months now. The freight engine is doing work which had previously been done by some simple engines of exactly the same dimensions, received from the Baldwin people also. We find the results with that freight engine to be very satisfactory. The engineers like the engine. It seems to be ample cylinder power. The fireman likes the engine because he has not got so much coal shoveling to do. We have not attempted to make any test of these engines. We keep an elaborate performance sheet, and we determined to rely upon that performance sheet simply. We find that there has been a uniform saving every month amounting to at least 20 per cent. in fuel. We do not find that the oil has been required more copiously. It is apparently about the same for freight work, except, of course, the first month or two in which the engine was put in service. The repairs of that engine we find to be practically the same as the ordinary engine—that is, the running repairs. We cannot see that it is necessary ever to keep that engine in from a trip, or that it has any large repairs required.

"On the passenger engine, however, we have been rather unfortunate. A great many small matters have gone wrong with that engine, partly, perhaps, due to the higher speed at which it is worked, but I think mostly from rather undeveloped designs and a little bad workmanship. The result of these troubles has been that we are not quite satisfied with the passenger engine. We bought that passenger engine with a definite object. We have sometimes, during the truck season especially, very large trains of perishable freight. I mean large trains compared with the speed at which we had to haul them. We take on twelve or fifteen, or even more, 50,000-pound freight cars loaded completely and run them at passenger speed. The engine does this very satisfactorily, so far as speed and power and general performance are concerned, but, as I said before, it has given us trouble in many little details. I do not know whether to conclude that the compound engine is not suitable for passenger service or not. It is rather a small experiment on which to base any conclusion. But I was over in England last winter, and, of course, I went to see the Crewe Works, and also went to Gateshead on the Northeastern Railway. At the Crewe Works I was surprised to find that they had not built a single compound engine for eight months except the engine which was then under construction, and which is now at the Exposition in Chicago.

"That seemed to indicate that the compound was not quite a success on that road. I then went to the Northeastern Railway, to Mr. Worsdell's works, who, we all know, has been long a very strong advocate of the compound engine, and I was still more surprised to find that they were building twenty locomotives for passenger service with simple cylinders, and abandoning the compound for that purpose. I did not quite get at the reason why they abandoned the compound for passenger service. It was a little difficult to get an expression of opinion. But in talking to other people on the railway, they said that they found the compound rather unwieldy for passenger service, considering the slight advantages which they derived from it otherwise. The saving in coal was, perhaps, a little, but there were other things which militated against that, and which destroyed the value of the compound on passenger service. I would say in regard to oil on compound engines, that I think any report which the committee has made about the consumption of oil is utterly valueless. I think we all know that a locomotive very seldom indeed receives the oil which is necessary for lubrication. It receives the amount which in the judgment of the engineer he thinks is needed, and that is often two, three, four and five times the amount actually necessary. I therefore think that the oil question is quite undetermined yet, and the figures given are of no service. In determining whether a compound engine ought to be used in passenger service or not, we must, of course, remember that the engines are still in their infancy, and that if we go along experimenting with those engines in freight service that we shall perhaps eventually obtain an engine which is very desirable for passenger service. Notwithstanding the apparent success of those compound engines on the Reading road and on the Jersey Central, I think that it is still a very undetermined matter about the success of those engines in passenger service.

"In obtaining the results from different people of the test of compound with simple engines, we all notice that they vary very much indeed and a very large factor comes into that question. In determining the relative efficiency of the compound or its relative economy the question is, what is the efficiency or economy of the simple engine against which it is being tried or tested? The compound may be tested against a simple engine which is a very poor machine indeed, or the simple engine may be a good engine, and the compound one or it may be improperly handled. There is therefore, I think, a very important question to determine, what is the factor of efficiency as a machine of the simple locomotive against which the compound may be tested.

"Respecting the way in which a compound engine may be abused, I can give you one very good example. When we received those two engines from the Baldwin Works, I was preparing to go away for some time, and I had only time to receive the engines and see them through a trial trip before I left. On my return ten or eleven weeks after, of course, one of the first questions I asked was what about the compounds, and to look at the figures on the performance sheet showing the fuel consumption. I was very much astonished to find that the compound passenger engine was using 50 per cent. more fuel than the simple engine. I thought that was not right. In the meantime while they were doing this, eating up all this coal, of course, they had no one to instruct them in the use of the compound. I took a few rides on the engine and I talked to the engineer a little, and we have now, instead of the compound using more fuel, she uses somewhat less fuel than the simple engine—a little less, say 10 or 12 per cent. This has been all brought about simply by talking to the engineer and showing him that the engine was a compound engine, and that it was not to be used to its full capacity all the time with the live steam running into the low-pressure cylinder. That was his chief fault. The result, I say of that talk has been a very considerable reduction. I think we reduced the coal per car mile somewhere about 75 or 80 per cent. and I thought that a very good example of how a compound may be abused."

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The newspapers of Cleveland, O., have been carrying on a crusade against the smoke nuisance, and the lives of steam users and firemen have been made a burden by the threats of smoke inspectors. Railroad people are coming in for their share of the abuse. Care, mixed with a little skill, would greatly reduce the nuisance complained of.

# LOCOMOTIVE ENGINEERING

A PRACTICAL JOURNAL of RAILWAY MOTIVE POWER AND ROLLING STOCK.




VOL. VI, No. 9. NEW YORK, SEPTEMBER, 1893. 20 Cts. Monthly $2.00 Per Year.

## The Railway Air-Brake Men.

The men who have charge of the air-brakes of railroads, those who test them, keep them in repair, and instruct the engineers and trainmen in their use, recently formed an educational association similar to that of the Traveling Engineers' Association. We publish herewith portraits of the officers and a photographic bird's-eye view of part of the working members—those who stayed in Pittsburgh after the work was done.

Robert Burgess, the president, is one of the bright young mechanics raised by hand under the tutorship of Pulaski Leeds on the L. & N. Since the formation of this society he has been employed by the Westinghouse Company as an expert.

C. C. Farmer, the vice-president, is in charge of the air-brake equipment of the M., K. & T. road and lives at Sedalia, Mo.

P. J. Carney, the secretary, is in charge of the repairs of brakes on the Milwaukee, Lake Shore & Western, at Kaukauna, Wis. It will be noticed that he looks some fifteen years younger in the group than when by his lone self; this is because the boys got him to shave in honor of the organization.

In the group, reading from left to right in the front row, can be found R. N. Martin, Penna. R.R.; L. S. Andrews, N. Y., N. H. & H.; H. P. Shreve, N. Y. Brake Co.; Sam D. Hutchins, Big Four R.R.; Otto Best, N. C. & St. L., and J. B. Swann, of the P. C. & St. L. Reading from right to left in the back row, can be found W. M. Carr, P. C. & St. L.; H. Montgomery, Penna. R.R.; C. C. Farmer, M., K. & T.; F. M. Nellis, Westinghouse Brake Co.; Robert Burgess, L. & N. (now with W. A. B. Co.); A. W. Bragdon, Penna. R.R.; P. J. Carney, M., L. S. & W., and W. C. Walsh, of the L. & N.

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One of our correspondents sends us the following copy of a recent entry on his work book, and heads it, "Puzzle for Roundhouse Men Only:" "Wash Out Boiler all so See on BallWheel on R. S. the Brake Shone wont Stay in it Place all the Cylner to the steam the hed is goin Look a Rond."

The Chicago & Alton people have begun the reduction of operating expenses by dispensing with the services of several superintendents and trainmasters.

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Locomotive engineers will recognize an old friend in the solid frame and smiling face of the center-fielder in the group of air-brake men, for it's Sam Hutchins, of the Big Four. Hutchins was recently promoted from the best express run on the road to the position of air-brake instructor, a position he is entirely capable of filling. S. O. Hutchins was promoted to the position of locomotive engineer when scarcely eighteen years of age, and was for some years the youngest engineer in the country. He attended to business strictly, had no trouble, and has been for long years in charge of the throttle of the fastest and most important trains on the road; he has taken a prominent part in Brotherhood affairs, and was chairman of the Ohio Legislative Board—the only board that ever accomplished very much in the way of legislation tending to protect railroad men.

## The Railroads of the United States.

**Their Length, Cost, Debts and Earnings—Number of Locomotives and Cars—Amount of Freight and Passengers Handled—Cost and Profit of Operating—The Facts for the Year 1892.**

The most reliable compilers of railroad statistics in the world are the editors of *Poor's Manual of Railroads*, and from advance sheets of their work on the railroads for this country we are able to concisely place before our readers a few interesting and reliable facts from the records of the year 1892.

### TRACK.

There were, on December 31, 1892, 175,223.44 miles of track laid, but there were only complete and in actual operation when the companies reported 171,866.29 miles; leaving out the elevated lines, this leaves 171,804.72 miles of main line. There are 49,823.81 miles of second track, sidings, etc.—a total trackage of 221,628.53 miles. Of this, 182,710.76 miles

OFFICERS AND MEMBERS OF THE RAILWAY AIR-BRAKE MEN.

are laid with steel rails and 38,917.77 miles laid with iron rails.

LOCOMOTIVES AND CARS.

There were in service, on the last day of 1892, 35,281 locomotives, 24,881 passenger coaches, 7,900 mail express and baggage cars and 1,168,849 freight cars

COST OF ROADS AND EQUIPMENTS.

These 171,804.72 miles of road and the equipment on them cost the enormous sum of $9,293,052,143. Besides this, the roads own in real estate, stocks, bonds and other investments, $1,600,493,849, and have other assets to the value of $253,089,497, and the current accounts outstanding are reported as $212,925,530—a grand total of assets of $11,359,561,019. This is a sum so vast in proportion that no man can form any idea of its magnitude.

THEIR LIABILITIES.

These roads have outstanding a capital stock of $4,863,119,073, a bonded debt of $5,405,049,960, an unfunded debt of $285,455,207 and current accounts of $417,466,957, making a total of liabilities of $10,971,091,286. Therefore, the excess of assets over liabilities is given as $388,469,733.

TRAIN MILES RUN.

During the year the trains on the roads in the United States ran 864,910,463 miles, of which 323,930,550 were run by passenger trains and 523,831,458 by freight trains and 17,148,455 by mixed trains.

PASSENGERS AND FREIGHT CARRIED.

During the year there were carried 575,769,678 passengers. The average ride of each passenger was 23.79 miles, if all the traveling had been done by one passenger he would have traveled 13,697,343,804 miles. There were 749,331,860 tons of freight hauled. the average haul for each ton being 112.70 miles; if one ton of freight had constituted the freight train load it would have traveled 84,448,197,130 miles.

WHAT WAS EARNED ON PASSENGER BUSINESS.

The total passenger earnings were $293,557,476. The average fare per passenger was only 50.99 cents. The average receipts per passenger per mile, 2.143 cents. The average receipts per passenger train mile were 90.62 cents. The average passenger receipts per mile of railroad were $1,721. There were carried 3,375 passengers per mile of road.

WHAT WAS EARNED ON FREIGHT BUSINESS.

The total receipts for hauling freight were $816,716,759, an average of only 0.967 cents per ton per mile. The average receipts per ton were 108.99 cents. The average receipts per freight train mile were 155.9 cents, and the average receipts for freight per mile of road were $4,787. The average number of tons per mile of road was 4,392.

WHAT WAS EARNED IN OTHER WAYS.

Beside the freight and passenger earnings there were received from other sources the sum of $81,582,864, and the elevated railroads (whose earnings are not included in figures given above) earned $13,414,924, exclusively from passenger business.

TOTAL EARNINGS AND OPERATING EXPENSES.

From all sources it will be seen that the roads earned from the traffic the enormous amount of $1,205,272,023. The operating expenses were $846,633,503, leaving net earnings to the amount of $358,638,530. Then from receipts, rents received by lesser companies, etc., there were received $114,619,545, leaving a total available revenue of $473,258,065.

PAYMENTS FROM AVAILABLE REVENUE.

Interest on bonds called for the payment of $232,659,089; other interest, $6,600,799; dividends, $83,336,811, rents, tolls, etc., $62,553,445; miscellaneous expenses, $32,711,558—a total of $417,861,702. This leaves a balance of $58,396,363 excess of available revenue over actual payments for the year.

WHAT RAILROADS ARE WORTH PER MILE.

Our railroads have a capital stock of $28,080 per mile of completed road and a bonded debt of $31,845 per mile, while the cost of each mile equipped ready for business is given as $54,644.

RECEIPTS AND COST OF OPERATING PER MILE.

For each completed mile of road there was earned $1,721 from passenger business, $4,787 from freights, the gross earnings being $6,986 per mile. The cost of operating was 70.40 per cent. of the earnings.

PERCENTAGE OF EARNINGS.

Of the gross earnings of the roads the passenger business was 24.63 per cent., freight earnings 68.52 per cent, while from other sources 6.85 per cent. was received.

PERCENTAGE OF INTEREST AND DIVIDENDS.

The average interest paid on bonds was 4.25 per cent, the average for bonds and debt, 4.38 per cent. Dividends averaged only 1.68 per cent. of the stock, while the total interest and dividends on bonds, debts and stock were 3.01 per cent.

ROBERT BURGESS,
President Air-Brake Men

P. J. CARNEY,
Secretary Air-Brake Men.

C. C. FARMER,
Vice-President Air-Brake Men.

### Demands for the Metric System.

It is wonderful how extensive the volumes of hope are in the breasts of the people who make it their mission in life to advocate the general adoption of the metric system of weights and measures. A writer, ventilating his pet theories in London *Engineering*, expresses the belief that the United States will soon adopt the metric system. For this reason he wants his British friends to begin the introduction of the metric system by forcing it upon India, and thinks the railroads there are the best field to begin upon. Great Britain and the United States are the two largest manufacturing countries in the world, and they contain 80 per cent. of all the railways in the world. To change their system of measurement alone would be more costly for these nations than the greatest war the world has ever seen. The impractical students who are weeping because the English-speaking nations will not adopt the French metric system have no idea that its introduction would cause the least inconvenience in shops, factories and on railroads. It would take tons of printer's ink annually to print the extra figures necessary in giving dimensions according to the metric scale.

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The enginemen of the Wisconsin division of the C. & N. W. Ry. have formed a club known as the "Engineer's and Fireman's Mutual Improvement Company." The railroad company furnished a room and the men are collecting models, books, etc. W. H. Whalen is a moving spirit in the enterprise and is making strong efforts to work up an interest among the men. These little self-education societies are among the most promising signs of the times and should be encouraged.

In a report on timber physics, published by the Agricultural Department of the U. S. Government, a statement is made to the effect that a few years ago a large amount of valuable chestnut and oak timber was felled along the line of the Louisville & Nashville for its bark. The timber itself was allowed to rot because those interested did not know that it was valuable timber for ties. The object of the publication referred to is to spread information relating to timber.

### Railroad Coppersmithing.*

BY JOHN FULLER, SR.

My attention has been called to your invitation to coppersmiths to discuss matter and things appertaining to their trade or calling. You appear to have noticed the absence of information in this line of the metal trade, as well as your correspondent who doubtless, like thousands of others before him, has searched in vain for a trustworthy guide to assist in exploring this interesting field of operative labor.

The art of coppersmithing takes in such an extensive field of labor, that one must of necessity confine himself to a particular section of the trade and be content if he would become efficient, because only here and there a man can be found with the natural ability to become proficient in more than one or two of the many branches of the copper trade. Usually the copper workers are divided into three classes, which may almost be designated as three separate trades. The first and most ancient have been known for centuries as braziers. These men were, and are now, employed in the manufacture of all kinds of kitchen utensils, transmitting their craft from father to son for many generations, and they have guarded their patrimony with a jealous eye. The next division turned their attention in the direction of larger and heavier vessels, such as brewing coppers, tallow coppers, dyer's coppers, sugar tieches, stills of various kinds, and vacuum pans and boilers for refining sugar, worms and coils, and many other heavy articles and vessels. These men are called coppersmiths, and properly so, because a majority of their work has no need of soldering, and therefore from these circumstances as a rule they are poor braziers. With the invention of the steam-engine another and third branch was called into existence. These men are employed about locomotive and marine engines, and seldom seek employment in any other line. Their work principally consists in making pipe of various sizes, forming bends, T-pieces, cross-pieces, expansion joints, and, in fact, twisting a copper pipe into any conceivable shape required to fit the position it is intended to occupy.

Now, before a man can work to advantage in any of the metal trades, it is necessary that a comfortable shop be provided, and that it be equipped with suitable appli-

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ances to execute the work required to be done. This is more often than not overlooked or totally disregarded; hence there are only a few coppersmiths' shops on American railways where a good job could be done expeditiously and in a workman-

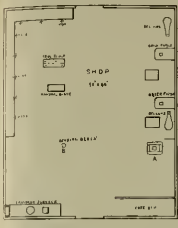



FIG. 1.—PLAN OF SHOP.

like manner, as evidenced by my own observation. As we are about to engage the attention of the reader to this class of coppersmith's work, we will endeavor to describe a well-appointed shop wherein to do

On the opposite side of the shop three forges may be placed, two made of brick, and one, *A*, of iron. The two brick, Fig. 2, should be about 3 feet high, and 3 feet 6 inches wide, and reach 5 or 6 feet from the wall. In the center of the top is the fire-hole, which is about 10 inches wide and 12 long and from 8 to 10 inches deep. The blast can be supplied in the most convenient way, either from a fan or a large bellows; if from bellows, they should be hung overhead out of the way so as to be convenient for the two outside forges, pipes being laid so the blast can be carried from one fire to the other, and to all of them if necessary. The iron forge, Fig. 3, should be made of ¼-inch boiler iron, and so constructed that the two side leaves of the top can be taken off easily when necessary to get the fire closer to work in hand. In the spaces between the fires there should be two pits of convenient depth to receive from 8 to 10 feet of pipe.

These pits are about 3 x 4 feet and 6 feet deep, and covered with a lid made of 2-inch oak plank; one plank of the lid, or cover, is left loose, to give access to the pit, when the whole opening is not necessary. In one of the outer corners of the pits a blast-pipe is fixed for work which must be done over or near a pit. On the same side of the shop is a bin to hold coke, Figs. 1 and 3, which is placed near or close to the door for convenience in keeping it stocked. On the opposite side, and in the

caught in the links. These chains are used to hoist and sling work, that it may be easily manipulated over the fire, at the bench and mandrel-block. To the wall is fixed a cleat or hitching-hook, for the pur-

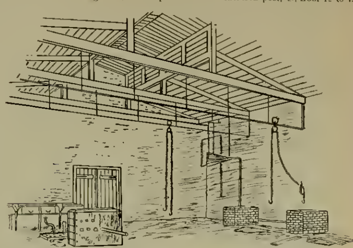


FIG. 2.—INTERIOR VIEW OF FRONT END OF SHOP.

pose of tying the fall end of the chain when work is slung over the fire.

The tramways are conveniently placed so that work may be easily carried from one place to another and to and from the

go through both plates, so that the mandrels may be securely wedged and held fast in their places. Some 20 feet from the back or furnace end of the shop floor is fixed a cast-iron post, *B*, from 12 to 14 inches square. This post is for the purpose of bending pipe, and is called a bending-block. It should be placed as near the middle of the shop as convenient, and must be firmly set in the ground with a


FIG. 4.—A RAILROAD COPPERSMITH SHOP IN LONDON.


FIG. 5.—A RAILROAD COPPERSMITH SHOP IN LONDON.

it. The most essential thing for a healthy coppersmith's shop is a lofty, spacious room; if possible, not less than twenty feet high, with a floor 50 x 60 feet; the light should, if practicable, come from the roof through opaque glass; the roof should be furnished with dormers having movable slats, which may be raised and lowered as occasion requires to let out the fumes and gases that arise from the fuel in the forges and from the metal being worked, for they are often of the most repugnant nature.

The room having been provided and proper provision made for the exit of the poisonous gases, benches for the accommodation of from four to six men may be erected and firmly fixed against the wall, as shown in the accompanying sketch. The bench should not be less than three feet wide and three inches thick, of some hard wood, preferably beechwood. They should be provided with capacious drawers for the tools of each man, with a vise at each drawer, the vises being not less than eight feet apart. The bench may reach as far as necessary along the side of the shop, and may turn at the end as far as the door. The doors should be in the middle of each end, and large enough to allow such work to pass through as is likely to be done, and admit a current of air readily when necessary.

space from door to wall, a furnace is erected having a cast-iron caldron for the purpose of melting lead, also a fire to melt resin used to fill pipes for bending. Above

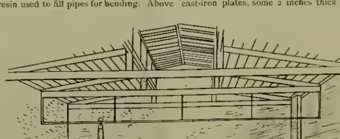


FIG. 3.—INTERIOR VIEW OF BACK END OF SHOP.

each of these fires and forges is a kind of tramway for wheels to run on, the lower wheel carrying a chain, as shown in cuts. The chain should be large enough so that a hook at each end of it can be readily

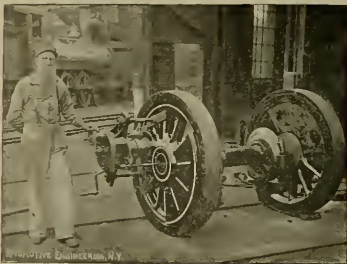
fire, also to hold the work balanced while being operated on at the bench and mandrel-block. The mandrel-block is made of cast-iron plates, some 2 inches thick and about 6 feet long and 3 feet wide, stood on edge and 2 feet apart. The plates, which are firmly fixed opposite each other, have holes in them, both round and square, to receive round and square mandrels, which

good broad foot at the bottom (similar to the stump of a tree), as it requires considerable power to bend 5-inch pipe filled with lead, and if the block is not made solid the power used in bending would loosen it and make it useless.

The top of the block has a ledge four inches down for a strap to rest upon, the strap is of iron an inch thick and three inches wide, made like a square staple with the ends drawn down so that a 1¼-inch thread can be cut on them. Another piece of iron with holes at each end is made to go over the threaded ends of the strap. This strap is to hold a thick lead-piece on top of the block, the lead having a hole in it large enough to take the pipe in easily which may be required to be bent.

For the benefit of the reader, and to make more clear what has gone before, I herewith present two photographs of a railway coppersmith's shop in London, taken from different positions, so that as much of the interior as possible may be seen. The first object in the picture, Fig. 4, is the floor block, with a brazier's bottom stake standing in it; a little to the right of this is a coppersmith's anvil, used to work down the saddles of bends, which are made in two halves (one of these bends is lying on the right-hand end of the mandrel-block in picture, Fig. 5).

In a table near are two brass safety-valve covers, the crowns of which have just been brazed in. The next thing beyond these covers is a forge, in which there was a fire when the picture was taken. Other prominent objects are three brass dome covers, the making of which may described in a future article




Streiber's Crank-Pin Turning Machine.

The next thing we notice is a coping, which is made of sheet-iron, and when it is fitted to its place makes a necessary and neat finish to the lagging at the back end of the firebox. Under the left hand end of this coping is a pit with a blast-pipe in the southeast corner of it, convenient for work which must be performed over a pit. Hanging on the wall is another kind of a coping for the front end of the firebox and which connects the lagging of the fire box with that of the boiler

The traveler chains used for slinging work are all clearly shown hanging at different parts of the shop. In the other picture (Fig 5) taken from another point the benches are all shown. The principal object on the bench is another coping finished ready for fitting, and in the corner are two long boiler steam pipes, 6 inches in diameter, which are the largest pipes usually made in a locomotive shop. The next thing is the mandrel-block, upon which are lying four cods, six small heads of different shapes and three large long heads, in the end hole at the left hand of the mandrel-block is a wooden bar shoed with an iron strap to keep the head in and form the hole for the head shank

In the north left-hand corner, and securely fastened to it, is a 3-inch round iron bar about 7 feet long, upon which are two cast-iron blocks that slide up and down the bar as required. These blocks have holes in them to receive a round or square mandrel, and are made fast to the bar by a suitable set-screw at the back, which holds the block and mandrel at any required height when the main block is too low for the work in hand. A little to the left of this bar is a screw jack, used to hold up one end of a pipe at the fire or for other purposes On the wall may be seen various wire templates of delivery and other pipes. The shop, it will be noticed, is illuminated by electric light, two lamps being shown. Altogether, these pictures afford an interesting peep into a London railway coppersmith's shop.

## Master Mechanics' Investigation Committees.

The following is a list of the subjects selected by the Master Mechanics' Association for investigation and report at the next Convention, with the committees appointed on the various subjects by President Hickey. The first name on each list of committees is that of the chairman.

The subjects are unusually good, and will no doubt provide matter for a very interesting and valuable meeting

*1. Cracking of Back Tube-Sheets.*—What method of construction can be devised to prevent the cracking of tube-sheets?

T B. Purves, Jr., J. M. Boon, R. C. Blackall, David Brown, John Mackenzie, L. R Pomeroy, Committee.

*2. Oiling Devices for Long Runs.*—What devices can be provided for locomotives to supply lubrication on long runs?

J. Davis Barnett, J D. Campbell, Geo W Stevens, George W. West, C. E. Smart, W A Smith, Committee.

*3. Locomotive Fire-Kindlers.* — Best methods of starting fires in locomotives and their relation to insurance risks.

John Hickey, J. O Pattee. Geo B Brooke, Wm. McIntosh, W. T Reed, John A. Hill, Committee

*4. Exhaust Nozzles and Steam Passages.*

Robert Quayle, William Forsyth, James McNaughton, James W. Hill, W. S. Morris, D L. Barnes, Committee.

*5. Boiler and Firebox Steel.* To report on standard specifications and tests for boiler and firebox steel for adoption by the association.

A. W Gibbs, G. R Henderson, J. A. Lawes, J. W Luttrell, E M. Roberts, W D. Crosman, Committee.

*6 Sanding Devices*

O. Stewart, F M. Twombly, L M. Butler, C E. Fuller, John Medway, H. P. Robinson, Committee.

*7 Special Shop Tools.*—To report on new or improved appliances, either hand, power, pneumatic, hydraulic or electric, applied or applicable to locomotive manufacture and repair

T W Gentry, George L. Potter, H D. Gordon, G. R Joughins, William Swanston, F. B. Miles, Committee.


Foster's "Handy Man" Unloading Lumber with Air. Fall Brook Railway.

*8 Standard Tests of Locomotives.*—(Continued from last year)

J. N. Lauder, George Gibbs, P. Leeds, R. H Soule, Angus Sinclair, F. W Dean, Committee.

*9. Tire Treatment.* — What is the amount of shrinkage to be allowed for large driving-wheels? Is there any necessity for retaining-rings or clips? What is the limit of thickness tires should be worn down to? What is the greatest permissible depth of groove on the tread before turning?

A. E. Mitchell, W. C. Ennis, Thos. Millen, J. H. McConnell, A. J. Cromwell, John Y. Smith, Committee.

*10. Cost of Maintaining Locomotives* —Report on the comparative cost for repairs of locomotives built in contract shops and those built in railroad shops.

G. W Rhodes, Jacob Johann, W Smith, J. N. Barr, Wm. Garstang, W H Marshall, Committee

## Streiber's Crank-Pin Trueing Machine.

The photographic reproduction herewith shows a new crank-pin trueing device and its application to its work.

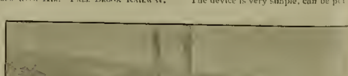
As can be seen, a large shell is used to carry the cutter and act as a frame and guide for the tool.

The two large lugs on the shell are used to clamp it solidly to wheel, the two smaller lugs carry set-screws that merely true it up and act as feel for it to stand on, a large center-point screws through the center of the shell to bring the machine true by entering the drilled center on the pin, and there are three jaws on the back of the shell that center the collar or flange of the pin.

Inside the shell there is a second shell that revolves, carrying a tool-post with it, this tool-post being fed out and in by a screw, operated either by hand or the small belt shown.

With this device, not only the bearing but the faces of the collars, can be trued up. When it is desired to turn the inside bearing of a main pin, an extension to the tool-post is screwed into place, as shown in the engraving The machine will true up all pins from 4 to 7¾ inches in diameter

This machine was designed and built by Mr. H. Streiber, a machinist in the tool room of the W. N. Y & P. shops, at Oil City, Pa.




There is More than one Way to get them in. The Way it was Once Done on the Canadian Pacific.

## A Speed-Figuring Watch Dial.

Will McCarroll, one of the traveling engineers for the Baldwin Locomotive Works, has invented a watch dial that tells the speed a train is running at by looking at it.

He accomplishes this result with the fewest possible figures, and figuring that the need of such a dial is for high speeds, the miles per hour figures range only from 25 to 120 miles per hour.

Our illustration shows the arrangement there is an extra circle on the dial and outside of it a row of figures in red, these are the distance figures.

For instance, if you have made a mile in 34 seconds, looking at the row of outside figures you will see that this is at the rate of 105 miles per hour (nearly, the lines don't quite coincide). If you have run a mile in 57 seconds you see that this is at the rate of 63 miles per hour. If you are a minute and, say, 7 seconds, the speed is shown 54 miles an hour.

The mile circle is figured in five-mile jumps, and the distance these lines are apart will vary as the speed varies.

The device is very simple, can be put on any watch in place of the present dial, and would be a neat, handy thing for any railroad man. We hope some concern will put these on the market—we want a couple anyway.

The Traveling Engineers' Association will meet at the Hotel Hayes, corner Sixty-fourth street and Lexington avenue Chicago, on September 12th.

## What the Finished Parts of a Standard 18 x 24-inch American Locomotive Weigh.

Some months ago the Schenectady Locomotive Works took the pains and trouble to weigh the parts of one of their standard eight-wheelers, of course where there were more than one piece of a kind only weighing one.

The engine weighed is shown in our engraving. She has a boiler 54 inches in diameter at smallest ring, tubes 12 feet long, cylinders 18 x 24-inch, driving-wheel base 9 feet, total wheel-base 24 ft. 1 in.

| No. | | Lbs. |
|---|---|---|
| 1 | Eccentric. | 87 |
| 1 | Eccentric strap | 122 |
| 1 | Engine frame, complete | 5,360 |
| 1 | Foot-plate | 3,266 |
| 1 | Guide-yoke. | 192 |
| 1 | Piston, complete, *no rod.* | 320 |
| 1 | Steam-chest. | 203 |
| 1 | Steam-chest cover. | 323 |
| 1 | Steam-chest casing, cast-iron | 95 |
| 1 | Steam-chest valve | 132 |
| 1 | Safety-valve, including studs. | 12¼ |
| 1 | Driving-box shoe | 32 |
| 1 | Driving-box wedge | 40 |
| 1 | Throttle-valve and pipe | 202 |
| 1 | Bumper knee (frame to front bumper) | 104 |
| 1 | Piston-rod | 102 |
| 1 | Bell, yoke and frame, complete | 188 |

| No. | | Lbs |
|---|---|---|
| 1 | Cab bracket | 230 |
| 1 | Chafing-iron (engine) | 50 |
| 1 | Dome-casing top | 178 |
| 1 | Dome-casing base | 195 |
| 1 | Exhaust-pipe | 265 |
| 1 | Exhaust-nozzle | 20 |
| 1 | Grate-bar | 110 |
| 1 | Steam-pipe in smokebox | 250 |
| 1 | "T"-pipe | 90 |
| 1 | Front drawhead engine | 220 |
| 1 | Headlight bracket and stand | 11 |
| 1 | Front drawhead, tender | 283 |
| 1 | Back drawhead, tender | 282 |
| 1 | No. 8 N. & Co. oiler | 31 |
| 1 | No. 9 Monitor injector | 66 |
| 1 | No. 8 Monitor injector. | 65¾ |
| 1 | Steam-gauge | 6 |
| 1 | Injector steam-valve | 12 |


American Eight-Wheeler. Each Part Weighed at Schenectady Locomotive Works.

| No | | Lbs. |
|---|---|---|
| 1 | Ash-pan. | 520 |
| 1 | Boiler (no tubes nor braces) | 17 690 |
| 1 | Set of braces | 541 |
| 1 | Tube | 25 |
| 1 | Cab apron | 40 |
| 1 | Dome casing sheet | 30 |
| 1 | Tank, complete. | 7,325 |
| 1 | Wheel-guard, with pipe edge. | 42½ |
| 1 | Truck wheel-guard | 16½ |
| 1 | Spring-box | 17½ |
| 1 | Tallow can-holder | 12 |
| 1 | Cinder-pocket | 36 |
| 1 | Bumper, front. | 330 |
| 1 | Cab | 700 |
| 1 | Pilot | 575 |
| 1 | Running-board, front part | 152 |
| 1 | Running-board, back part. | 192 |
| 1 | Brake-beam, head and shoe (tender) | 236 |
| 1 | Pair cylinders | 5,110 |
| 1 | Front cylinder-head | 118 |
| 1 | Back cylinder-head. | 240 |
| 1 | Crosshead | 166 |
| 1 | Main crank-pin | 84 |
| 1 | Back crank-pin | 90 |
| 1 | Dome-cap, no valves | 116 |
| 1 | Dome-ring (in boiler) | 405 |
| 1 | Main driving wheel | 2,008 |
| 1 | Back driving-wheel | 1,936 |
| 1 | Engine truck, complete | 6,615 |
| 1 | Engine truck-wheel | 465 |
| 1 | Engine truck-axle | 395 |
| 1 | Engine truck-box, cellar and brass | 159 |
| 1 | Engine truck-axle collar | 17 |
| 1 | Engine truck-spring | 218 |
| 1 | Engine truck-frame. | 395 |
| 1 | Angle-iron tender-frame, complete (no tank nor trucks) | 6,390 |
| 1 | Tender truck, complete. { F. 5,320 / B 5,370 } Aver. | 5,345 |
| 1 | Tender truck-wheel | 504 |
| 1 | Tender truck-axle | 375 |
| 1 | Tender truck-box, brass, plate and cover | 112½ |
| 1 | Tender truck-spring | 18 |
| 1 | Set of driver-brake work (air), includes brackets to frame, does not include brake-cylinders | 750 |
| 1 | Large air-drum | 420 |
| 1 | Boiler front and door | 660 |
| 1 | Bumper, back | 182½ |
| 1 | Driving-spring | 141 |
| 1 | Dry pipe, with elbow and ring | 290 |
| 1 | Eccentric-rod | 46 |
| 1 | Furnace door, complete | 114½ |
| 1 | Reverse shaft-spring | 45 |
| 1 | Reach-rod | 90 |
| 1 | Steam-chest casing, sheet-iron. | 22 |
| 1 | Cylinder casing, sheet-iron. | 44 |
| 1 | Smokestack, including base on smokebox | 536 |
| 1 | Sandbox, complete, including sheet-iron casing | 440 |
| 1 | Tire | 992 |
| 1 | Axle | 850 |
| 1 | Axle collar | 30 |
| 1 | Driving-box, brass and cellar | 278 |
| 1 | Engine truck center pin | 224 |
| 1 | Equalizing beam | 150 |

| No | | Lbs. |
|---|---|---|
| 1 | Blow-off cock | 10 |
| 1 | Blower-valve | 3½ |
| 1 | Cylinder-head cover, F | 84 |
| 1 | Cylinder-head cover, B | 63 |
| 1 | Cylinder gland and ring | 21½ |
| 1 | Cylinder-cock | 3½ |
| 1 | Engine step and hanger | 33 |
| 1 | Flag fixture | 3½ |
| 1 | Set (8) guides and blocks | 776 |
| 1 | Gauge-cock | 1½ |
| 1 | Injector-check, complete | 45 |
| 1 | Link-block and plate | 80 |
| 1 | Front number plate | 40 |

| No | | Lbs. |
|---|---|---|
| 1 | Reverse-lever | 62 |
| 1 | Reverse-lever quadrant | 42 |
| 1 | Reverse-shaft | 210 |
| 1 | Lifting link | 11 |
| 1 | Reverse-shaft bearing | 30 |
| 1 | Rock-shaft | 93 |
| 1 | Rock-shaft box (2 halves) | 122 |
| 1 | Steam-chest valve-yoke | 42 |
| 1 | Steam-chest valve-rod | 33 |
| 1 | Steam-gauge stand | 8 |
| 1 | Steam-chest gland, complete | 8 |
| 1 | Throttle-lever, complete | 25 |
| 1 | Throttle stuffing-box and gland | 21½ |
| 1 | Tank-cock rod, handle and rack, complete | 65 |
| 1 | Tender brake-shaft, handle, hanger and ratchet | 58 |
| 1 | Whistle | 25½ |
| 1 | Whistle-shaft, handle and hangers | 15 |
| 1 | Main connecting-rod. | 362½ |
| 1 | Parallel connecting-rod | 314 |
| 1 | Front draw-bar | 123½ |
| 1 | Back draw-bar | 114 |
| 1 | Set driving-spring links. | 97 |
| 1 | Set equalizing beam fulcrums | 36 |
| 1 | Set running-board brackets to boiler | 68 |
| 1 | Driving-box saddle | 120 |

## The Wreck on the Big Four, Aug. 5th

One of the most disastrous freight wrecks of the summer was that suffered by the Big Four road at Danville, Ill., on August 5th. Our engraving gives a fair idea of the appearance of the wreck on the day after its occurrence.

A valued correspondent on the ground writes as follows.

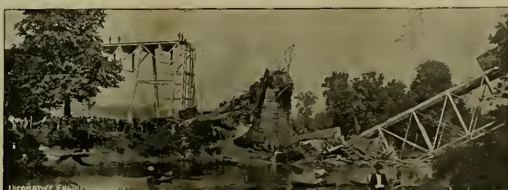
"At about 10 o'clock on the evening of the 5th inst., two freights were started out of Urbana for Indianapolis, over the Peoria division of the Big Four Railway; the first one arrived here (Danville, Ill.) about 11.30 P M. The bridge where the accident occurred is situated at the northwest edge of the city, and approaching it from the west is a heavy down grade of between two and three miles in length, and leaving the east end of the bridge is a heavy up grade for about a half mile to the depot.

"The first train broke in two pieces in going up the grade east of the bridge, and on the crew attempting to couple up the detached portion, started back and was not stopped until on the bridge, which is about seventy feet high at the channel span.

"Before a flagman could get back far enough, the second train, consisting of twenty-eight cars of merchandise, grain, flour, and one car of hogs, came down the grade at the west end of the bridge and ran into train on bridge, tearing the bridge down and precipitating the whole of the last train, engine and caboose and all, and six cars and caboose from the head train, to the ground and river below.

"The engineer jumped before he got on the bridge and was slightly bruised, as also did the hind brakeman, but the fireman, head brakeman and conductor went down with the wreck. The fireman was thrown into the water below, a distance of seventy feet, and clear of all wreckage, with only a few bruises to show for his startling adventure. The body of the brakeman was found under the debris two days later. The conductor was taken from the caboose with a mashed foot. There were wild rumors about there being seventeen tramps in the wreck, but, so far as known, there has been but four bodies found as yet.

"The bridge was a structure of steel and wood, the approaches at the east and west ends being composed of wooden trestles; the channel span was steel and rested on stone piers, one on each side of the stream, just west of the west pier there was another steel under-truss span, the east end of which rested on the west abutment, and the west end rested on a heavy steel pier, as shown in the illustration. It seems that the engine left the bridge immediately above the stone pier seen standing alone in the wreckage, and fell into the water below with the head end to the west.




Three Lives, a Locomotive, Two Cabin Cars and Thirty-four Loaded Freight Cars and a Bridge Lost in one Wreck for the Want of Brakes.

"There are six cars, one caboose and engine in the river, and piled around the stone pier are twenty-eight cars and two cabooses. There were several thousand bushels of oats and shelled corn in the train

"The loss is variously estimated at from $100,000 to $110,000—which would have come very near equipping the entire road with air-brakes. As it was, at least ten cars had air-brakes on, *but the engine was not equipped.*"

Those who wish unfolded copies of our inset, printed on heavy plate paper, can secure same by remitting one dollar.

## Compound Express Locomotive for the N. Y., N. H. & H., for Heavy and Fast Trains.

The "Consolidated" road has recently put into service some new Rhode Island compound locomotives that are doing remarkably well on their heavy and fast expresses

The elevation and cross-section drawings shown herewith will give a good idea of the plan and arrangement of these modern American engines.

The general dimensions are as follows

Fuel—anthracite coal.

Gauge of track, 4' 8½".

Cylinders, 21" and 31"x26".

Driving-wheel diam., 78".

Driving wheel base, 8' 6".

Rigid-wheel base, 19' 8".

Total wheel-base of engine, 22' 9.

Total wheel-base of engine and tender, 47' 6¼".

Weight on engine-truck, 41,000 pounds.

Weight on drivers, 84,000 pounds.

Total weight of engine, 125,000 pounds.

Weight of tender, 75,000 pounds.

Capacity of tender, 4,000 gallons

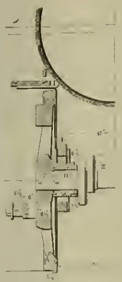
Boiler, radial-stayed, extended wagon-top.

Boiler, diameter at smoke-box, 60.

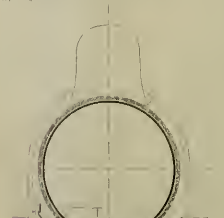
Boiler, diameter at rear, 69½.

Material, ⅝ steel

Firebox, 120 long, 41¼ wide, of ⅜ steel



Cross Section Through Main Driver



Cross Section Through Guides—Looking Back

250 tubes, each 2" diameter and 10' 9" long.

Water-tube grates, with cleaning-bars.

Heating surface of tubes, 1,229.00 sq. ft.

Heating surface of firebox, 166.50 sq. ft.

Heating surface, total, 1,395.50 sq. ft.

Grate area, 34.50 sq. ft

Steam ports, H. P. cylinder, 20" x 1½".

Steam ports, L. P. cylinder, 25" x 1½".

Exhaust port, H. P., 20" x 3".

Exhaust port, L. P., 25" x 3".

Travel of valves, 6⅛".

Tires under engine and tender are Krupp's crucible steel.

Driving-box bearings of Damascus bronze

Every wheel under the engine and tender has an air-brake on it.

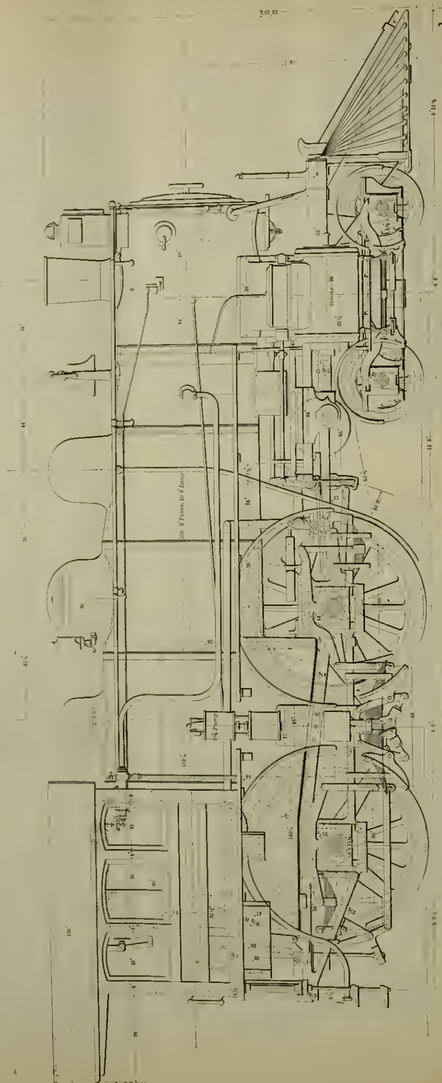
Valves are balanced.

Metallic piston and valve-stem packing.

Tender fitted with Miller coupler

Steam-heating apparatus.

Other principal dimensions are shown on engravings.



Compound Locomotive for Heavy Fast Passenger Service. N. Y., N. H. & H. R. R.

Built by Rhode Island Locomotive Works, Providence, R. I.

Designed by John Henney, Jr., Supt. M. P.

## The Traveling Engineers.

### Souvenir of the First Annual Meeting—Personnel of the Inset.

The Traveling Engineers of the American Railroads is destined to be one of the most useful of the many educational associations of railroad men. Organized for mutual advancement in their particular calling, with the aims of their association condensed into the motto "To improve the Locomotive Engine Service on American Railroads," they have, since the formal organization perfected in the office of this paper only last January, secured a working membership of over 100. On the 12th of September they meet in Chicago to discuss live subjects pertaining to their line of work. A prominent railroad manager, writing to this paper on the subject of this association and its possibilities, said "It is my opinion that a good, honest, earnest, *fair* man in the position of traveling engineer can save more money for a railroad company than any other officer."

We only collected fifty chromos of the boys in time to include in the collection, and you would go a long way before you would find a finer looking lot of men, but truth compels us to say that from the samples of "lates" coming in we are led to believe that the other fifty are the best looking of the lot.

The central figure, as can be seen, is the president of the association, Clinton B. Conger, traveling engineer of the Chicago & West Michigan and the Detroit, Lansing & Northern roads. Mr. Conger was mechanical engineer of the Railway Commission of Michigan until the politics of the State went "'agin' the government," he is well known to our readers as a bright correspondent of this paper.

John W. Sheldon, the first vice-president, is the well-known hustler on the Philadelphia & Erie divisions of Pennsylvania Lines, located at Renovo, Pa.

R. D. Davis, second vice-president, is traveling engineer of the Illinois Central road of Chicago.

W O. Thompson, secretary, until last month has been traveling engineer of the Western division of the Lake Shore; he has been promoted to the position of foreman and dispatcher. He has been one of the men who worked to make the association a success

W E. Miller, the treasurer, is traveling engineer of the Vandalia Line and lives at Terre Haute, Ind.

The rank and file are numbered and can be found by reference to the plate; unless otherwise stated the subject occupies the position of traveling engineer or road foreman of engines.

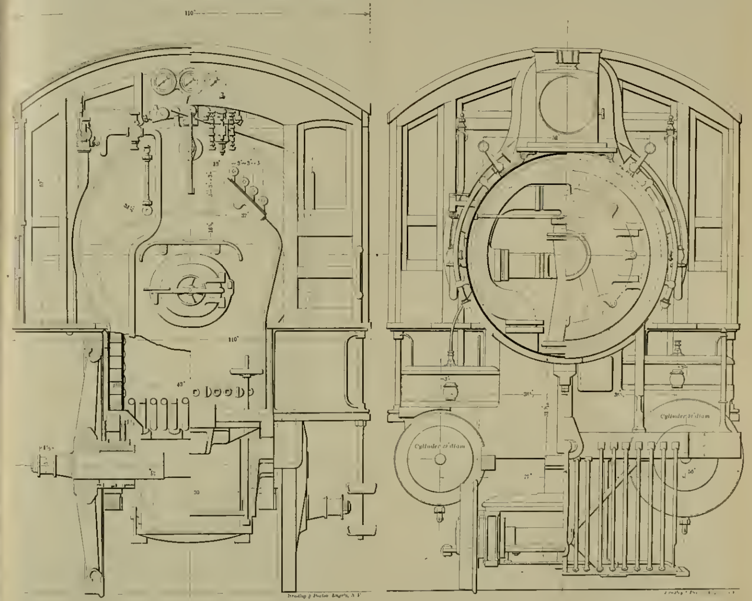
No. 1. J. W. Brant, Wabash, Decatur, Ill.
2. J. S. Seeley, Wis. Central, Waukesha, Wis.
3. M. Mast, C. & E., Huntington, Ind.
4. Meritt Turner, Erie, Port Jervis, N. Y.
5. Chas. E. Cramer, A. & P., Albuquerque, New Mexico.
6. Curtis McCollum, C. M. & St. P., Milwaukee, Wis.
7. J. D Vantwood, M. L. S. & W., Kaukauna, Wis.
8. A. S. Work, N. Y. C. & St. L., Fort Wayne, Ind.
9. M M. Dodd, Seaboard Air Line, Portsmouth, Va.

No. 10. J. J. Parmelee, Baldwin Locomotive Works, Philadelphia, Pa
11. M. M Meehan, D. S. S. & A., Marquette, Mich.
12. F. N Risteen, N. P., Tacoma, Wash.
13. J. O. Bradeen, L. S. & M. S., Toledo, O.
14. Wm. C. Chapman, F E. & M. V., Fremont, Neb.
15. R. W. Harris, C. & C., Hinton, W. Va.
16. Geo. Holmes, Air-Brake Inspector, N. & W., Roanoke, Va.
17. C. E. Shearwood, N. P., Livingstone, Mont.
18. C M Brinsley, C. & E. I., Danville, Ill.

No. 19. D. H Toomey, C. H. & S. A. and T & N. O., San Antonio, Tex.
21. W A. Pitcher, P. & L. E., Chartiers, Pa.
22. N. S Moore, C. & N. W., Chicago, Ill.
23. D. R. McBain, M. C., Jackson, Mich.
24. P. E. Riley, Lake Superior T. & T Co., West Superior, Wis.
25. L. H. Palmer, C. M St. P. & O., St. Paul, Minn.
26. P. H. Stock, U. P., Council Bluffs, Ia
27. N. M. Main, C. M. & St. P., Austin, Minn.
28. W. A. Murdock, C. & N. W, Chicago, Ill.
29. Wm. Owens, P. & R., Sayre, Pa.
30. J. W. Johnson, Erie, Paterson, N. J.
31. Martin Monroe, D. & R. G., Denver, Col.
32. Robert McVicar, Galena Oil, Expert (formerly Wis. Central), Denver, Col.
33. W. T. Simpson, C. & G. T., Battle Creek, Mich.
34. M. J. Reams, E. T. V. & G., Knoxville, Tenn.

No. 35. J E. Phelan, Superintendent N, P. (formerly general traveling engineer of the system), Dickinson, N. D.
36. W. T. Hamar, E. T. V. & G., Atlanta, Ga
37. Chas. Hogan, N.Y.Central (made the 100-mile-an-hour record with the 999), Buffalo, N Y.
38. Geo. O. Taylorson, W. N Y. & P., Olean, N. Y.
39. J. W. Hall, St. L. Southeastern of Tex, Commerce, Tex.
40. J. H Burns, Ass't M. M. (formerly T E. of the B. C R. & N.), Cedar Rapids, Ia.
41. J. R. Belton, C. & O., Covington, Ky.

No. 42. John P. Dolan, air-brake instructor, C. & E., Huntington, Ind.
43. P. Fraser, B R. & P., Bradford, Pa.
44. E. W. Griffith, Schenectady Locomotive Works, Schenectady, N. Y.
45. G. A. Billmire, C. & N. W., Boone, Ia.
46. W. J. Anthony, C. & N. W., Escanaba, Mich
47. G. H. Fairchild, N P., Missoula, Mont
48. Frank Lowery, P. R., Elmira, N. Y.
49. J. E. Goodman, N. P., Brainerd, Minn.
50. S. W. Simonds, Fitchburg Ry., Boston, Mass.
51. Frank P Wilson, general traveling engineer D. & R. G., Denver, Col.



Cross Section Through Back Driver. Rear Elevation. Cross Section Through Smokebox. Front Elevation.

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The Twenty-fourth Annual Convention of the Master Car and Locomotive Painters' Association will meet at Milwaukee on September 13th. This is a practical, hard-working association which deserves the cordial support of railroad men.

LOCOMOTIVE ENGINEERING
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## Schemes for Reducing Compression.

A correspondent writes us that, "in view of the high railroad speeds becoming common it is of the greatest importance that the capacity of the locomotive should be increased in every possible manner consistent with keeping down the total weight of the machine, and that the most practical way to do this is to reduce the loss of power and loss of steam due to compression." Particulars are then given of a method for reducing compression by means of a supplementary release pipe.

This subject has been discussed so often that it is a stale and unprofitable theme for many of us, but there are so many of our readers who are just beginning to study the action of steam that we feel inclined to go over well-trodden ground once more. This seems to be necessary, since those who will see only one side of the question keep lamenting about the imperfections of the link motion because it increases compression as the cut-off is shortened and so reduces the capacity of the cylinders as the speed augments. All locomotives have what may be called excessive compression at high speed, but it is not, as a rule, more than the nature of the forces to be controlled requires. What can be said in favor of or against high compression are not mere theories based on mathematical calculation, they are the teachings of experience over a long period of years.

As soon as the peculiarities of the link motion in the distribution of steam were properly understood, attempts were begun to protract the periods of release and of valve closure. It was argued that by preventing the steam from escaping as soon as it does when a link-motion engine is notched up, that more work would be taken from the expanding steam, and that by holding the port longer open during the return stroke, less piston resistance would result, and more work would be done with a given volume of steam. Some of the ablest engineers the world has ever seen devoted their energies to improving the locomotive on these lines. Numerous forms of special mechanism were applied to secure the desired end, and in every case failure ensued. Keeping the steam longer in the cylinder caused increase of back pressure that neutralized any gain due to greater expansion of the steam. In connection with the attempts to reduce compression, it was found that the smooth working of the engine demanded that compression should be of sufficient intensity to fill the clearance spaces and raise the cylinder pressure to that of the steam-chest when the valve opened. If this was not done, the engine did not work smoothly nor steam well. There is tremendous force stored in the moving connections of the piston which have to be brought to a state of rest at the end of each stroke. The most practical way to stop these parts smoothly is by using the steam confined in the cylinder as a cushion. When this is done skillfully, several advantages are obtained. The parts are brought smoothly to rest without having to draw on the boiler for steam to cushion with, and the mechanical heat generated in the compressed steam heats the cylinder at the beginning of the stroke, so that the heat loss, due to steam condensation at the beginning of the stroke, is reduced and economy of heat increased.

The forces in the reciprocating parts that have to be controlled at the end of each stroke are of much greater magnitude than the average railroad man realizes. The piston, with its connections, weighs, say, 650 pounds. When the speed is very high there are two difficulties in controlling this projectile that is flying towards the cylinder-head. The mass has a force in proportion to the velocity, and this velocity shortens the time in which it has to be stopped. An engine, with drivers 72 inches diameter and 24 inches stroke, running at sixty miles per hour, makes 280 revolutions per minute and has a piston speed of 1,120 feet per minute. As the piston has to be stopped twice during each stroke, cushioning must take place 560 times a minute or over nine times each second. Only very positive forces will perform this work in the brief time available, and nothing has been found equal for this purpose to the steam that the returning piston compresses after the valve is closed.

It may be edifying to our studious readers to follow the calculations of the mechanical energy in the reciprocating parts of the engine taken as an example at the speed mentioned. The piston speed is 1,120 feet per minute, and the reciprocating parts weigh 650 pounds. The total energy in foot-pounds is calculated as $E = \frac{W v^2}{2g}$, when $W$ weight in pounds, $v$ velocity in feet per second, and $g = 32.2$, the velocity in feet per second acquired by a body falling by gravity at the end of one second. Putting the formula in figures, we have $E = \frac{650 \times 18.66^2}{64.2} = 3{,}514$ foot-pounds of a blow that has to be brought quietly to rest at the end of each stroke.

In some kinds of engines it has been found practicable to control the reciprocating parts principally by means of steam admitted by opening the valve before the piston reaches the end of the stroke; that is, by giving lead sufficient. The practice is, however, out of the question for locomotives. The piston speed varies so much that it is impracticable to provide for pre-admission of steam to do the work of cushioning at all velocities. The amount of cushion obtained from lead that would be sufficient to make a smooth working engine at 50 revolutions per minute would be entirely inadequate to control the moving parts at 300 revolutions per minute, and the action of the link motion of increasing the lead as the engine is hooked up does not provide the necessary port opening for very high speed. A decided advantage obtained from cushioning by compression is that the supply is to a great extent automatic. When the piston speed is very high an increased volume of steam is left in the cylinder because it has not time to escape through the ports. This increases the intensity of compression when the greatest amount of cushion is wanted.

Those who object to the use of compression say that at best it causes a waste of power, reducing the capacity of an engine for doing work. With certain kinds of engines this may be a serious objection, but not with the locomotive. The cylinders of locomotives are generally too large for the work to be done after a train is forced well into speed, and the natural effect of cylinders too large for the work to be done is the wasting of steam. As compression reduces the capacity of the cylinders it lessens the probabilities of wasting steam in a remarkably simple and efficient manner. There are many locomotives in use with viciously designed valve motion which causes excessive compression that keeps the engine working against itself. In such cases compression is carried to an injurious extent, but that does not prove the principle to be wrong. Yet it is cases of this kind that set men to the inventing of methods for relieving the disorders due to excessive compression. A simple form of remedy is adjusting the valve motion. Any effort beyond that is certain to end in disappointment.

## Hot Boxes.

There is no minor trouble connected with the operating of railroad trains that gives so much annoyance as hot oil-boxes. Some roads are chronically afflicted with this malady, which is an extremely expensive disturbing element in the movement of traffic. No end of exhaustive investigations have been carried out to ascertain the exact cause of hot boxes, and we are familiar with no question in mechanics where the truth has been so sedulously withheld. It looks as if many of the reports on the subject have been framed with a view of finding fanciful causes for hot boxes when the true cause was staring all concerned in the face. It is very amusing to read some of these reports. There will be learned disquisitions on the reasons why rubbing surfaces generate heat and on the action of lubricants as a preventative of friction. A great deal will be said about the safe pressure per square inch of surface, and concerning the composition of the metal best adapted for journal bearings. In rare cases the party making the report will venture on the slippery subject of lubricants, and will generally fail to give information of interest, yet this is the real heart of the subject. Almost every road in the country that is suffering from hot boxes is using inferior oil that will not keep the rubbing surfaces apart.

This is one of the worst phases of dear cheapness that we are familiar with. It eats away the revenues of railroad companies, showing nothing in return but bitterness and contention among the men responsible for operating trains and those whose duties it is to see that the machinery is kept in good running order. The hard times which have come upon us so suddenly have furnished us with a good object lesson on the cause of hot boxes. The A. & B. railroad trains have been noted for the few detentions caused by hot boxes. For the last five years a hot box on a passenger train was practically unknown, and there was very little annoyance from hot boxes on freight cars. The company used a good quality of oil and paid fair prices for it. The details of the mechanical department were so well attended to that oil-boxes seldom got hot through becoming dry, and a good quality of packing was used to supply the oil to the journals. When the money stringency arose the management became panic-stricken, although there was no cause whatever for alarm, and orders were given for retrenchment in every department.

In addition to this, inferior quality of supplies was resorted to as a method of reducing operating expenses. Among the changes made was the purchasing of an inferior quality of oil and cheap bearing metal. Before the new bearings got in their inevitable trouble, the change of oil put the road in an uproar. The road is carrying an unusually heavy passenger business, and, being a single track, the successful movement of trains requires that they should be run nearly on time. Hot boxes were so numerous soon after the change of oil was introduced that the train dispatchers were harassed in arranging meeting points. As usual, the management alleged that the trouble was worked up by those who objected to a change of oil, and there has been very badly strained relations between various offices, but hard words or misrepresentations between the men in authority do not help the trains over the road. Meanwhile it seems seasonable to remark that a manager who ventures to demoralize the train service of a railroad for the sake of the small saving that might be effected by cheap oil is an idiot unworthy of holding a position higher than that of galvanizer.

## Can Car-Couplers Be Too Strong?

Before the existing depression of business knocked everything out of railroad men's heads to make place for the cogitation of schemes for keeping things running on the least outlay of money, there was considerable interest developing concerning the relative merits of steel castings and malleable iron for car-couplers. Several makers of couplers are employing steel, and, naturally, claims are made that this renders the coupler more reliable; but those who are using malleable iron are by no means ready to allow that steel is the better material for couplers. The experience with good malleable iron couplers certainly indicates that the material is well suited for the purpose. It is doubtful if mere increase of strength is an unmixed advantage in a coupler. A remark made by Mr. G. W. Rhodes on this subject is worthy of earnest attention. He said "The engineer who makes a device stronger than necessary may be more politic but not any more skillful than the one who makes them too weak. Those who have the coupler problem to solve will have to steer through the channel of the two extremes."

The point evidently implied is that it is better to make a coupler which will break under an irresistible shock than have the draft timbers and sills torn off. A coupler that is strong enough to withstand ordinary shocks and weak enough to yield before its attachments are torn away would seem to be the kind likely to keep down the cost of repairs. The breakage of attachments of couplers causes the most numerous and most expensive repairs to cars, and it seems desirable not to render the case worse by employing couplers that will act as battering-rams upon the weaker parts. The number of blows that a coupler will stand in a drop test is a very indifferent way of demonstrating its utility.

## New Method of Testing Steel.

At the International Engineering Congress held at Chicago, last month, Mr. Alfred E. Hunt read a paper in which he proposed a new method of testing structural steel. It consists in punching, cutting, shearing or drifting pieces of a given thickness, and comparing the force required in this work with that required to treat standard pieces in a similar manner. The comparison can be made also with the work done at different stages of the punching, etc., with results obtained in treating standard pieces in a similar manner. He uses the term "work" to express the force necessary to punch a given hole or cut a given notch or drift a given hole, multiplied by the space through which the force moves, and by the time during which the force acts. In practice a combination of the first of these factors with the second or third is often used, and it is the combination of force and space that the author has so far found to be the best and most accurate way of using the method.

### Emergency During Service Application.

A man used to the handling of air-brakes cannot help noticing the interest taken by enginemen who visit the Fair and the air-brake exhibits, and, if he is observant, will not fail to notice that six out of ten of them want information on two points, *i. e.*, the "kicking-off" of brakes and how much can be gained, if, while there is a slight service application on, to recharge and then go to emergency, in case of dire necessity, rather than to put the engineer's valve into emergency at once.

Some harm has been done by too fine-spun theorizing on this subject, and too many chances are being taken when the recharging plan is used, or attempted to be used.

With a short train a quick throw to full release might increase the auxiliary pressure some, but the time is too short to get much past the feed-port, and beside this, the distance between the train and obstacle is lessened very much. It would have been far more effective to have had a lower braking pressure for the longer time.

In an emergency, time is everything. If you recharge you lose what air you have in your cylinders; release your brake entirely and lose valuable time in the uncertain hope of getting a better hold when you do apply.

Every man cannot calmly sit in front of an emergency and figure this out—*don't fool with it, but go to emergency at once.* You may have reduced your pressure in service application so much as to prevent the quick-action valve from working, but rest assured that the brake is full on *from the start.*

We want this lesson impressed on all young runners who are so interested in every detail of the brake and who are striving to be experts with it. You may try to be "too fine" with it in a case of this kind. An emergency stop should call for the engineer to slam his valve-handle into the emergency notch *and leave it there.* You might save some of the train-line pressure, if the brake was fully charged, by causing the quick-action valves to act by a quick reduction of 20 or 30 pounds, and then bringing the valve to lap. This would be advisable in making a water-tank stop or where emergency has to be used to prevent running by a station, where failure would simply mean inconvenience, but where there is a real emergency, no matter what you are doing with the brake, don't take any chances; go to the emergency stop instantly. It's sure, safe and correct.

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The Report of the Proceedings of the Twenty-sixth Annual Convention of the American Railway Master Mechanics' Association has just been issued. This book contains 275 pages, twenty more than the report of 1892, and is the best job of printing yet done on the work. This work contains a mass of information at first hands, experience related by railroad men to each other, and is far different from the ordinary book that is apt to take one side of a question only. It is distributed to members of the association and railroads and sold to outsiders. Anyone interested can secure a copy by addressing Angus Sinclair, secretary, 5 Beekman st., New York.

### Reducing Wages.

The existing financial stringency came upon the country like rain out of a cloudless sky and many people think it will pass away as quickly as it came on, but many railroad companies seem determined to turn the tide of depression to the purpose of pulling down the pay of their employés. From all directions come intimations that railroad companies are reducing the hours of labor, reducing the force of men, and that not a few have given notice of a reduction of wages, while others are reported to be contemplating similar action. In some cases the reduction of working force and of hours of labor is a necessary result of decreasing business, but in many cases action of this kind merely anticipates decrease of business and helps to bring it about. The notices of reduction of wages tell of panic-stricken managers who are courting worse evils than a slight depression of business.

The relations between the railroad companies and their employés have been remarkably friendly and cordial for the last few years, and both sides have benefited by this condition of affairs. Those who invite a change by inconsiderate interference with men's pay are not acting wisely, to say the least of it. The process of pulling down wages is harassing to every person who suffers and the balance secured does not represent saving. There is no line of employment where economy is so much dependent on cordial heart service as in railroad work, and reduction of wages nearly always brings reduction in results that more than raise the cost of work to its old figure. There are thousands of railroad men who take as much pride in doing work at the least possible cost as if they were working for themselves. The proper way to take the heart out of this kind of zeal is to intimate that the pay will be reduced. Railroad men are generally well organized for self-protection, but they have made little use of their power. The reckless movement to reduce pay as soon as the smallest excuse is presented will arouse animosities that are difficult to root out. A few thousand dollars saved by reduction of pay is a miserably small profit on which to face years of hatred that thinks not of moderation when the opportunity for retaliation offers.

### Curious Economy.

We were recently shown a letter of recommendation given by the general manager of a Western road to a large manufacturing firm, asking them to put his late traveling engineer on the road for them.

He said the applicant was a first-class man, had done good service and his work had resulted in *great economy in supplies used on the engines*; but that in the present financial distress the cutting down of expenses required the abolishment of his office.

A foreman, traveling engineer or other man in charge of men who can show by his management of the work in hand that ten men will do, under him, as well as twelve men without a leader, is well worth his hire, and he becomes more valuable just in proportion to the number of men he has any influence over.

You can scarcely find an official in the country that won't acknowledge that the traveling engineer causes a saving of supplies, better handling of brakes, better inspection of engines, raises the standard of intelligence by examination of enginemen, insures more accurate information about accidents, locates and remedies more petty troubles on the road, and has a good influence in keeping up running repairs—any one of them worth more than the man's wages to the company—yet how often we see short-sighted managers who cut off this official's head at the first order for economy (?), because the trains can actually be run over the road without him.

For every dollar the railroad saves now by this kind of economy, they will lose two in the service and have to pay two more to get it back where it was.

*Esprit de corps* is like a house—when left vacant it goes back into the elements with surprising rapidity—keeping it up and occupying it, from cellar to garret, is the only way to make it valuable.

### Criticism of the Erie Engineers' Locomotive.

On another page will be found a scrap of discussion at the last Master Mechanics' Convention, which mentions the engine designed by the Erie engineers.

There are several things about the Erie engine that we cannot approve of, but we believe that in its cab can be found as handy an arrangement of manipulating devices as can be found anywhere for this class of engine.

The hand-brake on tender *is* a bad scheme, the ratchet is too high, and any tank-brake located on the left side of tank is a nuisance, and not a brake; it is always in the fireman's way, and he will take the wheel off to prevent butting his brains out; in this particular the Erie engine is not far different from 90 per cent. of the locomotives in the country, and the sand-pipes are about four feet too far away from the wheel.

The boys must not take to heart what was said by one member about engineers designing tank-handles and sand-levers, "things that they knew something about" and letting alone "boilers, cylinders and things about which they knew nothing." The man that made that remark came up from the foot-plate of a locomotive, and is proud of it, and nine out of ten men that heard him came to the positions they now hold, at the head of motive power departments, from the same place—and came up because they did know something about "boilers, cylinders, etc."

The fact of the matter is, that the Erie boys did very little *designing*. They were anxious to demonstrate to the officers of their road that a very heavy eight-wheeled hard-coal locomotive could be built that would handle the trains now hauled by the big ten-wheelers, and they voted on the weight, size of boiler, cylinders, etc., and asked the Cooke Locomotive Works to build the machine, and it is a very creditable one, too.

It may be big and clumsy and uncomfortable-looking to Western men used to soft coal and a big cab, but hard coal means a very long firebox, a boiler through the cab and all the crowding that this entails.

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Our railroad system requires annually 80,000,000 ties, costing the railroad companies about $30,000,000. Their life in the average may be computed at six and one-half years. There are means of doubling their life easily by using only the more durable kinds, paying proper attention to the handling of the ties and by impregnation with fungus-resisting materials or by other processes. Such increase of durability may be obtained by an expenditure of say $20,000,000, by which an annual saving of more than $5,000,000 would be effected, or 25 per cent. on the additional outlay.

### BOOK REVIEW.

LOCOMOTIVE RUNNING REPAIRS. By L. C. Hitchcock, late General Foreman of the "Soo" shops. Debs Publishing Co., Terre Haute, Ind. Price, 50 cents.

This little book, of 110 pages, is gotten up in the same style as "Progressive Examinations of Locomotive Engineers and Firemen." Small, but neatly bound in cloth and printed on good paper, almost every chapter is illustrated.

The regular readers of this paper are more or less familiar with the subject matter, as most of the articles appeared in this paper.

It is the only book published on the running repairs of locomotives, and every machinist and shop apprentice ought to have one of them, as the right way to care for cocks and valves, line up rods, shoes, wedges, driving-boxes and guides, how to change flange wear, adjust spring rigging, move eccentrics, set valves, etc., is told in plain language and illustrated by sketches. This little book deserves to sell like the proverbial "hot cakes."

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The Rogers Locomotive Co., of Paterson, N. J., have just issued a very neat little book, giving photo reproductions and outline drawings of the locomotives exhibited by them at the World's Fair. Copies can probably be secured at their exhibit at the Fair, or at the works.

### PERSONAL.

Mr. Lucius Tuttle, general manager of the N. Y., N. H. & H., has been elected president of the Boston & Maine.

Mr. J. E. Rose, for several years with the Big Four, has been appointed superintendent of the Iron Mountain road.

Mr. George W. Jenkins has been promoted from conductor to be train-master of the Decatur division of the Wabash.

Mr. James Cunningham has been appointed master mechanic of the Choctaw Coal & Iron Co., with headquarters at South McAlester, I. T.

Mr. T. D. Kline has been appointed general superintendent of the Central Railroad of Georgia. He was formerly general manager of the Mexican National.

Mr. H. F. Houghton, train-master of the Wabash, has been appointed assistant superintendent of the Big Four, with headquarters at Indianapolis, Ind.

Mr. M. D. Campbell, general foreman of the Lehigh Valley shops at Delano, Pa., has been appointed master mechanic of the Buffalo division in place of Mr. A. Dolbeer, resigned.

Mr. J. B. Boone has been appointed master mechanic of the Kansas City, Osceola & Southern, with office at Coburg shops, Mo., in place of Mr. I. E. McCracken, resigned.

Mr. W. E. Guerin, of Columbus, Ohio, has been chosen president of the Sandusky & Columbus Short Line. He is also secretary and general solicitor of the Columbus, Shawnee & Hocking.

Mr. R. E. French, general foreman of the Southern Pacific shops at Oakland, has been promoted to be master mechanic of the Bakersfield division of the same road, with headquarters at Bakersfield, Cal.

Mr. James E. Palmer, engineer of maintenance of way of Peoria & Pekin Union, has been appointed general superintendent of that road, with headquarters at Peoria, Ill., in place of Mr. C. E. Schaff, resigned.

Mr. A. G. Wells has been promoted from the position of train-master to that of superintendent of the Atlantic & Pacific, with headquarters at Albuquerque, N. M. He was formerly a superintendent on the Big Four.

Mr. George F. Copeland has been appointed superintendent of the Butte, Anaconda & Pacific, with headquarters at Anaconda, Mont. He is a railroad man of mature experience, and has risen through the engineering department.

Mr. G. W. Butcher has been appointed superintendent of motive power of the San Antonio & Aransas Pass, with headquarters at San Antonio, Tex. He was formerly general foreman of the Southern Pacific shops at Houston, Tex.

Mr. W. E. Knox has been appointed superintendent of the Alabama Mineral division of the Louisville & Nashville, with headquarters at Anniston, Ala., in place of Mr. T. K. Scott, resigned. He has heretofore been chief train despatcher.

Mr. Henry Tregelles, a member of the Railway Master Mechanics' Association, who has been agent for the Westinghouse Air-Brake Company for several years in Brazil, has returned to Pittsburg. Mr. Tregelles was formerly a division master mechanic on the Erie.

Mr. W. O. Thompson, road-foreman of engines of the Lake Shore & Michigan Southern, has been made foreman of engine-house and engine despatcher at Elkhart, Ind. He has been given charge of the movement of all the engines on the southern division of the main line.

Mr Alonzo Dolbeer, master mechanic of the Lehigh Valley, at Buffalo, has resigned. A few days after he gave up the position, a number of the employés of the mechanical department presented to him a gold watch and charm as a manifestation of their warm feelings towards their old superintendent

Mr William M Greene has been appointed general manager of the Cincinnati, Hamilton & Dayton. Mr. Greene was for several years assistant to President Ingalls of the Big Four, and was for a short time general manager of that road He has been out of railroad service for several years.

Mr J W Fowle has been appointed master mechanic of the Cincinnati, New Orleans & Texas, with charge of the shops at Ludlow, Ky Mr Fowle has been for several years on the Colorado Midland, with charge of the Leadville division. He went there from the Cincinnati Southern, and was one of the bright young mechanics who graduated upwards under the inspiring influence of Mr James Meehan.

We have to acknowledge several pleasant calls from Mr David G. Watson, of Dundee Scotland, who was sent by the *Weekly News* to visit the World's Fair, and report on matters of interest to Scotch railway men Mr Watson is an engine driver on the North British Railway, and is remarkably well informed concerning railway appliances He found much to admire on our railways, and the comfort and convenience of our locomotives impressed him very greatly

Mr George D Wadley, who has been for some time general superintendent of the Central of Georgia, has resigned under peculiar circumstances He is very much of a disciplinarian, and men with a strong leaning in that direction generally consider it necessary to discharge men frequently The road is in the hands of a receiver, and some of the discharged men applied to the United States Court for justice and were reinstated, which caused Mr Wadley so much chagrin that he resigned

Mr John W Kendrick, chief engineer of the Northern Pacific, has been appointed acting general manager in place of Mr Mellen, who died suddenly last month. Mr. Kendrick is a New England man and is a graduate of the Worcester Polytechnic Institute. Shortly after graduating he went into the engineering corps of the Northern Pacific, then engaged surveying the line up the Yellowstone Valley. He remained in the employ of the company ever since, and gradually rose step by step and was made chief engineer in 1888

Mr. Alexander Mitchell, the well-known Lehigh Valley master mechanic was made superintendent of machinery of that system under the Reading's lease. The Lehigh Valley never had a chief of motive power under its old management, every division master mechanic was a law unto himself, and many thought that when the lease was annulled that things would go back into the old way. This, however, is not to be, as Acting General Manager Voorhees has appointed Mr. Mitchell superintendent of motive power of the entire system

Mr. J. E Morrison has been appointed superintendent of the Chicago and South Side Elevated road, vice A J. McBlair, resigned. F E Colgrove takes Mr Morrison's place as trainmaster This is the first time a trained elevated railroad man has been in a position of responsibility on the alley road. Mr. Morrison was raised on the Manhattan, and the best thing the management of the road can do is to let him handle the business and give him power to rip off some of the red tape and operate the line as a railroad—and not as a side show.

Among our foreign callers last month was Mr A Brunner, of Munich, who has been in this country for four months attending the World's Fair and investigating American railway machinery and shop methods Mr Brunner is manager of locomotive works in Munich and is looking up the American system of manufacture with a view of adopting the parts suitable for a German shop He worked for years in Glasgow, Scotland, and is a most progressive engineer. He is extremely well pleased with what he saw at the Fair and elsewhere, and is very free in expressions of admiration. Engine "999" he considers the finest piece of locomotive work he has ever seen

Mr T F Oakes, president of the Northern Pacific, puts himself nearer to the hearts of many men on that system through his warm-hearted and kindly notice issued on the death of the general manager, William S Mellen In the circular on this subject he speaks of Mr. Mellen as a man of strong physique, a tireless worker, he was devoted to the interests of the company, which he served with conspicuous faithfulness and ability, while by mingled firmness and consideration he won the regard of all employés. He had mastered the business of management. His death removes a valuable and useful officer, whose services to this company will long be held in grateful remembrance.

Some of the most substantial work ever done in connection with street railway cable lines has just been completed at the terminal of the Third avenue, New York The work has been done under the close supervision of Major R B Tomassek, a well-known engineer, who has done a great deal of difficult surface railroad work since the war. The personal history of the Major is more varied and interesting than the pages of most romances He is a Hungarian nobleman and was educated as a military engineer. When the French expedition to Mexico was organized, Major Tomassek joined the staff of Maximilian and took an active part in all the military operations He was taken prisoner with Maximilian and would have shared the fate of his chief had he not escaped and made his way to the United States He has been engaged on bridge and railroad work ever since.

The *St Louis Republic* of July 28th contained the following General Manager W B Doddridge, of the Missouri Pacific Railway, was yesterday presented with a team of high-bred Kentucky horses by R M Galbraith, general master mechanic of the Cotton Belt, in behalf of the officials and employés of the latter road. Mrs. Doddridge received at the same time a beautiful pair of diamond earrings as a token of esteem from the Cotton Belt employés Mr. Doddridge is not a man of ceremony, and the gifts were presented and received informally. It was a sort of family affair Mr. Doddridge was general manager of the Cotton Belt before he became general manager of the Missouri Pacific, and to know, by the present to him, how much he was liked by the men who worked under him made yesterday one of the happiest in Mr. Doddridge's life.

It seemed only a few days since we enjoyed a pleasant visit from our old friend W S. Mellen, general manager of the Northern Pacific, who was in New York for a couple of weeks getting treatment for rheumatism. He was then greatly encouraged about the improvement in his health and was full of schemes of future useful work. Mr. Mellen's mind ran greatly towards plans for making the life of the men under him more comfortable. Now comes the announcement of his death from paralysis of the heart Mr. Mellen was an Illinois man, and he entered railway service in December, 1865, when nineteen years old, as telegraph operator on the Chicago & Northwestern at Milton Junction, Wis , and remained in the employ of that road as agent and operator at different points until 1872, in which year he accepted the position of general freight and passenger agent of the Green Bay & Lake Pepin, now the Green Bay, Winona & St. Paul In 1874 he returned to the Chicago & Northwestern as general agent at Winona, Minn., and one year later was promoted to be assistant general freight agent at Chicago He held this position until 1881, when he went to the Atchison, Topeka & Santa Fé as assistant general superintendent, but in October, 1882, he again returned to the Chicago & Northwestern as general freight agent. He held this position until February, 1885, when he received the appointment of assistant general superintendent. He resigned in October, 1885, to become general manager of the Wisconsin Central, and on July 1, 1889, was appointed general manager of the Northern Pacific.

### Sheet-Iron Jackets.

There is not much danger that the locomotives from England, France and Germany, now on exhibition at the World's Fair, will be very extensively copied in this country. There is nothing about any of them that is really worth copying, except the material and workmanship, which are both very fine, and one other item, and that is the jacketing. All the European engines have sheet-iron jackets, nicely painted and varnished. It presents a nice appearance, is serviceable and easily kept clean.

It seems strange that this style of jacketing is not used more extensively on American locomotives Sheet-iron is fully as durable as planished iron, and when painted is not as liable to rust

If an accurate account was kept of the amount of waste, oil, and polishing material used on a planished-iron jacket in the course of a year, it would surprise many a master mechanic who is studying continually how he can best keep down expenses The sheet-iron jacket, with a good coat of paint and varnished, will look fully as well No cleaning material required, only a little waste and an occasional washing off with soap and water.

This idea of the sheet-iron jacket may be copied with good results by American builders, both for economy and neatness. Where iron or steel of about a sixteenth of an inch in thickness is used, it never becomes dented or bent up, and lasts as long as the rest of the engine does, simply requiring paint with the rest of the machine. A Russia iron jacket only lasts for a few years at best

We are anxious to secure two back numbers of the Railway Master Mechanics' Reports, those for 1870 and 1873. We will give $3 00 each for them Any party having these reports to spare will confer a favor by sending them to this office

The extremely uniform covering of foreign passenger cars, which many visitors to the World's Fair notice as being remarkable, is due to the siding being of steel about ⅛-inch thick This practice of using steel for covering is followed because the material is cheaper than good wood siding, and the claim is made that it takes a better polish than wood and wears longer without revarnishing. Those who have had experience with iron cars in this country agree that the outside finish is more easily maintained, as there are no nails to work out and no cracking to damage the paint and varnish.

### Kansas City, Memphis & Birmingham Shops.

(EDITORIAL CORRESPONDENCE )

In Memphis, on the top of a high bluff overlooking the Mississippi river, stand the repair shops of the Kansas City, Memphis & Birmingham Railroad. A curious interest attaches to these shops. The river when in flood is rapidly eating away the bank, and it is only the question of a few years when the shops and a big slice of Memphis real estate will fall upon the bosom of the Father of Waters, unless heroic measures are taken to turn off the hydraulic action of the fast-flowing stream.

During a brief visit to the shops I was surprised to see the small establishment provided to maintain the rolling stock that has to be kept in running order here There are about fifty heavy engines to be looked after, and all the tools to do the work are grouped in a small brick building about 40 x 80 feet. The tools consist of one wheel lathe, one engine lathe, two small lathes, one heavy planer, one shaper, one bolt-cutter, two emery wheels and a few minor tools. This small supply is all Pond tools, nearly new and capable of taking deep cuts, otherwise the work put through could never be done Mr. R. H. Briggs, the energetic master mechanic in charge, helps the work wonderfully by good management, but with all that it is surprising to find the rolling stock in such good order. The place is clean and orderly, and everywhere there are evidences of close attention to every detail.

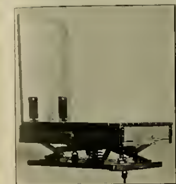
Mr. Briggs is proud of the small amount of boiler work required by the engines, which is to a great extent brought about by the care taken to prevent the formation of scale and mud. The engine-house is provided with a hot-water system for boiler-washing operated by a Rue instrument The water on the line is not very bad, but the boilers are washed out regularly after every second trip. Three years ago Mr Briggs began a practice of putting a gallon of kerosene in the boiler at every washing-out and the results have been wonderfully successful. Before this was done, the frequent washings did not prevent the flues from getting so badly coated with scale that they had to be removed through the dry-pipe hole. Since the kerosene came into regular use the tubes could be removed through their own holes This ought to be good testimony in favor of the kerosene habit. I have heard of several roads that tried kerosene and declared it no good, but I suspect those trying the experiment were not persistent enough. Regularity and persistency are highly important factors in the success of any system of boiler treatment

The performance sheets of the engines on this road testify strongly in favor of enlightened management. Repairs, wages, fuel and oil only cost 14.8 cents per mile run during the past year, and this, too, with mostly heavy ten-wheel engines. Included in this was the cost of six sets of air-brakes and the rebuilding of an engine whose boiler exploded. Part of the credit for the fine showing is no doubt due to a highly intelligent class of enginemen. I met several parties of engineers and firemen, and have seldom seen such bright men It goes without saying that a large percentage of them are readers of LOCOMOTIVE ENGINEERING Several of them spoke enthusiastically about the pleasure and benefit derived from reading the paper.

The ten-wheel engines on this road all have rigid leading trucks, and a blind driving-wheel tire in front. On careful inspection of all the engines in the roundhouse, I found all the tires in good order, and no sign of flange cutting. Several driving boxes on the floor that were getting the lateral motion taken up by Babbitting indicated that there might be considerable wear of the boxes. They have just applied a set of malleable iron driving-boxes and they are watching with much interest to see how they stand. All the engines have the globular form of exhaust-pipe introduced by Mr. McCrum, and it is highly spoken of. A 5-inch nozzle is used on the large engines, and steam is made very freely with that large opening. The men say that the engines work with very little indication of back pressure. The coal account shows that the engines are light on fuel! A. S.

### Drop Cab-Seat for Small Cabs.

A new form of drop-seat for the cabs of "Hogs" and other big engines with the boiler coming through the cab, has been put on the market by Stannard & White, of Appleton, Wis. The platform spring arrangement is the same in this as in their other seats, but the cushion is dispensed with, and a seat of sheet metal covered with horsehide takes its place. This admits of a good drop-seat in a space of six



inches. The back, when wanted, is simply an inch board. This whole seat is arranged on a rod, and can be shoved ahead out of the way when down and not wanted.

Stannard & White are making their well-known seats now in the best possible manner, the latest kink being the building up of the cushion so that any spring can be taken out of the seat by hand and replaced in case of breakage or weakening of the spring.

### Scooping Too Much Water.

When scoops for dipping up water for locomotive tenders while the train is in motion were first brought into use in England, the enginemen using these useful aids to long runs were often embarrassed and put into ludicrous plights by the apparatus sticking after it was dropped into the trough. The washing of nearly all the fuel off the tender by the flood of water that could not be stopped caused many an express engine to stop for coal before the journey was over.

The scoop mechanism on American locomotives appears to be so well designed and built that accidents are very rare, but they occur at rare intervals even on the best regulated railroads. The New York *Sun* lately contained the following account of a miscalculation in scooping water

"One of the Pennsylvania fast trains that do good by bringing Philadelphia within suburban time of New York is known to the railroad people as the '7.30,' because it leaves Philadelphia at that hour in the morning. It runs through without a stop, and takes water on the run out of a long trough between the rails near Edgley. A scoop is let down from beneath the tender into the trough. Yesterday morning the first coach of the train contained about thirty passengers Some of them were women. * * * Well, no one was thinking about the water-trough or the water, until suddenly the front door of the coach next to the engine was burst in by a broad stream of water, like that thrown from a water-tower at a fire. In just one second every man and woman was standing, and in another they were all sitting, sittin on the backs of their seats to keep their feet out of the stream of water that rushed along the car floor with such force as to roll the aisle carpet up into a wet wad which landed against the rear door and dammed the flood there, and also prevented the door from being opened.

"No one had the remotest idea of what was going on. The passengers were all getting a shower-bath, and the car was rapidly being converted into a pond. There were a great many cries of alarm, but for once no one offered any advice, for a huge stream of water pouring into the front door of a lightning train on a cloudless day offered no suggestion to even the most expert advice-giver. It was very lively while it lasted, but it was all over in twenty seconds. Then the water drained out of the car and the passengers began making investigations. The water-tender had been filled before the end of the trough was reached, and while the scoop was still down. The force of the water had knocked off the cover of the manhole in the center of the rear end of the tender, and the speed of the engine directed the stream from the manhole against the front door, and the force was so great as to knock in the door. When the scoop was lifted up the shower ceased. Then the people began mopping themselves with handkerchiefs, and some said they thought it was funny. They were the ones who sat in the rear seats."

### An Inventive Engineer.

Mr Merrit Turner, road foreman of engines of the Erie, writes us

"It has been my observation that an inventor's mind is so rapt in his studies of invention that he never accomplishes much beyond the useful things he invents, but the monotony is broken by an engineer on the Delaware division of the New York, Lake Erie & Western Railroad, by the name of Arthur O'Hara, who has made several useful inventions and is not second to the best engineer in the country.

"His first was a device for the purpose of turning a switch when approaching it toward the points, where the switch might have been left wrong, and the approaching train would set it right for the main track on approaching it and before passing it.

"His next was a dump-car to be used on construction trains. to dump by air or steam taken from the engine which hauled the train. There are several of his cars in use on the Long Island Railroad, and have proven a great success in labor-saving.

"His third is a device for pumping air in the pneumatic tire of a bicycle, while in motion, in the event of the tire becoming punctured and causing a leak, which would disable the machine and leave its occupant to walk home without the use of Mr. O'Hara's pump, which requires no pains or discomfort to the bicycle riders, but is brought into use by the ordinary motion of the machine."

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The Nathan Manufacturing Company have an elegant pavilion and fine display of their goods at the World's Fair, but the management of Machinery Hall stuck their beautiful job of cabinet work behind an immense iron column in a side aisle, while a chicken wire fence surrounds a public telegraph office on the main aisle corner just opposite.

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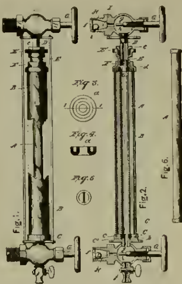
The boilers of the steamship Campania have 102 furnaces.

### A New Design Safety Water-Glass.

In the Hausman safety water-glass, just being put on the market by F. McLewee & Son, of 25 Waverly place, New York, we have an invention that seems a step in the right direction.

The trouble with the ordinary water-gauge glass has been its fragile nature




and liability at any moment, as a Scotch engineer put it, to "gang awah."

Hausman uses two glasses, the large outer one protecting the inside glass from atmospheric changes, snow, water or other substances that suddenly contract and break the glass, he uses the old and well-know ball-valve to effect automatic closing in case of breakage.

His main invention is in packing the glass *on the end* and in making the tension of this packing always adjustable by the hand of the engineer.

This is accomplished by making a "steam-pin" from the upper cock to the top of the glass, on this screw is a packed nut carrying flanges at the bottom for the glasses, this nut has a movement up and down of about half an inch, there are no nuts, glands or packing around the glass.

When it is desired to put in a glass the engineer screws up the gland *E*, Fig. 1, this lifts the sleeve at the bottom and the glasses can be set in place, the inner one having its end gaskets of vulcabeston, Fig. 4, in place, the nut is then screwed down until there is a joint on the end of the glass. The outer glass fits into a loose sleeve on the main one and there is no tension or compression on it, the space between it and the gauge-glass proper being open top and bottom by small holes, its sole duty is to protect the inner glass.

Cleaning blades extend from the valve, so that when screwed home the hole through to the boiler is thoroughly cleaned out.

The makers of this gauge are using the best of material, especially imported glasses, and there is no doubt of their success.

### Jigs for Drilling.

The Americans often use what is termed a jig for drilling. Will anyone kindly give a sketch, together with drill?

The above is from an English mechanical paper and shows what our cousins across the fish hatchery know about American shop methods—they evidently think a jig is some kind of a machine with a drill attached, or something that runs a drill. A jig is merely a device for holding work so that machine work can be done on a number of the same kind of pieces in precisely the same way—a device that insures accuracy and interchangeability without "setting" or measuring each piece of work.

### The P. R. R. Standard Registers of Locomotives and Cars.

The Pennsylvania Company issue every few months a corrected "register" of locomotives and cars, that are small, cheap, paper thumb books, and are given freely to the men.

We have taken a page at random from each of these little books and reproduced them, full size, in order to show how much information can be gotten into a small space.

Each page has 100 squares and each square represents a locomotive or car. The first page is headed "0 Hundred" and has a description of the stock numbered below 100, the next page is "1 Hundred" and so on.

We have reproduced page 8 of the locomotive register and it contains information of all engines numbered from 800 to 899. If you wanted to know what engine 855 was you look in the column headed by the figure five and follow down to the five in the side column, and you find that the 855 is a Class M engine carrying 160 pounds of steam (some Class M's carry less), that she was built at the Juniata shops in 1892. Any car can be traced in the same way.

**8 HUNDRED.**

| | 0 | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 |
|---|---|---|---|---|---|---|---|---|---|---|
| 0 | I '81 | Baird DE '73 | Baird D '73 | Baird DE '73 | Baird D '73 | Baird DE '73 | Baird DE '73 | P 160 '92 | O 160 '81 | Baird DE '73 |
| 1 | Baird DE '73 | I '77 | DE Odd '69 | O 160 '90 | Juni M 160 '92 | I '82 | Baird DE '73 | I '79 | Bald'n D '73 | Baird D '73 |
| 2 | Baird D '73 | O 160 '91 | M '82 | Baird DE '73 | I '77 | I '81 | M 160 '92 | Juni M 160 '92 | M 160 '92 | R '90 |
| 3 | Baird DE '73 | R '90 | I '79 | O 160 '92 | I '90 | M '82 | Juni M 160 '92 | Bald'n DE '73 | O 160 '91 | Bald'n D '73 |
| 4 | Bald'n DE '73 | Juni R '92 | A Anth 62 '87 | I '80 | Juni M 160 '92 | I '80 | I 82 | I '91 | Juni R '92 | R '91 |
| 5 | Bald'n D '73 | O 160 '91 | P 160 '92 | Bald'n D '73 | Bald'n DE '73 | Juni M 160 '92 | O 160 '92 | Bald'n D '73 | Bald'n D '73 | Bald'n D '7[illegible] |
| 6 | Bald'n D '73 | M '82 | I '80 | I '79 | P 160 '92 | M 160 '92 | I '83 | O 160 '91 | Bald'n DE '73 | Bald'n DE '73 |
| 7 | Bald'n D '73 | M 160 '92 | Bald'n D '73 | M 160 '92 | A Anth 62 '88 | I '79 | Bald'n DE '73 | Bald'n D '73 | Bald'n D '73 | I '81 |
| 8 | I '81 | I '81 | I '81 | I '81 | I '81 | I '81 | I '81 | I '81 | I '81 | I '82 |
| 9 | Bald'n I '83 | Bald'n I '81 | Bald'n I '83 | Bald'n I '83 | M '91 | M '91 | Bald'n I '83 | Bald'n I '81 | Bald'n I '[illegible] | Bald'n I '83 |

P. R. R. Standard Locomotive Register.

**6 HUNDRED.**

| | 0 | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 |
|---|---|---|---|---|---|---|---|---|---|---|
| 0 | PD '81 | PD 81 | PD '81 | PD '81 | PD '82 | PD '82 | PF '91 | PD 82 | PD '82 | PD '82 |
| 1 | PD '82 | PD '82 | PD 82 | PD '82 | PD 82 | PD '82 | PD '82 | PD '82 | PD '82 | PD '82 |
| 2 | PD 82 | PD 82 | PD '82 | PD '82 | PE '83 | PE '83 | PE '83 | PE '82 | PE '84 | PD '82 |
| 3 | PD '82 | PD 82 | PD '82 | PD 82 | PD '82 | PD '82 | PD '82 | PD '82 | PD '82 | PE '84 |
| 4 | PD '82 | PD 82 | PD 82 | PD '83 | PD '82 | PD '82 | PD '82 | PD '82 | PD '82 | PE '84 |
| 5 | PD '82 | PD '82 | PD '82 | PE '83 | PE '83 | PE '83 | PE 83 | PE '83 | PE '83 | PE '83 |
| 6 | PF '82 | PE '82 | PE '82 | PE '83 | PE '83 | PE '83 | PE '83 | PE '83 | PE '83 | PE '83 |
| 7 | PE '83 | PE Comb 31 Vestib '84 | PE Comb 31 Vestib '84 | PE Comb Vestib '84 | PF Comb 33 Vestib '84 | PE '84 | PE '84 | PF 84 | PE '84 | PF '85 |
| 8 | PE '84 | PE '84 | PE '84 | PE '84 | PF '85 | PE 85 | PE '85 | PE '85 | PE '84 | PE '84 |
| 9 | PE '84 | PE '84 | PE Comb 18 '84 | PE Comb 18 '84 | PF Comb 18 '84 | PF Comb 18 '84 | PE Comb 18 '84 | PE Comb 18 '84 | PE Comb 18 '84 | PE Comb 18 '84 |

P. R. R. Standard Coach Register.

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The fine and complete set of models of early locomotives exhibited at Chicago, should be made the nucleus of a national railway museum, where all the valuable relics and records of our old and historic roads could be kept and cared for.

### Brooks Two-Cylinder Compound Ten-Wheel Locomotive.

Gauge—4 ft. 8½ in.
Fuel—Bituminous coal.
Weight in working order—102,000 lbs.
Weight on drivers in working order, 76,-500 lbs.
Rigid wheel base—8 ft.
Driving-wheel base—13 ft. 3 in.
Total wheel base—23 ft. 1½ in.
Diameter and stroke of cylinders—18 x 24, 28½ x 24.
Diameter of driving wheels—56 in.
Diameter of boiler—52 in.
Length and width of firebox—96 x 54½ in.

TENDER.

Coal capacity—6 tons.
Capacity of tank—3,700 gals.

ENGINE AND TENDER.

Total wheel base—45 ft. 6½ in.

### Brooks Eight-Wheel Passenger Locomotive.

Gauge—4 ft. 8½ in.
Fuel—Bituminous coal.
Weight in working order—112,000 lbs.
Weight on drivers in working order—74,-000 lbs.
Driving-wheel base—8 ft.
Total wheel base—22 ft. 8 in.
Diameter and stroke of cylinders—18 x 26.
Diameter of driving-wheels—73 in.
Diameter of boiler—58 in.
Length and width of firebox—102 x 32 in.

TENDER.

Coal capacity—8 tons.
Capacity of tank—4,200 gals.

ENGINE AND TENDER.

Total wheel base—46 ft. 8 in.

Brooks Compound Ten-Wheeler—Now at World's Fair.

### An Encouragement.

From the Creston, Ia., *Advertiser* we quote the following item of interest:

"Engineer Chas. McClellan is the owner of a very fine brass oil-can of improved pattern, valued at $8, and his fireman, John Miller, sports a new patent engine seat, of splendid design. These were presented to Messrs. McClellan and Miller, this morning, by Master Mechanic Jones and Traveling Engineer Button for making the best three months coal record on the west Iowa division. This record is for the months of May, June and July, when they handled mogul engines 436 and 439 on trains 76 and 77 between Lincoln and Creston. In May they made 28 miles to the ton, in June 28½ and in July 29 miles. This is certainly a remarkable record when it is taken into consideration that they pulled heavy freight trains and made fast time, and the presents they received were well merited. Engineer McClellan and Fireman Miller have done work that they can well be proud of."



Brooks American Passenger Engine—Now at World's Fair.

### Need of More Secure Couplings Between Engine and Tender.

At the last Master Mechanics Convention a very valuable report was submitted on "Attachments between Engine and Tender," by a committee, of which Mr. J. Davis Barnett was chairman. After reading the report, Mr. Barnett said:

"In the matter of draw-bars there is some very bad practice on this continent, if one were to accept the blue-prints as representing the actual shop and road practice. In bent coupling-bars there are cases where the double set put in the bar is put in a distance equal to twice the thickness of the bar, and where no reason could be seen why a gentle curve could not have been used, making that bar stronger for its service without increasing its weight.

"There is another case where the bar is set downward almost at an angle of 45°, a very great depth, the sharpest possible corners are shown, and even the hubs on the ends of the bar are not so put on as to lessen that bend. The hubs are so put on as to increase the amount of angle. That has been sent to the committee as being good practice, which they recommend to this association. There are cases of very light safety couplings, and I noticed in one engine at the Columbian Exposition, a powerful engine at that, where the safety chains are ⅞ of an inch in diameter—just one-third the cross-section area of that which the committee recommends. It seems to me, personally, that if it is worth while putting on the safety chains at all, it is worth while putting on something that will do the work on the rare occasions they are called upon to come into play.

"May I say, too, that if the blue-prints are to be believed, the hook usually fastened to the tender, securing the free end of the coupling-chains, is in many cases shown with the sharpest possible corner where it bends around the wood—a right-angled turn—the most favorable condition for breakage at that point when a sudden pull comes on, and in many cases it is bolted with but a single bolt. It seems to me no earthly use if you are running and the coupling-bar should break; you might as well have left all such fixings off."

Mr. W. H. Lewis, of the Chicago, Burlington & Northern, considered the subject of very great importance, owing to its bearing on the safety of trainmen. Any subject, he said, "that involves the injury or loss of life of the employés of railroads is a more important subject than the proportions of a locomotive, and I do not believe that too much importance can be placed upon the suggestions of the committee about this, as regards the safety of employés. We can readily correct any defects in the locomotive in other respects, but we never can recall the injury or death of an employé, and I hope that the suggestions that have been thrown out by the committee will be taken by the members, and that they will profit by those suggestions in the line of improving the appliances to the better protection of the employés."

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All the Brooks engines at the Fair have cabs that are at least half open across. Even in the largest consolidations the boiler comes but half way through the cab. This has its advantages, but also its disadvantages, especially where the engineer's seat is in the back corner of the cab. To see well at night the engineer should be as close as possible to the front windows of his cab, this being especially true in stormy weather. When beside the boiler and well ahead, the light from the open fire-door does not blind him. For seeing well the farther ahead on the boiler the engineer is the better; there are other conveniences that have to be given up for this advantage, however.

### Smoke: Its Cause, Effect and Cure.

At the meeting of the Engineering Association of the South, Nashville, Tenn., July 13th, the subject of "Smoke Prevention" was presented by Prof. Olin H. Landreth, of Vanderbilt University. The paper discussed successively the causes, the effects of smoke and the remedies for it. Objectionable smoke comes mostly from bituminous coal, other fuels producing very little smoke. When fresh coal is thrown on incandescent coal there at once begins the distillation of the more volatile hydro-carbons, which distilled matter is burned if sufficient oxygen is present and the temperature is sufficiently high, but which otherwise passes up the chimney as yellowish fumes. As the fresh coal becomes more highly heated the less volatile hydro-carbons are distilled, and are decomposed at a temperature much below that necessary for the combustion of the carbon liberated, about 2,000 degrees Fah., a temperature so high as to give considerable margin of opportunity for this portion of the carbon to escape unburned. It is this free unburned carbon in a finely divided state that, while incandescent, produces the luminous flame and, when cooled, the clouds of smoke that issue from the chimney and afterwards settle as soot.

After the volatile matter is driven off the fixed carbon remains, and in burning produces but little flame and no smoke, since the particles of carbon are not detached from the solid mass till combustion takes place. As to the effects of smoke production, the fuel loss in the smoke itself is but small, estimated at one-sixth of 1 per cent.; but the causes of smoke are also the causes of imperfect combustion and consequent waste of fuel in the form of invisible gases, carbonic oxide and light hydro-carbons, and the presence of smoke indicates this parallel waste.

Aside from the fuel waste, the effects of smoke outside the furnace make its abatement of public interest. It is authoritatively stated that the residuum of smoke in the lungs induces consumption of an incurable character; and that, in the city of Pittsburg, Penn., the death-rate was 1.62 per 1,000 lower during the eight years in which the use of natural gas almost freed the city from smoke, as compared with the preceding eight years; and that, since the partial return of smoke, the rate has increased 2.57 per 1,000. Carbon, in a finely divided state, is an easy vehicle both for noxious gases and organic impurities. The insidious soot pervades and defaces public and private buildings, and calls for fruitless efforts for cleanliness, when cleanliness is impossible. Smoke is objectionable, from the loss of light and increased cost of artificial light; also from the repression of æsthetic tendencies and consequent mental and moral discouragement. Consideration of the causes suggests the agencies and the mechanical devices for the prevention of smoke; these latter, so far as pertains to steam boilers, are classed as mechanical stokers, air-flues in the walls and grate-bars, coking-arches, dead-plates, down-draft furnaces, steam-jets for injecting air and mixing the gases, baffle-plates and double furnaces. Smoke prevention must be accomplished by educating the public to consider smoke a nuisance, that unquestionably can and should be abated, for the smoke-producers are very slow to be convinced that this abatement is to their interest. Following the influence of public sentiment, laws are to be enacted and provision made for their enforcement, and for furnishing to smoke-producers, when desired, professional advice regarding the means and appliances for smoke prevention. The paper gives the statutes passed in Chicago, Cincinnati, Cleveland, Pittsburg, New York, Rochester, Boston, Denver, the State of Ohio and the city of Birmingham, England, with statements of the success attained in preventing smoke in these localities, success in each case being proportional to the vigor of action taken. The paper also contains descriptions of various mechanical devices for smoke consumption, and closes with a list of literature on the subject.

The report is published by the society, Walter G. Kirkpatrick, secretary, Nashville, Tenn.

### Volume of Receiver of Compound Engines.

There is great diversity of opinion among all engineers having to do with the designing of two-cylinder compound locomotives as to the proper size of the receiver that receives the steam from the high-pressure cylinder and delivers it to the low-pressure side. When the experiments to be made with locomotives in the testing department of the Purdue University are carried out, it may be possible to settle the best size of a receiver; but in the meantime the matter is a question largely of speculation. An English authority on compound engines, writing on this subject some years ago, said:

"The average pressure in the receiver, and therefore the 'drop' at high-pressure exhaust, depends wholly on the volume of the low-pressure cylinder open to the receiver at the point of cut-off, compared with the total volume of the high-pressure cylinder. The high-pressure cylinder full of steam at the terminal pressure, expands into the low-pressure cylinder, and the initial pressure in the low-pressure cylinder will be less than the terminal pressure in the high-pressure cylinder in the inverse ratio of the total volume of the high-pressure cylinder to the volume of low-pressure cylinder at point of cut-off. And this pressure will be quite unaffected by the size of receiver the steam may have gone through on its way to the low-pressure cylinder. Theoretically, the bigger the receiver the better, for the variations in pressure caused by the varying volume between the high-pressure and low-pressure pistons will be proportionately smaller.

"The angle between the cranks will affect the variations in receiver pressure, if the receiver is small compared with the high-pressure cylinder, but the *mean* receiver pressure will be quite independent of this angle.

"In practice it is impossible to avoid a material drop in the receiver, because, in the first place, the terminal pressure in the high-pressure cylinder must be something above the receiver pressure, which is the back pressure on the high piston, to give a steady running engine.

"Then, with ordinary two-cylinder compound engines it is not desirable to arrange the low-pressure cut-off so as to avoid any drop, because in this way the balance of power on the cranks will be altogether destroyed (the low-pressure doing more than its share) and this balance of power, though not absolutely essential, is generally aimed at."

### A Growing Superstition.

That staid old newspaper, the Providence *Journal*, got rid of the following editorial notice a few days ago:

"It is an appalling fact that cheap novels can be turned out at the rate of 5,000 an hour and at a total cost of three cents apiece. The book is printed, folded and trimmed, all by a single revolution of a great cylinder. Then it is distributed all over the country and sold for ten cents, and the masses buy and read, often with the most direful, not to say fatal, results."

Just to see what *fatal* kind of books were sold so cheap, we went out on to the street and purchased for 25 cents the first four paper novels on a stand—6¼ cents each. They were: "The Scarlet Letter," by Nathaniel Hawthorne; "A Marriage at Sea," by Clark Russell; "The Other Man's Wife," by John Strange Winter, and "Very Hard Cash," by Charles Reade. That cheap machines can turn out good novels just as easy as bad seems to have been forgotten by the *Journal*. The fact of the matter is that the howl about pernicious books being printed because they can be printed cheap is as thin as the mother-in-law joke. The machine that can turn out books at a revolution, enabling them to be sold at a profit for ten cents a copy, will put a million good books in the hands of those who can't afford better ones, for every hundred bad books turned out. The quality of printing is not the *fatal* part of the book—it's the quality of the reading matter. Here's more power to the printing press that cheapens literature—and, God bless the mother-in-law!

### How Sentiments Change.

When a railroad is first opened to a country town in a Western State, there are no bounds to the courtesy displayed by the people, and even by the local editors, towards those who have given the district new transportation connections. After the thing gets old, and it is plainly understood that the railroad company is not likely to tear up the tracks, then the period of squaring up comes. Few granger communities fail in the long run to express their contempt for and independence of railroad companies. But when the only road is first opened, anything will be endured.

A new railroad was opened a few months ago to a Kansas town, and an excursion was run for fifty miles out into the prairies to show the wonderful resources of what was really a barren country. The track had not been surfaced up, and the road was as rough as a corduroy trail. The local editor lost his footing as he was passing from one car to another and fell off. He walked to the next station, and was kicked out of the place by the station agent, who said that they would not tolerate tramps or loafers about that depot.

He walked on to the next station, where there was a water-tank, and waited for the return train. The conductor refused to carry him, saying that no suspicious persons would be carried on that road unless they paid their fare. The editor had to walk home.

Those who knew what had happened expected a roasting for the road in the next issue of the *Western Eagle*, but the general passenger agent had agreed to give passes for the weekly publication of the company's time table, and the aggrieved editor vented his chagrin thusly:

"We cannot too cordially congratulate our readers on their good fortune in seeing our city connected with the great A., T. & S. F. system. The finely ballasted track leading to our city makes the cars ride like wafting balloons, and the employés of the company make traveling a round of pleasure. The courtesy of conductors and station agents leaves nothing to be desired, unless it be that the company should insist on their wearing slippers."

There is great mystery in the district as to the true significance of the last sentence.

### An Aluminium House.

Engineers and others interested in metals who visit the World's Fair will find a metallic curiosity there in the shape of a house built of aluminium which is well worthy of examination. This metal, although hardly fulfilling the predictions of zealous advocates, is coming steadily into use. The present cost of aluminium, though still higher than any of the cheap metals, has brought it within the range of everyday life; and its present uses, limited as they are, necessarily bear some relation to the great question of the future of the new metal, and the possibility of realizing the hopes of the metal worker and the engineer. For all personal equipment which must be carried by the owner, aluminium is rapidly taking the place of every other metal. Its lightness is its obvious recommendation in this case. In the German cavalry, even the stirrup "irons" are now made of aluminium. The men's water-bottles are also of the same light and strong material. In binoculars for field use, and all kinds of scientific instruments for distant and toilsome expeditions, such as Dr. Nansen's Arctic journeys, or observations on high mountains, the same metal takes the place of the heavier brass, when the saving in weight so secured may often make the difference between scientific success or failure. Nearly all the small articles of luxury and ornament usually made in silver or brass are now produced in aluminium, though where weight is not a drawback, the gain is rather one in appearance than construction. But aluminium thimbles, pen-holders, paper-knives, flasks or cups are so far superior to those made of the ordinary materials that no one who has once made use of them in the new metal will readily return to the old.


A German Express Locomotive. Observe the Good Steps and Hand-Holds and the Sausage-Mill Crank on Tender-Brake.

## A Failure of an Apprenticeship Experiment.

BY SAM SHORT.

Some railroad men are destined to be in trouble all the time and their endeavors to keep things right and straight appear to result in working up kinks where a smooth rope ought always to be. My friend Greatsam, of the Twin Threes, is one of these men. With the best intentions in the world, with energy and no end of industry, he is constantly in hot water through faults of omission and commission. When he decides through good nature to permit breaches of discipline to pass unheeded he gets into disgrace with the management; and when he displays energy enforcing orders he raises a tumult among the men. He has the name on one side of the social circle of being a tyrant without a heart to feel for those who have difficult and trying duties to perform. On the other side he is looked upon with suspicion as an officer who spares his men in preference to acting strictly in the interests of his employers. The real weakness of Greatsam is that he is deficient in tact. That is a very valuable attribute for a man who has to keep contending interests in harmony.

Greatsam is in hot water now over a curious thing that many men would have managed without a hitch. When the money stringency began pressing the credit of corporations, the management of the Twin Threes was very prompt in ordering a reduction of the shop force. The road is doing a good business, and the outlook for heavy traffic was never better, but that does not matter. The management called for a reduction in the pay-roll, and the shopmen were considered the most convenient victims. Greatsam made a reduction in the force below what he considered necessary to do the work; but that was not enough to satisfy those above him. They demanded the discharge of more men. Greatsam presented figures to show that he had not enough good men left to keep up the running repairs, and the manager told him to run the shop with the apprentices and laborers. This matter of apprentices has been a stumbling-block and a cause of much disappointment and heart-burning.

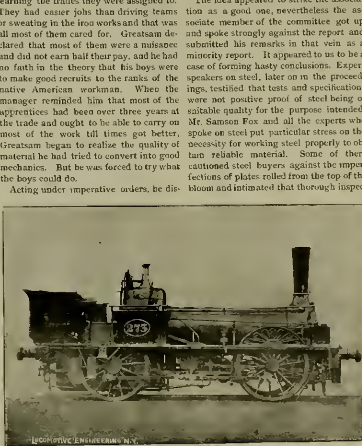
Some years ago there was a social reformer lecturing in the town where the headquarters of the Twin Threes are, and he made an eloquent appeal to the employers of skilled labor to foster and encourage the apprentice system He drew pathetic pictures of the thousands of American youths who are hungering after the opportunity to learn a trade, and appealed to the patriotism of the people to encourage this laudable desire. The wife of the general manager attended this lecture, and went home soturated with the subject. Next week, Greatsam received an order to employ all the apprentices that could be worked to advantage in the shops.

An order of this kind is not long a secret in a country town and Greatsam was immediately besieged with applicants for employment as apprentices. He could not accommodate half the applicants, so he determined to move slowly in the matter. To escape the persistent appeals of the father he first took in young Tom Sullivan, son of the night watchman; and widow Green next forced in her boy Joe by the same means that a similar person used many years before to worry out the patience of an unjust judge. These two boys were known to be the hardest cases in the town and they set the standard of the class of boys who could fill the apprentice list in the shops. A few bright ambitious boys got in, but the roughs soon made the place too disagreeable for them. In an effective and persistent way the rowdy boys obtained possession of all the apprentice openings. No test of fitness was made. If a boy looked sturdy enough to pull on a jack-lever he was considered eligible, no matter what his previous training or form of servitude had been. There had been talk of requiring candidates for the places to be able to read and write, but older sympathizers had asked if reading helped a man to push a file straight and if writing would make a man more skillful in calking a seam. That was considered good argument.

As time went on even the best friends of the apprentice system had small reason to gush over the success of the apprentice experiment in the Twin Threes shops. The boys, themselves, displayed no interest in learning the trades they were assigned to. They had easier jobs than driving teams or sweating in the iron works and that was all most of them cared for. Greatsam declared that most of them were a nuisance and did not earn half their pay, and he had no faith in the theory that his boys were to make good recruits to the ranks of the native American workman. When the manager reminded him that most of the apprentices had been over three years at the trade and ought to be able to carry on most of the work till times got better, Greatsam began to realize the quality of material he had tried to convert into good mechanics. But he was forced to try what the boys could do.

Acting under imperative orders, he discharged all but a few leading mechanics, and attempted to run the shop with the boys. Never was there a more dismal failure. There was not one of them who could line a set of guides or put in a set of flues, and none of them tried very hard to do the work right. Greatsam stood over the boys day and night trying to encourage them to get the work out, he helped, and praised, and flattered, but all could not make workmen out of the youths who had not learned the business. Then he lost patience and tried abuse and invective, with the result that all the boys went on strike. The terms of settlement they wanted were full mechanics' pay and proper treatment. When the stoppage of work began to tell on the train service, some of the old men were hired and more have been taken on.

There is now a sore subject between Greatsam and the G. M. in connection with the failure of the apprentice system. Greatsam says that apprenticeship is a humbug, since boys are not sufficiently under control to make them learn the trade properly. The G. M alleges that neither the system nor the boys is entirely to blame for the failure, and he is looking up facts bearing on the case. Meanwhile the workmen are perfectly satisfied that apprentices cannot be trained properly in a railroad shop.




AN OLD CRAMPTON CENTER CRANK ENGINE.

## Tests of Steel and Iron.

One of the best reports submitted to the Master Mechanics' Convention, was that of the Committee on Tests of Steel and Iron, of which Mr. William Smith, of the Chicago & Northwestern, was chairman. The report presented the subject in a thoroughly digested shape and read like a good article by an expert on steel and iron. As the ordinary methods of testing steel and iron are presumed to be familiar to the members of the association, little was said on the subject and the well-known forms of specification of steel were not discussed. The committee, however, urged that a system of expert inspection ought to be introduced because steel was often found to pass the required tests and to fulfill the specifications and yet failed prematurely in service.

The idea appeared to strike the association as a good one, nevertheless the associate member of the committee got up and spoke strongly against the report and submitted his remarks in that vein as a minority report. It appeared to us to be a case of forming hasty conclusions. Expert speakers on steel, later on in the proceedings, testified that tests and specifications were not positive proof of steel being of suitable quality for the purpose intended Mr. Samson Fox and all the experts who spoke on steel put particular stress on the necessity for working steel properly to obtain reliable material. Some of them cautioned steel buyers against the imperfections of plates rolled from the top of the bloom and intimated that thorough inspection was the only means for detecting the defects common to steel taken from that part of the pouring.

The Committee's report merely emphasized the necessity for more expert inspection. There is good reason for believing that the additional safeguard proposed by Mr. Smith for detecting the presence of poor material would work for the benefit of railroad companies.

## Curious Shop Nomenclature.

It is curious to notice the difference in railway and in shop nomenclature in American and in British shops. Both sets of men talking the same language, it seems natural to expect that the names of things should be the same, but in a great many cases they are different. "Chordal" writing years ago in the *American Machinist* on this subject, gives some amusing examples, and time has tended to diversify expressions instead of bringing uniformity He says

"With the English, our steady rest is a catch-plate and our follow rest a back-stay. Our engine lathe is their self-acting lathe Our 24-inch swing lathe is, in mother English, a 12-inch center lathe. Our belt is with them a strap, our stripper, a strap-shifting apparatus, and air counter-shaft, an overhead driving apparatus."

Special trades in our country vary about as much. Men brought up in railroad shops call a shaper a compound plane, and engine-slides of any description guide bars. But the worst thing the railroad machinist is guilty of is bringing into shops such words as "six square nuts, three square files," etc He has often sent cubs running among roundhouse men after circular squares and straight hooks, and wondered at the greenness of the boy in supposing for an instant that there are such things, when he himself uses daily such outrageous expressions as bevel square, four square file, etc

We have in this country four names for a connecting-rod. It is main-rod, connecting-rod, pitman and rod. Eccentric-rods are often cam-rods, crossheads and tee-rods, and safety-valve weights are often called Pees, from P weight in the equation, I suppose. The crank-pin with some becomes a wrist.

## Workmen Reporters.

The proprietors of the *Daily News*, of Dundee, Scotland, have displayed remarkable enterprise to obtain news of interest to all classes of industrial readers concerning the Columbian Exposition. They sent twelve workmen belonging to the principal trades to take notes of what was to be seen at the World's Fair, and to collect information of value from all sources where it could be obtained. Besides descriptive matter of their several interests the delegates were required to collect information regarding the conditions of the American wage-earners, how they live, what kind of houses they have, what hours they work, what leisure they enjoy, what kind of food they get, and anything else concerning workmen likely to interest their own class in Scotland.

## The Clang of the Bells.

BY L. R. ANDREWS.

Where railroads are found, the world around,
The "Baldwin's" bell is known,
And as it rings, the song it sings
Is a very familiar one

From Tehachapi's heights to Dakota's plain,
From Maine to Mexico;
With a deep harsh note from it's brazen throat
The "McQueen's" alarm doth go.

There are bells and bells, no two the same,
On lowlands or on highlands,
They count their friends to the world's ends,
The bells on the "Rhode Island's."

In lands of sun, 'mid tropic climes,
Thro' wintry ice and snow,
The "Brooks'" bells rhyme their varied chimes,
As o'er their course they go.

The "Pittsburg" bell has a curious clang,
As it echoes thro' the vale,
'Tis easy to tell the sound of this bell,
Rumbling o'er the rail.

With a shrill "ding! ding!" and a short, sharp ring
The "Rogers'" bell peals loud,
You may always know that they're ready to go
When its clapper warns the crowd

Oh! the "Mason's" bell is balanced well,
But its voice is not for me;
As to and fro it sways so slow,
Like the bell-buoy of the sea.

"Cooke," "Richmond," "Dickson,"
"Rome" and the rest
Have their champions who love them true,
Each thinks well of his fav'rite bell,
Tho' it suits but one man in the crew

But the "Blood" bell's tone is all its own,
Sonorous, mellow and clear,
It's rhythmic ring in measured swing
Is music I love to hear.

*Bath Beach, L. I., N. Y.*

### Quartering Driving-Wheels.

BY GEO. K. WENTWORTH.

As there has not been anything in LOCOMOTIVE ENGINEERING for some time in regard to quartering driving-wheels, I will try to explain how it is done in shops where there is no quartering machine.

Will take any pair of driving-wheels that require a new axle or a driving-axle that requires new wheel-centers. The keyway in axle or wheels is already cut; if new wheel-centers, the hole for the crank pin has been bored out, after axle and wheel-center have been fitted, place axle on two wood V-blocks, high enough so wheels will be clear from floor; then put each wheel on axle about ½ inch, or just enough so keyway can be marked on axle, or if it is a new wheel-center, keyway can be marked from axle onto wheel.

When putting wheel-centers on axle put them on so crank-pins will be as near right angle to each other as can be done with the eye; be sure the leading crank-pin is put on the proper side; on all locomotive engines that I have seen, the crank-pin on the right side was the leading one, when running forward. After the wheels are on axle get the centers of the wheel fit on a small piece of tin, fastened to a small piece of wood that is tight in hole where axle fits in wheel-centers as shown at *A*, Fig. 1, or better, use a tool made as shown at Fig. 3—as all sizes are given it can be easily made.

Take a straight-edge, put one edge against collar on crank-pin, or hole for crank-pin, at *B*, Fig. 1, and the other end of the straight-edge at edge of hole where axle fits at *C*, draw a straight line from *B* to *C*; put straight-edge at *P* and *E* and draw another straight line, where these lines bisect at *F* make a small center punch mark; then put one point of a pair of dividers at *F*, and the other point a little distance below points *C* and *E*, and make the lines *G* and *H*; make small center punch marks at the points where the lines *G* and *H* bisect the lines *D E* and *B C*, then with dividers from the points *G* and *H* make the two lines at *I*, make a small center punch mark at this point; draw a straight line from *F* to *A* and to *I*—this line could be got without the point *I* by drawing the straight line from *F* to *A* and continuing it to the point *I*—when the point *I* is got from the points *G* and *H* and coincides with the points *F* and *A*, it proves that the points *F*, *A* and *I* are correct. From the center of wheel *A*, with a radius *A* to *I*, draw the arc of a circle *M*; where this bisects the line *F A* make a small center punch mark, draw a line at *A* right angle to the line *F I* by using the points *I* and *M* and drawing the arc of a circle at *K* and *L*, make a small center punch mark at these points *K* and *L*, draw a straight line from *K* to *A* and *L*; this line should be at right angles to line *F A I*. From the center *A* draw a circle with a diameter equal the diameter of collar on crank-pin next to wheel, as shown at *O* and *P*; get all these lines on both wheels.

With a square made as shown at Fig. 2, the small holes at *C C* are for a plumb-line to be put in—draw a line on square from *C* to *E* and *C* to *A*, have these lines parallel with the edge so when using this tool you can see if plumb-line hangs parallel to edge and line; place the edge *A B* of the square on the collar of crank-pin at *D* and edge of circle of same diameter as crank-pin collar *P*, Fig. 1, on left side, put a plumb-line in small hole *C*, Fig. 2, then move this wheel until plumb-line hangs true with square; then place the edge *E F* of the square on the collar of crank-pin at *B* and edge of circle of same diameter as crank-pin collar at *O*, Fig. 1, on right side, then move the wheel on axle until plumb-line hangs true with square.

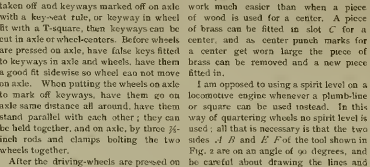
Be careful that in moving one wheel on axle the other doesn't move. It is best to try the first wheel again after the second wheel is in place to be sure that it has not moved. The first wheel, or the one on left side, can be proved by placing plumb-line over collar on crank-pin next to wheel, and having lines coincide with circle same diameter as collar on crank-pin, as shown at *O P*, Fig. 1.

After both wheels are true with the square and plumb-lines, then keyways in wheels can be marked off from keyway on axle, or, if new axle, mark off keyways on axle from wheels; then wheels can be taken off and keyways marked off on axle with a key-seat rule, or keyway in wheel fit with a T-square, then keyways can be cut in axle or wheel-centers. Before wheels are pressed on axle, have false keys fitted to keyways in axle and wheels, have them a good fit sidewise so wheel can not move on axle. When putting the wheels on axle to mark off keyways, have them go on axle same distance all around, have them stand parallel with each other; they can be held together, and on axle, by three ⅞-inch rods and clamps bolting the two wheels together.

After the driving-wheels are pressed on the driving-axle they can be tried to see if they are correct by scribing from center of axle with a ball-center on one point of a pair of dividers, a circle on each end of axle, of same diameter as collar on crank-pin next to wheel; then place the wheels with one crank-pin on the top, so when plumb-lines are placed over collar on crank, pin will coincide with circle on end of axle of same diameter as collar on crank-pin; then place square, shown in Fig. 2, on crank-pin collar of wheel on opposite side, and edge of circle on end of axle of same diameter as collar on crank-pin; if plumb-line hangs true with square, then wheels are correct; if not true, press one wheel nearly off and take false key out and file enough off from false key on side that fits next to wheel, so wheel can be moved around on axle so crank-pins will stand at right angles to each other, then put false key back in keyway and press wheel on axle a little so pressure will hold it, then set a jack under one spoke of the wheel on the side so wheel can be moved around on axle; set another jack under one spoke of the wheel on opposite side; have the two jacks set so they will be on opposite sides of each wheel, so the jacks will "lift" against each other when screwed up tight; then press the wheel on axle and the wheel will turn around on the axle until it comes against the false key, then the jacks can be taken away and the wheel pressed on as far as needed.

A handy and useful tool for getting the center of hole in wheel where axle fits, is shown in Fig. 3. it is made of 1-inch square steel; in one end is a ⅜-inch screw with a square head, turned to a sharp point so it can be screwed into hole in wheel to hold it rigid. The piece *B* is fastened to the 1-inch square piece by the screw *D* so it can be set at edge of circle of same diameter as collar on crank-pin, and edge of square can be set against it and collar on crank-pin. This little tool makes the work much easier than when a piece of wood is used for a center. A piece of brass can be fitted in slot *C* for a center, and as center punch marks for a center get worn large the piece of brass can be removed and a new piece fitted in.

I am opposed to using a spirit level on a locomotive engine whenever a plumb-line or square can be used instead. In this way of quartering wheels no spirit level is used; all that is necessary is that the two sides *A B* and *E F* of the tool shown in Fig. 2 are on an angle of 90 degrees, and be careful about drawing the lines and making center punch marks.



Left Side

Right Side

Fig. 1

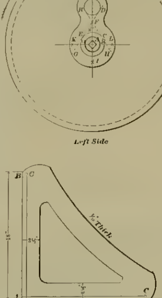


Fig. 2

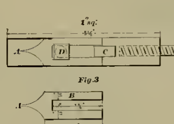


Fig. 3

### Handling the Air-Brake.

BY GEO. ELLIS.

I have just finished reading an article, "Handling the Brake-Valve," which appeared in the July number of LOCOMOTIVE ENGINEERING, by Mr. Will W. Wood, and I think a few remarks upon the same are in order. The first part of his subject is given to discussing the propriety—after having attempted a service application and wishing to make an emergency one—of quickly throwing brake-handle to full release position for a second or so, thereby throwing a volume of air into train-pipe, and immediately returning same to emergency position. Mr. Wood gives a very graphic account of what takes place under this method, and in this I fully agree with him.

But what strikes me as strange—considering the number of times this argument has come forth—is that some recognized air expert, or even the Westinghouse people, do not come forward and put a damper on this method, or if it should be the proper way to handle the emergency feature of the Westinghouse brake-valve (which I candidly admit I would not attempt even as an experiment), let them say so.

There are lots of engineers in this country who would like to see this quickly brought to an end. Meantime, I shouldn't advise any one to shoot any air into train-pipe in making emergency stop, until this method is approved by unquestionable authority, as it is just possible they might not stop, at least not where they want to. Some people speak of pressures as others do of weights and solids, and appear to think they can be drawn and pushed from place to place in the same way, never considering it takes volume—compressed volume—to make pressure, and that placement or displacement of pressure can take place only upon the compression and release of volume.

It is a disregard of this rule, it appears to me, that leads some to think, that by shooting a "solid mass or embankment of air" into train-pipe and against triple pistons, and "suddenly" withdrawing it, gives the "cushion" or pressure on the other side of the triple-piston a better "hold," "fulcrum," or "grip," to sort of slam it along toward the emergency feature of the valve, which, if the volume could be handled quickly enough, might to a certain extent fill the bill, providing he had the original pressure in auxiliary—which, of course, he has not. Mr. Wood goes on in his essay to state that the Westinghouse people have perfected and produced a brake-valve that can be handled successfully by those unfamiliar with the finer points of the brake mechanism, if the engineman will only follow the directions in their instruction book, and that "younger runners do a great deal of reading nowadays and that naturally enough many will believe the statements of those air-brake experts, printed in technical publications, and handle their brakes accordingly."

Also that "there are five indicated points for the brake-valve, and the instruction books explain clearly when and how to use those different points." Now, this would have excited no comment, but further on Mr. Wood undertakes to set forth a set of instructions, just like an expert, that sounds to me just like "Skeever's Fourth Vice Mahogany Desk Affair." I do not wish to hurt Mr. Wood's feelings, but I must say I cannot believe he has ever handled a freight train for a living, with and since the introduction of the Westinghouse "Engineer's Equalizing and Discharge-Valve."

Some of Mr. Wood's statements are not consistent. He seems to infer that by following the instruction book to the letter, it is impossible to make a mistake. All railroad companies publish a book of rules that is supposed to be absolutely correct. If followed to the letter in every instance, how many of us would railroad for a living? Westinghouse instruction book, page 16, paragraph 3, says: "To apply the brakes with full force, a quick reduction of the pressure in the train-pipe of ten to twelve pounds is made," etc. And Mr. Wood tells us to move our brake-handle to emergency position and leave it there until we have stopped. Zounds! How can we take his advice and follow the instruction book and his instructions, too? Isn't a young runner liable to get "rattled" with such advice?

And again, he says: "To apply the brakes gradually, move the handle to service stop position, and watch the black pointer of the gauge; it will show how much air you are letting out of your train-pipe, and you can graduate your stop by the distance it falls back. When you have exhausted twenty or twenty-five pounds of air, your brake is fully applied. [This is official—Westinghouse says so.] Don't let out any more air; save it to release the brakes and recharge the auxiliaries. *You may run by—you will sometimes—but don't get 'rattled.'*"

The above italics are used by me, not Mr. Wood. Any young runner coming into a meeting point, and the opposing train not into clear, or what is more to the point, not in at all, will, of course, make the usual reduction of 20 to 25 pounds of air, and if the locomotion or headway continues about the same, it will be very unbecoming of him to get "rattled." No

matter if he does run by, there is no help for it but to haul her over, a little sand, and when matters get too close, calmly step off.

Away down in your gizzard you feel the satisfaction of knowing your brakes were fully applied. If, by any good fortune, you are able to attend the following investigation, you might tell this to the railroad officials, and also that you know you are right, because your gauge registered a reduction of 20 to 25 pounds, and your brakes were fully applied. Mr. Wood and the instruction books say so. This will readily influence them.

I am inclined to think Mr. Wood's instructions are considerably out of line in regard to some points I have mentioned. I have found it necessary, on numerous occasions, to reduce 40 and even 45 pounds of air, before the brakes would take hold—due to triples being very dirty, dry, etc. Some companies handle so many foreign cars, that very little attention is given to cleaning this part of the service when the business is heavy, and some cars are months and months away from the home road.

I think it foolish to lay down iron-clad instructions, when the service and good judgment make it necessary to deviate from the same. Some people can run a train across a desk or floor, and make all kinds of good stops (as per instruction book), but when they attempt to give some old runners pointers, and instruct young runners how to handle a thirty or fifty-car train, composed of dry triple valves and a prominent leak or two, I notice, they invariably scheme up an excuse to "slide off and take four back to town."

### Brooks Ten-Wheel Passenger Locomotive.

Gauge—4 ft. 8½ in.
Fuel—Bituminous coal
Weight in working order—138,000 lbs.
Weight on drivers in working order—111,000 lbs.
Rigid wheel base—14 ft. 6 in.
Driving-wheel base—14 ft. 6 in.
Total wheel base—25 ft.
Diameter and stroke of cylinders—19 x 26.
Diameter of driving-wheels—72 in.
Diameter of boiler—60 in.
Length and width of firebox—114 x 32 in.

TENDER.

Coal capacity—8 tons.
Capacity of tank—4,000 gals.

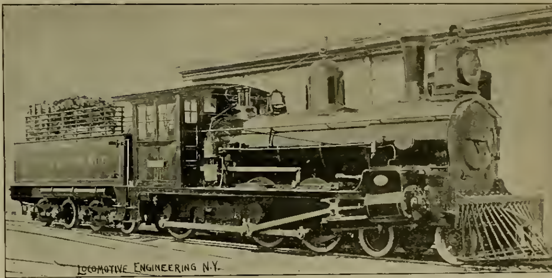
ENGINE AND TENDER.

Total wheel base—52 ft. 3¾ in.

### A Mexican Southern Freighter.

The engraving shown herewith represents a type of locomotive doing good service on the narrow-gauge Mexican del Sur. These engines were built by Kitson & Co., Leeds, England, and rebuilt at Puebla, Mexico; they have 16 x 22-in. cylinders and 48-in. wheels placed inside the frames. They are something like a mule in that they are hybrids—neither American nor English in design.

The men say they are very good mills and serve the purpose for which they were built very well.




ENGINE OF FAST FRUIT TRAINS, MEXICAN SOUTHERN RAILROAD.

### The Erie Engineers' Locomotive Criticised.

The locomotive designed by the Erie engineers, which is exhibited at the World's Fair, received some very severe criticism from the master mechanics at the Lakewood Convention.

Mr. J. D. Barnett said on this subject:

"When walking through the Columbian Exposition, and noticing an engine said to have been designed by men running engines, I thought I would pay some little attention to see if an engine designed by men exclusively handling engines was any safer than an engine designed by a master mechanic. I found, as soon as I stepped upon the foot plate, that I could just get the top of my nose onto the brake-wheel. The ratchet and pawl, to be worked by the foot to hold that brake-staff from slipping back, was 14½ inches above foot-plate level. The depth of the horse-shoe in the tender was the greatest depth in any tender I have seen for several years, there being no slope either at the back or side to throw fuel well forward to the front. The steps were simply secured by a single set-screw, by no means the safest form of securing a step, and the hand-rail and foot-steps in the neighborhood of the head-lamp to be used by the men when lighting up were far from being the safest and most convenient that I have seen.

"Mr. MITCHELL—I wish to say, respecting the engine referred to by Mr. Barnett, which the engineers built, that I think the parts that he referred to were designed by the builder. The railroad company with which these engineers were connected, had nothing whatever to do with the design in any detail, and in talking with some of the committee of the engineers, I inferred from what they said that they only specified the principal parts, like the size of cylinders, size of boiler, journal, and such details as that. I think these minor details referred to are the designs of the builders.

"Mr. GILLIS—I think, in justice to the builder, it should also be said that, as I understand, the engineers who designed this engine had inspectors to overlook the construction and see that it was done as they desired.

"Mr. MACKENZIE—I was very much interested in the remarks made by Mr. Barnett as to the designing of that engine. It would seem to me that if a committee of engineers were to design an engine, they would look particularly after the parts that they were to handle and which they knew something about, and would let other parts, that they knew nothing about, alone. It seems that they lost sight of the fact that they did not know anything about the boiler or cylinder or anything of that kind, and they went to work and designed those parts of the engine, and when they came to the brake-wheel, as Mr. Barnett says, they put it where they could not get to it without a step ladder. I am surprised to hear of the condition of that engine. I thought it would be a model engine as to brake attachments and all that sort of thing. I did not suppose the boiler and cylinders would amount to anything, but the minor attachments I did suppose would be very convenient."


BROOKS TEN-WHEELED PASSENGER ENGINE. NOW AT WORLD'S FAIR

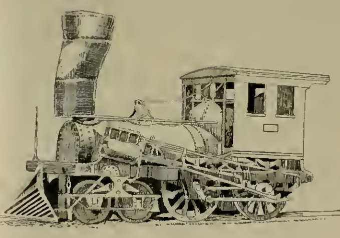
We are in receipt of a neatly bound volume containing fine lithographic pictures of all the locomotives exhibited by the Pittsburgh Locomotive Works at Chicago, as well as descriptions and specifications of each engine. In addition to the general dimensions, there is for each engine a table showing its hauling capacity in tons on grades varying from a dead level to 132 feet per mile, and at several different speeds. The book is well worth a place in the library of any mechanic or railroad officer.

Supt. Thos. Cronin recently left the International & Great Northern to take charge of the Houston, East & West Texas. One Sunday, while "back home" at Palestine, the boys caught him and presented him with some depreciated silver in the shape of a tea-set. Master Mechanic Huffsmith made the speech. Cronin says that silver is worth $400 per ounce.

James W. Holmes, an old-time employé of the Reading Railroad shops, is contributing a series of articles on the men who learned their trades at Reading and afterwards became famous. Col. F. K. Hain, general manager of the Manhattan, was recently "wrote up," with many others whose names are well known in the railroad world.

### Matthews' Improved Spark-Arrester, with Engine Attached.

The engine shown in the annexed engraving is of considerable historical value, having been the first eight-wheeler built for the Mohawk Valley road, now a part of the New York Central. The engine was designed by Mr. David Matthews, and built under his supervision. The smoke stack, which forms such a prominent feature of the locomotive, was Matthews' patent, and was the first departure to making smokestacks rival the boiler in size.



ENGINE "11," N. Y. CENTRAL, AS ORIGINALLY BUILT.

This engine was considered a tremendous, powerful machine in her day, and astonished people by the long trains of cars she would haul. After doing hard work for many years, till the working parts were worn out, the engine was considered worthy of being rebuilt. After going through this process she appeared as shown in the larger engraving. The changes made illustrate very forcibly the line of improvement followed in leading up to the modern locomotive.

An improvement in wrought-iron wheel-making has been patented in this country by Mr. Pierre Arbel, of Paris, inventor of the well-known Arbel wheel. The new invention consists of a process of making a forged wheel by building up a fagot of the rim, then heating this and forging it between dies to produce a spoke-wheel. A heated disk is applied on one side and welded to the spokes, rim and nave. There is talk of the Arbel Wheel Co. establishing works in this country.

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Mr. George Whaley, a well-known French engineer, who has been in America reporting on engineering appliances at the World's Fair, and in the country generally, visited this office in search of information. He is very much interested in railroad matters and is a most discriminating observer.

### Punching and Drilling Boiler Sheets.

Foreign engineers who visit American railway and locomotive building shops, nearly always express surprise at the prevalence of punching in the construction of boilers. The authorities that control nearly all Government boiler and iron ship work require that all holes shall be drilled, and very decided objections are raised against punching. Although locomotive boilers carry higher steam pressure than any other, and although they are subjected to more trying stresses than any other form of boiler, punching is universally followed in the construction of American locomotive boilers. Cheapness is no doubt the reason why this practice has become general, but there are two sides to the question of punched *v.* drilled holes. The case was very fairly covered by Mr. W. Barnett Le Van in a paper read some years ago before the Franklin Institute, of Philadelphia. The following is an abstract of the points made

Of all tools that take part in the construction of boilers none are more important than the machine for punching holes.

That punching has a more or less injurious effect upon the metal plates surrounding a hole, is a fact admitted by every engineer, and it has often been said that the holes ought to be drilled. But, unfortunately, no drilling appliances can at all compare with punching in rapidity and cheapness of working. A first-class punching-machine will make from forty to fifty holes per minute in a thick sheet. There is no drilling-machine that will approach that with a single drill.

The most important matter in punching plates is the diameter of the opening in the bolster or die relatively to that of the punch. This difference exercises an important influence in respect not only of easy punching, but also in its effect upon the plate punched. If we attempt to punch a perfectly cylindrical hole, the opening in the die-block must be of the same diameter as the point of the punch, or, at least, a very close fit. The point of the punch ought to be slightly larger in diameter than the neck or upper part.

When the hole in the bolster or die-block is of a larger diameter than the punch, the piece of metal thrust out is of larger diameter on the bottom side, and it comes out with an ease proportionate to the difference between the lower and upper diameters; or, in other words, it produces a taper hole in the plate, but allows the punching to be done with less consumption of power, and, it is said, with less strain on the plate

The difference which should exist between the diameter of the punch and die hole varies a little with the thickness of the sheet to be punched, for it is easy to understand that the die which might give a suitable taper in a $\frac{1}{4}$-inch plate would give too great a taper in a $1\frac{1}{4}$-inch plate. There is no fixed rule. Practical experience determines this in a rough-and-ready way, for if a machine has to punch different thicknesses of plate for the same size of rivet, the workman will seldom take the trouble to change the die for every variation of thickness The makers of punches and dies generally allow about $\frac{3}{32}$-inch of clearance.

Punches are generally made flat on their cutting edge, but others are made spiral on the cutting edge. The latter has a gradual shearing action, commencing at the center and traveling round to the circumference. This form of punch is not suitable for thick metal.

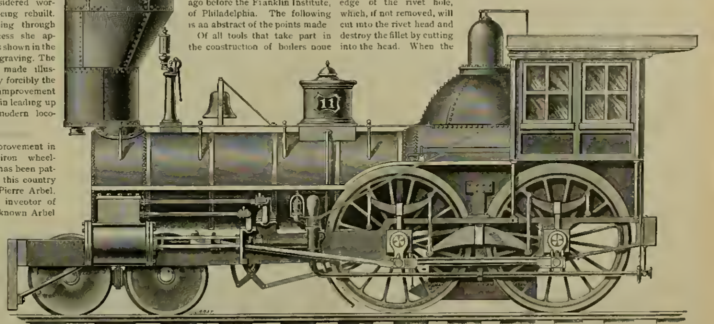
It is of the greatest importance that the punch should be kept sharp and the die in good order. If the punch is allowed to become dull, it will produce a fin on the edge of the rivet hole, which, if not removed, will cut into the rivet head and destroy the fillet by cutting into the head. When the punch is in good condition it will leave a sharp edge, which, if not removed, will also destroy the fillet under the head by cutting it away.

Punching possesses so many advantages over drilling as to render it extremely important that the operation should be reduced to a system so as to be as harmless as possible to the plate. In fact, no plate should be used in the construction of a boiler that does not improve with punching. Experiments made by Hoopes & Townsend show that good material is improved by punching The great objection to drilling rivet holes is the expense, from the fact that it takes more time, and when drilled of full rivet size we are met with the difficulty of getting the rivet holes to correspond, as they are when punched of full rivet diameter. When two plates are drilled in place together, the drill will produce a burr between the two plates—on account of their uneven surfaces—which prevents them being brought together, so as to be water and steam tight, unless the plates are afterwards separated and the burr removed, which, of course, adds greatly to the expense.

The difference in strength between boiler plates punched or drilled of full rivet size may be either greater or less than the difference in strength between unperforated plates of equal areas of fracture section. When the metal plates are very soft and ductile, the operation of punching does no appreciable injury. Prof. Thurston says he has sometimes found it actually productive of increased strength; the flow of particles from the rivet hole into the surrounding parts causing stiffening and strengthening. With most steel and hard iron plates the effect of punching is often to produce serious weakening and a tendency to crack, which in some cases has resulted seriously. With first-class steel or iron plates, punching is perfectly allowable, and the cost is twenty-five per cent. less than drilling, in fact, none but first-class metal plates should be used in the construction of steam boilers.

In the original punching machines the die was made much larger than the punch, and the result was a conical taper hole to receive the rivet. With the advanced state of the arts the punch and die are accurately fitted; that is to say, the ordinary clearance for a rivet of $\frac{3}{4}$-inch diameter, the dies have about $\frac{3}{64}$-inch, the punch being made of full rivet size, and the clearance allowed in the diameter of the die.

From the points made by Mr. Le Van, who is a practical boiler maker, it will be seen that the principal objection to punching is bad punching.



ENGINE "11," N. Y. CENTRAL, AS REBUILT

A sensible writer discoursing in a painter's paper about apprentices, says that the original trouble with apprentices in American shops is the want of care in selecting the boys. If apprentices were selected as carefully as brushes are, they would give more satisfaction than they do. The point is made that there is no use nowadays in withholding trade secrets from boys, because the current trade publications reveal them all.

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The first cab applied to a locomotive in New England was put on the "Tartar," belonging to the Boston & Albany, by an engineer named Ellis. It consisted of corner-posts, with canvas stretched between them.

## Close Measurements.

The Pratt & Whitney Co., and other makers of fine measuring instruments, have within a very few years reduced ordinary measurements to accurate quantities which were formerly considered an impossibility. There is nothing more striking about old and new methods of doing mechanical work than the processes of measurement. Ever since men began to use tools there have been artisans noted for the closeness of their work, but they were always the exception, and it is within the memory of men still at work when the subdivisions on a two-foot rule were considered close enough to measure to. This caused great increase of work in fitting. The improvements in machine tools have contributed greatly to the reduction of fitting by file and scraper. The mechanic arts have made immense strides in one century, for it was only about one hundred years ago that James Watt congratulated his men on the accurate boring of a cylinder which was only $\frac{1}{8}$ inch out of round. Probably Watt could imagine improvements being carried out in boring appliances that would succeed in boring a cylinder perfectly round. If he expressed views of this character to his contemporaries they probably considered that he was a visionary.

A peculiarity of early mathematicians and mechanicians was, that they had conceptions of accuracy, but they considered that accuracy was an ideal which could not be approximated in practice. Over 2,000 years ago Euclid had correct views about a straight line and about an accurate plane surface, but he had no idea that they would ever be made by the hand of man. Yet practically plane surfaces are to be found in every first-class machine shop. Every machinist ambitious to do close work has in his tool-chest a micrometer gauge by which he can measure to the $\frac{1}{10000}$ of an inch without the aid of a microscope. This is a modern miracle. The men who worked up this degree of perfection are not popularly considered heroes of industry, but they deserve more honor and praise than nine-tenths of the men whose names are considered worthy of being perpetuated by means of memorials and popular biographies.

## Slow Progress in Improving Tools.

The oldest machine-cutting tool is the lathe. In its most ancient form it was driven in a manner similar to the operation of drilling by means of a bow with the cord encircling a pulley on the drill. In this process the drill cuts during one stroke of the bow and runs back during the other stroke. This was the motion given to the first form of lathe introduced into Europe, and it may still be found in use in its most primitive form in China and Japan.

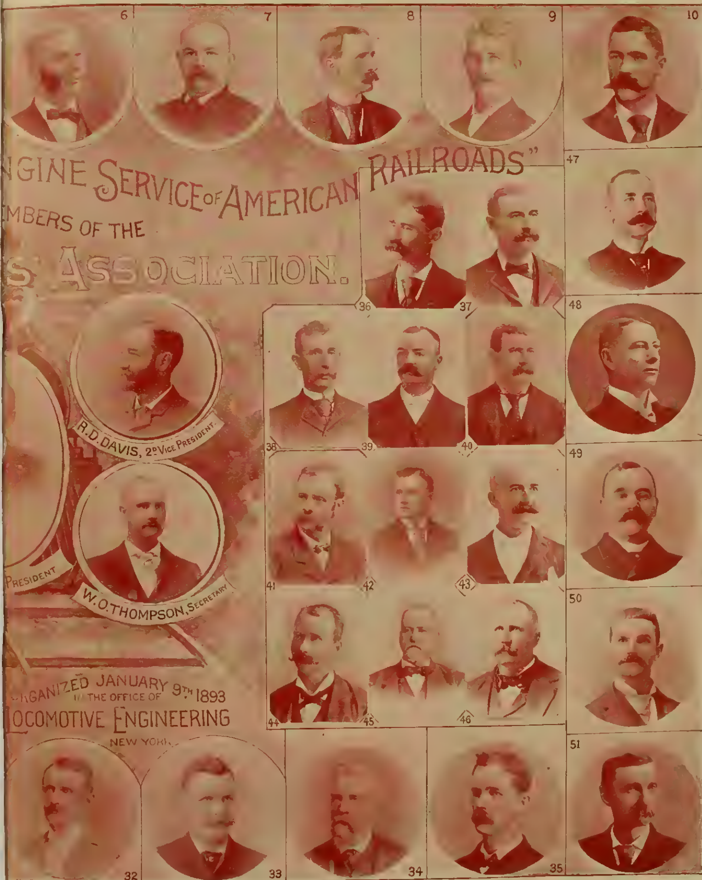
When the crank was applied to give it continuous rotary motion, a great advance had been made. It is strange that mechanics were so slow to adopt the crank, for it was used in water-raising machinery in Egypt almost since the dawn of history. But mechanics have always been slow to make radical changes on their tools. There may have appeared to be as great difficulties in the way of giving the spindle of a lathe continuous rotary motion as there now appears to be obstacles in the way of making a planer or shaping-machine cut during both strokes. Future mechanics may consider it as strange that machinists of the nineteenth century used planing-machines and shaping-machines that did no work during one-half of the machine's movement, as we consider it short-sighted in our ancient mechanics not to adopt continuous rotary motion for lathes.

Standard Steel Works.—Hammer Shop

Standard Steel Works.—Wheel Boring Mill.

The people of the Australian colony, Victoria, appear to be exceedingly hospitable to strangers, so far as giving free transportation over railroads is concerned. The favors given are not always appreciated, or at least reciprocated. In the course of a speech made in a lawsuit lately, a lawyer said that no less than 1,000 free passes were issued to distinguished visitors last year. These happy "globe trotters," who use the railways free, had not even a kind word to say for their entertainers. "They sleep in our houses," the speaker continued, "eat our dinners, drink our wines and finally shake the dust off their several shoes and return home, to write books about us which are extremely unpleasant reading." That appears to fit the case of many visitors from abroad, who have been handsomely treated by American railroad companies.


"TO IMPROVE THE LOCOMOTIVE E
SOME WORKING M
J.W. SHELDON 1ST VICE PRES.
W.E. MILLER, TREASURER
C.B. CONGE



NGINE SERVICE OF AMERICAN RAILROADS"
MBERS OF THE
S' ASSOCIATION.
R.D. DAVIS, 2º VICE PRESIDENT.
PRESIDENT
W.O. THOMPSON, SECRETARY
GANIZED JANUARY 9TH 1893
IN THE OFFICE OF
OCOMOTIVE ENGINEERING
NEW YORK
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# Railway Liars' Association.

Dr. MUNCHAUSEN, Sec'y.

References as to experience and ability required of all candidates.

## Annual Roundup of the Ananias Club—A Throttle Hero who Suffered the Pangs of Conscience—Election of a Dark Horse.

As the members of the Ananias Club gathered under the awning, for the annual meeting, there was a slight delay—the president had called the meeting for 9.30 and it was only 9.18—the president is very punctual.

The Old Colony man remarked that it was fine weather for any road running to the beach, as all the trains were crowded.

The D. & H. man said there were a right smart lot of people going up to the Adirondacks, and the whole party were soon talking of summer resorts and the handling of summer travel with winter power.

The N. Y. Central man sneered at the Ontario & Western man and remarked, That, of course, he supposed they *did* have a little business in summer, but think of the business we do with our *four* track."

The Ontario man retorted that the Jersey Central had four tracks and done a heavy summer business, too. He turned to the representative of the J. C., who had his chin in his hand, a woe-begone look on his face and a tear in his eye.

"Why, old man, what's the matter, brace up—how many trains are you running to Long Branch and Lake Hopatcong, now?"

The Jersey Central man sighed heavily, and, looking around vacantly, asked in a plaintive voice:

"What day o' the month is this?"

"Sixteenth," answered a dozen at once.

The Jersey Central man groaned.

"It's the day his wife died," whispered one.

"Anniversary of the day he run over his own mother," said a second, in a stage whisper.

"What is it, brother?" said the president. "We're all friends, and'l help you stand it."

"It's thirty-four year ago to-day," moaned the Jersey Central man, as he rocked himself back and forth. "Thirty-four year," he repeated, half to himself; "an' I can see it all jist as plain as if it was yisterday—them eyes, them *awful* eyes!" He half screamed, and put up his hand and arm as if to hide a gruesome sight.

The members respected his grief, and let him wear it out. Finally he ceased moaning, and looked from face to face around the circle.

"Boys," he began in a wavery voice; "boys, I hope it won't never be your lot to go through life with a load on your conscience. I hope none of you has never bin guilty of a crime. I hope none of you has ever been placed where you had to choose between death and the deliberate sacrifice of an innocent life—*for I have!*"

"Tell us how it was," said the chorus.

"Well, boys, it was the first summer the Central ran Long Branch trains—that was when I was running and afore I had any official position—I pulled the first train.

"I had a new Grant engine and a boy of a fireman, not over eighteen years old, and we doubled the Branch twict a day.

"Well, one day, nice warm day, just like this sixteenth of August, too, we went into the Branch about 7 o'clock in the evening and lay there for the last train out at 9.30.

"I took several drinks that evening, but thought I was all right, but that was my mistake. I was very drowsy and fell fast asleep at my post just as we passed Elizabethport.

"I was woke up by the fireman yelling, '*Shut her off, for God's sake, the draw is open*!' I woke clean up in a minute, but too late; I just got the air set when the Grant took a fearful plunge into the bay——"

It was a long time before he resumed.

"Boys, the train was all right, the brakes held it, the couplin' back of the tank broke——

"I remember tryin' to get her into the britchin' just as she went over, then all were black——

"When I come to I was layin' on the roof of the cab, and it was being carried out into New York Bay by the tide. I wan't hurt, and set up and looked around——

"I heard a moan, and lookin' behind me seen sompin' white-like; the moon com' out from under a cloud, and I saw it were my fireman's face—it was all bloody.

"'Bill,' sais he, 'give me your hand, my arm's broke.'

"Boys, the cab roof was small and splintered up, and the side he was hangin' to was under water, and I didn't offer to help him.

"He ast me agin, mournful-like, and said he'd drown if I didn't.

"'Willie,' said I, 'this roof won't hold two of us; you're crippled, anyway; let go.'

"But he wouldn't. He ast me to think of his poor old mother, but I told him I had a wife and five children.

"He begged and argued, and tried to climb on the raft himsef.

"Then is when the demon o' self-*pree*servitation possessed me, and I put my foot on his head and shoved him off.

"Oh, them eyes! I can forget him callin' me murderer; but them eyes will keep lookin' into my soul till I die."

He moaned a few minutes and then resumed:

"I were picked up by a tug in a short time and when my story were told I was the hero of the hour, 'the man who fearlessly met death doin' his duty,' 'the man who didn't flinch when he had life to save,' 'the man who grasped the throttle till the engine hit the bottom;' the passengers on that train give me a gold watch, the newspapers had my picture and the gineral supentennent give me the pay car to pull—but, gentlemen, none of these people knowed of the kanker in my heart, none of 'em suspected about the fireman."

After this confession the poor old fellow broke down entirely and there were few dry eyes in the assembly until John Campbell arose, cleared his throat and said:

"In view of the fact that I was raised on the Jersey Central and never heard of this case, I move that the distinguished professional be unani——"

"Gentlemen," said a stranger rising from a back seat and coming forward, "Gentlemen, there is an old saying that all things come to him who waits, for thirty-four long years I have waited for this moment and my revenge. *I am the man this villain tried to kill!* I swore the moment the tide left me high and dry on the mud flats that I would live to get even with my would-be murderer, and at last I have found him; he has fully confessed, and now I propose to whip him within an inch of his life!"

And with one swing of his left hand he knocked the old prevaricator over two chairs and landed him under the table. He made a dive to get on top of his victim, but a dozen hands held him back.

"Leave me git at the old villain!" he yelled, as he threw off his captors and kicked the Jersey Central man in the ribs.

They got him in the corner at last, and as Windy Rogers held him against the wall, the president pounded on the table with a cane and said:

"Gentlemen, this is not the House of Parliament or the Coney Island prize ring. Why this unseemly conduct?"

The Jersey Central man staggered to his feet, and, pointing his finger at his assailant, said:

"Mr. President and gentlemen, that man is evidently a liar, for he ain't thirty-four year old himself."

"No personalities, sir; no personalities," yelled the avenger. "I said I'd git even, and I will. Oh, for just one whack at the old cuss!"

"Why, man," said Brady, "the Newark Bay bridge wasn't built thirty-four years ago; nor twenty-four, neither."

"I don't care when it was built. I jest want to stamp on that old villain's pate—leave me git at him'!"

"Gentlemen," said the Jersey Central man, "a man as went through such an experience would know the number and make of engine he was on; kin he tell that?"

"You said it was a Grant, yourself," said the stranger. "I always fired Grants in them days."

"Mr. President," protested John Campbell, "there seems to have been some mistake here—far be it from me to doubt the word of any brother member—but neither the Long Branch road nor the Newark Bay bridge were built thirty-four years ago. The Grant Locomotive Works had not been established, nor air-brakes invented; one of these gentlemen was not yet born and the other was running a bolt-cutter out at the Hampton shops—I recognize you now, Pete—no engine jumped off the bridge that wasn't built yet, especially a locomotive yet in the ore; there wasn't no brakes to hold the train, no gold watch and no murder. It looks to me as if there was a mistake somewhere."

The stranger had struggled so hard to get to his victim that the crowd had thrown him down and Jim Brady was setting straddle of his chest.

"Mr. President," said Jim, without getting up, "I move that the gentleman from the Jersey Central be made an honorary member for life, and I would further move that this—'er, well, the Dark Horse here, be made president by acclamation; for while he may not be a gifted liar by tongue or pen, he is an actor and a man of some force; I know he could hold his own in a world's congress of liars, and we could all be proud of him."

Prolonged cheering, amid which the president put the regalia on the dark horse and the crowd divided itself each side of him as they faced the barkeeper.

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### Mistaken Identity.

He was an English railway man, and had run over to see the World's Fair, but he was not greatly fascinated with the attractions of the Exposition, and our great railroad system did not interest him much. Talk about fast trains wearied him.

Mr. John Clayshire had a hobby, and he came here to ride it out as far as his means permitted. A radical among English liberals, he looked upon America as the Mecca of those who loved to see good government, and he embraced the opportunity of cheap rates to witness his ideals.

Besides admiring our political system, he was a diligent student of American literature, and loved to rave about the writings of Emerson and Hawthorne and Longfellow, but more particularly about Emerson.

He landed in New York and took a cab, which jolted him over the dirtiest and worst paved street he had ever seen. The cab driver charged him $2—four times the legal fare—and he could find no means of redress. He proceeded to Niagara Falls and fell into the hands of thieves in the course of his sight-seeing; but fared even worse among those who levy legal blackmail inside and out of the Chicago Exposition.

We met Mr. Clayshire in one of the hotels there, and he was inclined to take a pessimistic view of the world. Freedom, he believed, could be carried a little too far, and he wanted some control mixed with it.

As we talked, Mr. Stott, from Boston, walked up and joined in the conversation. On hearing that Mr. Stott was from Boston, our English friend brightened up wonderfully, and expressed a keen interest in many New England places on account of their literary associations.

"I am a great admirer of Ralph Waldo Emerson, Mr. Stott," he observed. "Nothing would give me so much pleasure as to spend a few days in Concord communing with your great philosopher. Of course, Mr. Stott, as a Boston man, you are an admirer of your immortal Emerson?"

"Emerson! Emerson!" repeated Stott, slightly bewildered. Then a light coming to his memory, he exclaimed, "Oh, yes, you mean Emerson the great rubber man!"

"O ye celestials!" groaned the Englishman, "is this the Boston culture I have crossed the ocean to witness?" A cloud of sadness passed over his brow, and, rising pensively, he remarked, "Gentlemen, I feel as if I could swallow one of your beastly mint juleps!"

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### Sounded Wrong.

There was a slight misunderstanding at the Market street depot of the Philadelphia & Reading, at Philadelphia, the other morning. Letters have been posted up above the gates admitting passengers to the platforms, and each track is distinguished by some letter. This is a new arrangement.

A lady walked up to a gateman who was busy examining tickets, and asked "Which is the train for Doylestown?"

"Go to L," he exclaimed, pointing in a certain direction, but continuing to examine tickets.

The lady snorted, looked indignantly at the gateman and made a bee-line for the station master's office.

"One of your gatemen has grossly insulted me," she exclaimed, on finding the station-master. "I want him discharged right away."

"Why, you astonish me!" said the official. "What did he say or do?"

"I went and asked him where the Doylestown train was, and he told me to go to hell."

The gateman, on being accused of the serious charge, explained that he had told the lady to go to L, meaning L gate, and he was exonerated from all blame, but the passenger went away decidedly disgusted.

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### Where He Was Stuck.

When Ike Johnson registered in the roundhouse Saturday night, Gotlieb Schmidt, the new man, was setting on a pilot as glum as though he had buried his father.

"What's up?" asked Ike.

"I'm in a lot o' drouble, mein friendt; I got to made out a repord."

"Well, that's nothin'; make her out."

"I don'd like dot repord pusiness."

"Oh, they don't expect no Spencerian writin'—just say what's the matter, in your own way."

"Yes, I guess I wride goot enough, already, but den—ober, I dunno——"

"Know! why, you know what's the matter; you know whether the trouble is in the valve motion or the tank don't you?"

"Ah, Mister Ike, *dot ish youst vhere I was shtuck!*"

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G. D. Peters & Co., London, have opened an office in the Metropolitan Building, New York. This is the largest firm in the world that deals in railroad and steamship supplies. Their agent here is Captain J. L. Killmer, well known to railroad men as agent for the Boyer speed recorder. Captain Killmer was for seventeen years an engineer on the New York Central Railroad.

# —Practical Letters— from Practical Men.

Facts Wanted. There's a glut of Opinions.

Write on one side of the paper, state your point plainly and briefly, and then quit. We supply the generalities. No letters noticed unless name and address accompany.

### A Driver-Brake That Had a Pulse.

*Editors:*

Not long ago I was firing an engine and one day noticed that at every exhaust of the pump the driver-brake pistons moved a little and then dropped back. There was no leak in the train-line. What caused it?

R. HILL.

*Sherman, Tex.*

### Softening Leather Packing in Driver-Brakes.

*Editors:*

We can sympathize with Mr. F. B. Armstrong, as we have had considerable trouble with the leathers of a pull-up driver-brake. We have tried several ways, and the best thing we can find to do in warm weather is to soak them about twice a week in water, using very little oil of any kind. This can be done with very little work, by filling the space between the brake-piston and the top cylinder head, through the hole in the cylinder-head, with a small funnel. Cut the brake out, and let it stand over night. In the morning cut the brake in, and the water will work out itself as the brake is used.

Leathers may not last as long this way as they would without soaking, but they do good work while they do last.

M. E. WATTS.

*West Nanticoke, Pa.*

### How the Breaking of a Rocker-Arm Could Cause the Knocking-out of a Cylinder-Head.

*Editors:*

Some one recently asked what knocked out a cylinder-head when lower rocker-arm broke? I would say that when the arm broke it left the valve with front steam-port open. The pressure on valve held it there, the steam forced and followed piston on back stroke, and was forced back into boiler on forward stroke, so long as the throttle was open. *When the throttle was closed*, piston was near back end, cylinder full of steam, and, there being no way of escape (as would have been had the valve covered both ports, and escape made for the one revolution through exhaust port, by lifting valve off its seat), the pressure in cylinder was compressed by forward stroke of piston, and if 80 pounds was cylinder pressure, we have about 1,920 pounds per square inch at completion of forward stroke, and she found the weak point in cylinder-head.

A. A. BROWN.

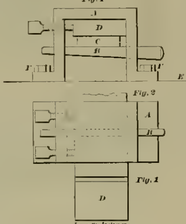
*Waycross, Ga.*

### Some Tool Kinks.

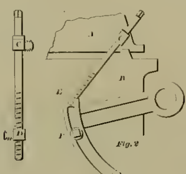
*Editors:*

In planing the ends of guides for closing, there is a great deal of trouble in setting the work in the planer-chuck to prevent the part to be planed being twisted with the wearing surface of the guide. There may be planer-chucks that will not cant the work, but if there are any the writer has never used them. To get rid of this trouble in planing guides I designed the jig shown in Fig. 1. It is a casting *A* of the shape shown, it is planed on the inside square with the bottom bearing, and clamped or bolted to the platen of the planer or shaper. A key, *B*, is put through and a liner, *C*, to suit the variation in thickness of guides. The guide *D* is now slipped through and the key driven, which forces the guide up and against the planed under side of the chuck or jig; the set-screws force the guide over against the planed surface and holding it true in all positions. We can now plane the work, knowing it will not be twisted with the wearing surface. If the guide is run hollow, put a thin liner of paper on low side and key up.

In changing the gears on a large lathe,




the swinging-arm holding the intermediate gears is very heavy and unhandy to handle, to overcome this evil I made a screw (with collar), of ¾ iron, cut thread in bolt-cutter. Made two studs, *C* and *D*, with square heads. The stud *C* is screwed into back head, *A*, of lathe the stud *D* is




screwed into inside of swinging-arm at *E*. The screw slips through the stud *C*—a loose fit, but screws through stud *D*. These studs must not screw snug up to the shoulder, as there is a movement to them as the swinging-arm is moved up or down The end of screw is made square to fit the handle, or crank, of cross-feed. To use the attachment, loose screw *F* (on all lathes), put on gears and draw the whole business into position by the screw. I hope one or both of these kinks will be of use to some brother mechanic.

W. DE SASSO.

*Indianapolis, Ind.*

### Those Air-Brake Questions.

*Editors:*

THAT ERRATIC TRIPLE-VALVE.

If I had been at the roundhouse, working on that St. Albans triple-valve, I should first have filled the packing-ring space in piston No. 5 with polar grease or tallow; if that did not cure it and the port leading to auxiliary was of the correct proportions, should have taken out and examined four-way cock, key No. 13, though I do not understand just what is meant by pressure in cylinder remaining at 70 lbs.; probably a misprint.

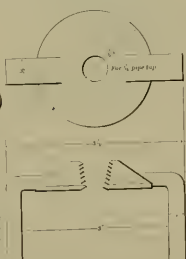
ABOUT ANGLE-COCKS.

Our Texas friend is right as to the necessity of an open train-pipe between each end of a train, but I believe there would be increased difficulties and dangers in the greater number of cars that would be left cut out, because nobody had a handle handy, either in yard or on road. Although I do not get a chance to read the *Engineers' Brotherhood Journal* as much as I would like, I saw in the August number a communication from C. P. R., advocating a hole in angle-cock, drilled in such manner that when the cock was shut the hose end would bleed off.

A few years ago, just after the angle-cock became common, a few were received on this road with these holes in them; hole had been made by leaving handle off and turning angle-cock key No. 2 past where it would be with handle on, and then drilling through side to slot in key. These cocks were hard to keep tight, on account of the short distance between the holes after cock was opened with handle on; I believe, however, that if hole were drilled in the upper part of the angle-cock body No. 1, Fig. 7, Plate D 24, so that it would come in space occupied by slot in key No. 2 when cock was closed, and a hole put in the side of the key itself and near the bottom of the slot so it would come in outer orifice of angle-cock body at the same time, the difficulty experienced in overcoming leaks caused by such holes would be reduced to a minimum; and as for the bell-cord idea, think it is very good.

CARE OF PACKING-LEATHERS IN DRIVER-BRAKE CYLINDERS.

Opinions are divided here in regard to chamfering packing-leathers; some think it helps the matter, some see no difference. I have put packing-leathers in 8-inch driving-brake cylinders, leaving one chamfered and the other square, sometimes one would leak and sometimes the other, and I am of the opinion that the proper plan to keep packing-leathers from leaking in




driving-brake cylinders is to keep them away from where they will get burned, but the greatest demand, that I know of, made for missionaries to overcome the bad effects of the profanity indulged in on account of such a leak, was caused by an 8-inch driving-brake cylinder, that seemed to be sprung in boring, as it was over 1/32-inch out of true. I should think our friend Congers' ¾-inch governor had too long a diaphragm-valve, and if so, after spring-box was tightened, the tension was already on the diaphragm plates, or, perhaps, the valve was too short and did not lift off its seat. The steam would have shut off, if the exhaust No. 10 was clear and the air could get by the diaphragm-valve. In the new 1-inch governor, Plate D 7, the diaphragm plates are about 1/16-inch less in diameter than their seat in diaphragm body No. 37, and when they are renewed, the diaphragm-ring No. 43 is liable to set the plates to one side while being tightened, thus cocking the valve and permitting air to flow through to top of piston; this governor is generally lazy.

RELYEA'S SIGNAL PROBLEM.

As to Brother Relyea's signal problem, there were a number of conditions not noted or stated that, were one present, would present the difficulty in such a light that it might, perhaps, be easily located, but so far, the half-inch stop-cocks might have been closed, the strainers could have been stopped up, the amount of air discharged from the drain-cock mentioned might have served better to locate the trouble. I once had a valve that apparently was all right when tried from the tender with almost any quantity of air, but which would not blow from the stop-cock at rear of first car. In taking the signal-valve apart I found someone had filed about half an inch off the spindle above the three-cornered part. A new spindle was all that was necessary to insure me a good night's sleep. When we wish to test the pressure on air or signal train-pipe we use a yoke, made as per sketch. I got the idea from Mr. Pritchard, of the Eastern Gen. M. D. W., this road. It works on both the old and new style couplings, if there are two inches thread on the thumb-screw, which should be of brass, so that it will unscrew easily. The yoke itself is of steel, and in case half-inch hole is not large enough at the end fitting on the packing ring, a larger one can be drilled and other fittings put in.

*Roanoke, Va.* GEORGE HOLMES.

### Tempering Tools.

*Editors:*

I saw a letter in the July number on tempering tools, in which the writer says taps, hobs, reamers, milling cutters and other tools of that order are subject to warping, cracking and general distortion in tempering, all of which can be overcome to an extent by first simply obtaining an equality of temperature of heat in all parts of the object to be hardened; secondly, the water to be used in hardening should be of the proper temperature. For example, a feather-edge cutter will not bear as much strain as a more bulky tool, hence it will not stand as cold a bath, for the colder the water the quicker the abstraction of heat, which will cause a sodden contraction of the thin edges.

The method of tempering so as to guarantee any desired degree or depth of the hardness of the tool, is to immerse it in water, keeping it there just long enough to harden the surface and cutting parts to the desired depth, then quickly transferring to an oil bath. The object of this method is to overcome the strain and stresses which sudden cooling develops. Now, you claim the water ought to be of suitable temperature for the certain shape cutter you have to harden. Now, Mr. Hinkens, your theory will never be a success, for this reason: "If your steel has been properly heated, it will not crack until it gets to about the same temperature as the water. If your water is of the same temperature as the atmosphere, and you would certainly not have it any warmer."

At any rate, it will not crack until it gets to about the temperature of 75 to 90 degrees, unless you overheat to a great extent, for the cause of your cutter cracking if properly heated is the center shrinking away from the cutting edges after they get to the same temperature as the water.

Now, then, the colder the water the quicker it will cool your cutting edges and the less strain on them, because they get

to their natural condition while the center is of a nice red heat.

Now, it is policy to cool your center gradually, so that the entire strain will not come just to that line where the water could not overcome the heat of the body, and where your cutter generally cracks.

Again, you claim, in order to get the desired depth of hardness, to immerse it in water, keeping it there just long enough to harden the surface and cutting parts to the desired depth, then quickly transferring it to an oil bath.

This may be good practice to prevent some irregular-shape cutters from cracking, but there is absolutely no need of this to get the desired depth of hardness, and I am only longing for an opportunity to prove in your presence that it can be done in a salt brine at a temperature of 32 degrees.

W. G. Lories.

*Rochester, Minn.*

### Curious Brake Action.

*Editors*:

I send you a case of queer air-brake action, for which I have only a theory as to cause, and would like to have it discussed to see if my theory is correct. I left terminal with a freight train partially equipped with air, eleven cars of air. Engine is equipped with latest Westinghouse brake-valve. There were no perceptible leaks in train-pipe. The brake would not creep on even when handle was left five minutes on lap. I had 70 pounds of air in train-line and 90 in main reservoir when I made first application of brake. I reduced air on gauge 5 or 6 pounds in service, when every brake went on emergency. As I was stopping too soon, I threw brake-handle in full release, but it did not release brakes.

Looking at gauge I found I had but 40 pounds of air in train-line and main reservoir. Train came to a full stop and brakes did not release until pumped off, when air pumped up all right. I tried the brakes several times and always with same result. I formed a theory as to cause of quick action from an article in your paper, but I could not account for the great loss of train-pipe pressure until I discovered and stopped the cause of the quick action, when I think I found the cause of loss of train-pipe pressure, but it is only a theory and may not be correct.

It would be proper to state that while trying to locate trouble I cut out behind fourth car of air and brakes worked all right, showing trouble was not in brake-valve.

W. N. Horton.

*Little Rock, Ark.*

### Old Times and Old Timers.

*Editors*:

I must say that Locomotive Engineering is the only paper in the country that reaches back a few years and shows up what we had a decade or two ago.

If the letters on the side of one of those old Mason's were erased and No. 11 put on I'd feel like I'd met an old sweetheart—they can all talk about "not owning a bolt in 'em," and all that, but I don't believe a good engineer can help getting stuck on a good locomotive.

Will some of the Philadelphia & Reading's old-timers send a sketch to Locomotive Engineering and tell us about the wood springs that were used on their rolling stock for so many years? And who will send a cut and tell us about some of the old Swinburn's and the John Brandt engines? the latter built at Lancaster, Pa.

W. De Sanno.

*Indianapolis, Ind.*

### Do the Top Guides Wear Most?

*Editors*:

I notice that Mr. Wentworth, in his article on lining guides, in the August number, follows the books in the statement that the top guide and the top of cross-head lug wears faster than the bottom. In an observation of steel crossheads with brass gibs, extending over sufficient time to make it more than superficial, I am led to contest the statement and say that it is not the rule but the exception where the top of the crosshead lug wears the most. It is true that the crosshead is held against the top guide nearly all the time when running ahead, and it would seem reasonable that the greatest wear should come on that guide, yet the fact remains that it is not so. Looking for an explanation, the most plausible reasons I have heard advanced are that the top guide is the best lubricated, and that the crosshead being held against the top guide, any sand or grit that may get on the guide is scraped off, while that on the bottom crowds between guide and crosshead and gets in its grinding work.

F. W. Peterson.

*Boone, Ia.*

### A Lame Engine.

*Editors*:

A passenger engine (eight-wheel American) came into relay on one side, with broken rocker-arm; one was wired for, and early next A.M. a man put on the job, completing it about the time she was wanted, and went to breakfast. When she was run on table a slight irregularity in her exhaust was noticeable, but hardly enough to distinguish it from water in ports, pipes, etc., from condensation. When turned and started for train a few revolutions revealed the fact that something was radically wrong; there were three exhausts and almost a fourth.

A second man was called "to lengthen blades and move quick, as time was short." She was put on front center, and the old familiar test method of marking valve-stems, by glands and reversing, and marking again in reverse, were tried. This showed O. K. She was moved to back center with same result.

The eccentrics had not been moved, the blades were put up O. K. as when taken down, the box bolted fast, and all bolts, keys, etc., were in proper place. The trouble was then located; where was it?

A. A. Brown.

*Waycross, Ga.*

### Quick and Slow, New and Old Valve Setting.

*Editors*:

Ever since Mr. Campbell asseverated that he "wouldn't have a machinist who couldn't set an engine's valve in ten minutes," I have been wanting to have a say. My objection is to the limit of time Mr. Campbell allows. Just as I was getting myself "plumed for flight," "Young Whiskers" bobs up with his quick-acting valve setting and fuel-saving method, knocking me out again. If "Y. W." can really do all that he claims he does, I should say it will not be long before the gentle zephyrs will cease their rude meanderings through and beyond his hirsute facial adornments, for he can hie himself to some locality where fuel is dear and talk cheap, and exchange a deal of his stock-in-trade for a small quantity of the article that in combustion converts *aqua pura* (and impura) into the commercial vapor we dub steam, thereby feathering his nest, and making it entirely unnecessary that the wild tempests should ever again circulate through his youthful beard. If this scheme as outlined here should fail, "Y. W." still has another course open to him—he may shave.

Now, as to Mr. Campbell's ten-minute job, I just want to say that I cannot conceive what a man who knows anything at all about setting valves makes such an assertion for, except it be to deceive somebody who doesn't know, and whom he wishes to impress with his capabilities, as testified to by himself. Why, it is an absolute fact that our youngest, most active and energetic machinists can scarcely crawl under one of our modern engines in ten minutes, and narrow gauges are not any more convenient. Then, I would ask, why is it necessary to try to limit a man's time on this operation to ten minutes? When it comes to a job in the office there is no such rush. I have seen a master mechanic's clerk consume ten minutes in sharpening a lead pencil. This fact was indelibly impressed on my memory, for the said clerk kept me waiting for my time-check while he pointed his Faber, and this was in Texas, but not so far south as Houston, nor on a road of such slim proportions as the H. E. & W. T. But here is an operation that a man is doing good work to accomplish in three to five hours, and it may take even longer and all be honest, yet Mr. Campbell says in effect that if he should send a machinist to set a set of valves he would fire the man if he didn't accomplish the feat in ten minutes. I trust I shall never have to strike Mr. C. for a job, for I know I would meet my Waterloo the first case of valves I got.

I worked under a master mechanic once whose method of adjusting valves was practically as described by Mr. F. C. Charles at the close of his article in the June number, and I believe that no man ever had squarer engines. Especial attention was paid to having tumbling shaft-arms proved, and shaft leveled, and lifters proper length, while engine was in shop. When ready to come out, steam was raised to a fair working pressure, then she was slowly run along by steam, and the man in charge walked along by the guides, holding the straight point of his tram in punch-mark in edge of cylinder-casting, just under steam-chest stuffing-box. Just before valve-stem stopped traveling he gave a succession of short, quick strokes on valve-stem; this was repeated for all four points, the extremes of travel being shown by the marks of the tram. The stem, of course, had previously been spaced off for the valve-seat, with the proper lead allowed (at that time they used a piece of Russia iron to give the lead). With a pair of dividers placed in the punch-marks, representing the valve-seat or edges of the ports, and extended to the points of cessation of tr[illegible] it was an easy matter to determin[illegible] he eccentric rods (or blades) neede[illegible] to divide the travel equally over ports. [illegible]ien one dead-center on each side was obtained, and the eccentrics placed in proper position just as is done in every case. No attention was paid to the cut-off matter, for it was not necessary; there was no pinching, scarcely, and all that work and time was saved, the job was much more quickly done than I had been used to seeing it, but yet it took longer than ten minutes.

The advantages claimed for that plan are. The valves are adjusted under the same conditions that the engine does her every-day work under, no trouble from undue or unequal expansion is experienced, all the operations are simpler and more easily understood and more easily performed; greater accuracy in tramming from an immovable point on cylinder, over the use of the short tram, where they tram from the steam-chest stuffing-box flange (as is the general custom). This last I consider as a most reprehensible practice, even if they are supposed to set the steam-chest with a tram mark to always insure the chest being in proper place, and lastly, but by no means of the least importance, much lung power is saved to the valve-setter and his aide in getting the engine on the dead-center eight, twelve, or more times. However, for those who are wedded to the other style, "one of whom even our friend Charles is which," I will say, there is an appliance in use that obviates the last objection in a great measure, but I am not able to give the name of its inventor or discoverer.

The device consists of two sets of rollers operated simultaneously by a lever and ratchet, the rollers are placed under the main wheels of the engine whose valves are to be set, the main wheels are disconnected from the other wheels, the wheels on the rollers are then revolved by the lever and ratchet at the pleasure of the man in charge, and all the pinching and shouting can be entirely dispensed with, to say nothing of the services of three or four laborers with pinch-bars that nine times out of ten won't pinch.

Just why this labor-saving, time-shortening apparatus does not find more favor with the men in charge of motive power, I am at a loss to understand. I never saw but two of them in use, and in one of the places it was very highly thought of; but in the other place it would be safe to say that they have forgotten they ever had it, and have gone back to the primitive old pinch-bar, and the old familiar yells of—"Pinch her ahead!" "Just a little now!" "Easy!!" "J-u-s-t shake her now!!!" "Too much; dammit, pinch her back!" etc.

W. H. Wisley.

*Nashville, Tenn.*

### Air-Brake Questions

*Editors*:

There are a few air-brake questions in the July issue of your paper about which I should like the privilege of saying a few words:

WORKING THE EMERGENCY.

I should like to ask of Mr. Wood if he has any definite figures as to the difference between the auxiliary reservoir pressure and that in the train-pipe when the emergency-valve is brought into action. The statement is frequently made, that to set the quick-action a reduction of 10 pounds must be made rapidly. This is a mistake, as an instant's opening of a large port will secure this result even though that port be closed again immediately.

This movement of the valve can be made so quickly that the gauge will not show as much as 10 pounds reduction, provided the gauge-pointer can be stopped before the quick-action sets, or, to express the idea a little more clearly, perhaps, suppose the triple-valves to be cut out and the handle thrown to emergency position and back on lap again as quickly as it can be done, the gauge will show scarcely any reduction, and yet we all know that such a movement of the valve-handle will actuate the emergency-valve. Careful tests made by Mr. Massey, of the New York Company, with a mercury gauge show that, with a heavy spring, the difference between the reservoir and train-pipe pressure at the moment the emergency-valve opens, is between 2 and 3 pounds, and with a light spring a little over 1 pound.

This can be proven to be approximately correct by a little calculation. The area of the large piston is a little over 9 square inches, which, with a difference in pressures between the reservoir and train-pipe of 2 pounds, makes a total force in movement of 18 pounds

Allowing 2 pounds for loss in moving the slide-valve and piston, or say 4 pounds, to be more generous, we have 14 pounds left with which to compress the graduating spring, and this, it will be seen, is ample for the average weight of spring.

A QUESTION OF SAFETY.

I should like to ask all our air-brake correspondents for their opinion as to whether they consider it good policy to use a plain triple-valve on engine and tender. Does it not increase very materially the liability of breaking the train in two on emergency applications? And if a plain triple-valve must be used, why should it have a large feed-groove when used with a small reservoir? Let us hear many opinions on these points.

PIERCE'S PUMP-GOVERNOR.

It is very evident that the pump-governor mentioned by Mr. Pierce as acting so queerly was not connected properly. It would act exactly as he describes, were

it connected directly to the train-pipe instead of the main drum. The chances are that the governor connection with the old valve was made with a boss on the train-pipe and this was not changed when the new valve was put on.

With Mr. Lee, in his desire to have air-brakes taken care of, I heartily sympathize. There are altogether too many brakes in the country in a useless condition. By all means let us try to find some good systematic way of taking care of them. It seems to me the trainman is the proper one to make the report, and if he were furnished with printed slips or blanks, he would be much more apt to get the facts down in intelligent shape.

PAUL SYNNESTVEDT.

*Chicago, Ill.*

## The Private Car Built for President Lincoln, 1863-1865.

*Editors:*

From time to time, since 1866, the writer has noticed in the press and railway journals different articles in regard to the car which was built during the war for the private use of President Lincoln, and, as this important relic (now the property of the Union Pacific Railway Co.) is likely to attract considerable interest among the exhibits at Chicago, he undertakes to state for the benefit of the reading public what he knows of its history. It may be added, without impropriety, that there is probably no one now living more conversant with this matter than the writer, as will be shown before he is through.

Soon after the beginning of the war the old railroad shops at Alexandria, Va., were enlarged by the Government for the purpose of building and repairing cars. The work was under the immediate supervision of Mr. B. P. Lamason, superintendent in charge of all car work in Virginia, and the writer was one of his foremen.

Some time during the year 1863 Superintendent Lamason either conceived the idea or had received instructions to build a private car for the use of the President. The work was begun in November of that year, and was completed in February, 1865. The car was designed for the general use of the President, and not exclusively for the purpose of conveying him to and from the front, as is generally supposed; neither was the car cased inside with iron, as stated by some writers.

As the car was completed but a short time before the assassination of the President, the first trip it ever made was to bear his lifeless remains, with those of his son, which had been disinterred, from Washington to Springfield, Ill.

After the car had been finished it was photographed by the Government photographer, from a copy of which, now in the possession of the writer, the accompanying cut is produced.

In design the car was similar to those in use on the Pennsylvania Railroad, was 42 feet long inside and had raised roof with circular ends. The inside of car was upholstered on sides and ends from the seat rail to head lining, and was divided into three compartments, viz., drawing-room, parlor and state-room, the latter being in center of car. The drawing-room and parlor were connected by an aisle extending along the wall inside of car, and in the drawing-room end a saloon was placed. The upper deck was painted a zinc white, with coat-of-arms of the different States in the panels.

The car was originally planned to run on two trucks, but after being raised, braced and bolted, Mr. Lamason changed his mind and decided to mount it on four trucks, which necessitated changing the bolsters and considerable other work. The body bolsters were Ambrose Ward's patent, and the ends of the bolster truss-rods projecting through the sides of the car were covered by brass-capped nuts, as shown in cut.

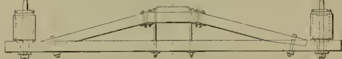
Each two pair of trucks were connected by means of a truss with main center-plate in center, and four guide center-plates with curved slots, one on each truck. There were eight side bearings made of spring steel and rubber.

The spread of trucks was 4 feet 10 inches; wheels, 33 inches, cast iron with broad tread. The springs in truck bolsters were hung on old-style long hangers, no sand-board, but bottom of hangers tied with "U"-shaped under-rods.

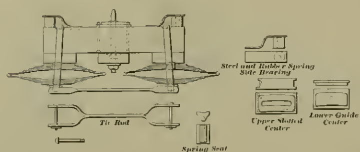
No equalizing bar was used, the elliptic springs being placed on top of oil boxes. The pedestals were cast iron of a pattern so elaborate as to be difficult to describe, Mr. Lamason having spent weeks in designing them.

The outside of car was painted a rich chocolate brown, and polished with oil and rotten stone with the bare hand. In the oval center, on side of car, was painted the United States coat-of-arms, and in center of panel above the coat-of-arms, in small gold letters placed in a circle, were the words, "United States." Car was ornamented in gold, but had neither number nor name except as described. A very good idea of the hand railings, etc., on ends of car can be obtained from the accompanying cut.

PRIVATE CAR BUILT FOR PRESIDENT LINCOLN IN 1865.



*Truss for Connecting Trucks*


Mr. Lamason had personal charge of the car in the funeral train, and, as the running gear was so different from cars then in use, was attended by one man, with a supply of duplicate parts, tools, etc., to facilitate repairs in case of accident.

When the car was returned to Alexandria it was still draped in black crape, which was removed, carefully boxed and sent to the Treasury Department. The writer had the honor of attending personally to this work, and in spite of orders to the contrary a small portion of the drapery was secured, a small piece of which he still has in his possession, as well as a block of wood from the catafalque on which rested the body of the dead President.

W. H. H. PRICE,
Master Car Builder,
*Atlanta, Ga.* E. T. V. & G. R'y.

## A Defective Engineer's-Valve.

*Editors:*

We have the '92 engineer's brake-valve, with feed-valve attachment, on all engines here.

On one engine we have a valve which has caused considerable talk. The brake-valve handle can be moved to position for service application until the air is heard escaping from preliminary exhaust port from brake-valve reservoir, but not from the equalizing exhaust port, as it should; but, nevertheless, the tank and driver-brakes will be slowly applied, when engine is uncoupled from train.

Upon examination the rotary-valve was found to be in good condition, also the seat, packing good in equalizing discharge-valve piston, gaskets in good condition, and there are no flaws in castings, train-line not leaking. For a pointer, will say that rotary-valve is perforated, *i. e.*, it is drilled full of holes about $\frac{1}{64}$-inch in diameter, and about $\frac{1}{8}$ from center to center in circles around the center of valve.

F. H. GABLE.

*Texarkana, Ark.*

## What Ailed the Engineer's Valve.

*Editors:*

An engineer's valve refused to set the brakes in service application notwithstanding air would flow freely through preliminary exhaust port. The valve was taken off, thoroughly cleaned and piston 17 made to move perfectly free and put on again, but it acted as before. Now, the fault was in the valve, but where?

W. F. RELYEA.

*Syracuse, N. Y.*

## Relyea's Whistle-Signal Difficulty.

*Editors:*

In answer to Mr. W. F. Relyea's whistle-signal question on page 363, would say as the whistle blew all right before the hose was coupled between the engine and train the stop-cock on the whistle-pipe at the rear of the train may have been open, or the whistle-valve on the engine may have worked a little hard and the air discharge-valves been partly choked up with cinders. The air-cock on the gauge "combination" having a larger opening, would reduce the pressure enough to blow the whistle all right.

M. E. WATTS.

*West Nanticoke, Pa.*

THE ANSWER.

*Editors:*

The whistle-signal problem which I gave to the readers of LOCOMOTIVE ENGINEERING last month may be thus explained. There was a crack in rubber diaphragm close to the joint between chambers *A* and *B* and directly under port *d*. Now, my theory as to why the whistle would blow by opening small air-cock at the end of last coach and refused to blow when the conductor's valve was opened, is this. By opening conductor's valve, a considerable amount of air being discharged from whistle-pipe, the pressure in chamber *B*, instead of raising diaphragm, would rush through the crack in diaphragm to chamber *A*. Then port *d*, being so small, would check the flow of air enough to retain a pressure in chamber *A* sufficient to hold diaphragm down and prevent air escaping through seat and enough to blow the whistle; but the hole through the small air-cock, being but a very little larger than port *d*, would allow but a moderate amount of air to escape, or enough so that the pressure in chamber *B* would raise the diaphragm before it could force itself through the crack into chamber *A* and equalize. I have had several cases of this kind, and in every instance it was caused by the rubber diaphragm cracking near the joint.

*Syracuse, N. Y.* W. F. RELYEA.

## Conger's Pump-Governor.

*Editors:*

I had a governor that acted like Congers', and after a great deal of trouble found out that there was a sheet copper gasket put into the cavity of diaphragm nut, 16. This prevented diaphragm valve, 17, from lifting at all. C. B. SMYTH.

*Chicago, Ill.*

THE ANSWER.

*Editors:*

Small air-valve, 17, was a little too long, so diaphragm could not raise it off seat on 12. When it was shortened and plug screwed further up into 16 it worked O. K.

*Grand Rapids, Mich.* C. B. CONGER.

## That Erratic Triple-Valve.

*Editors:*

In answer to Clark L. Pierce, on "An Erratic Triple-Valve," would say that I think the trouble was in the four-way cock which was leaking, as the plain and quick-action triples are the same in other respects. Hoping some one will say something on my question through your paper, I remain as ever,

F. H. GABLE.

*Texarkana, Arkansas.*

## Case-Hardening.

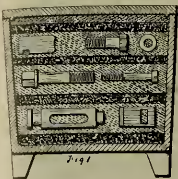
*Editors:*

It seems that certain methods of case-hardening are somewhat of a mystery to a large percentage of blacksmiths; that is, case-hardening and color at the same time, such as you see on gun-locks.

Now, this is something that cannot be explained on paper so that a man can get the same result he would get by having a little practice, but I think I can give any man an idea of how to go at it by furnishing some cuts.

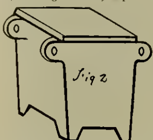
Fig. 1 shows you how to pack your material by first putting about 1 inch of fine-dry charcoal in the bottom, then about $\frac{1}{2}$-inch of fine charred bone-dust, being careful that the oil is all burned out of your

bone-dust and no ashes in it, or, in other words, none of the bones burned to ashes; then lay in your pieces as shown in Fig. 1, and cover up with this fine bone-dust about ½-inch over top; then scatter a little rock-salt over the top, two tablespoonfuls to every 12 inches of surface; then another layer of



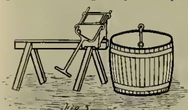

charcoal as you see in Fig. 1, and so on to the top, leaving 1 inch of charcoal on top, then about ½-inch of coarse, dry sand, then put your cover on, and put it in the furnace.

Keep it at a low red heat from 5 to 15 hours, according to size of your pieces and




the depth you want to harden, by keeping it red hot 15 hours you can harden in $\frac{1}{16}$ of an inch, but you get a nicer color by leaving it in the furnace about 6 or 7 hours.

Fig. 2 shows you the box when ready to go in the furnace, Fig. 3 the position to put



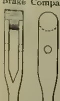

it in when dumping it. After getting your box in this position throw off your cover and quickly turn your box, bottom side up, towards your tub, being careful that no air strikes your pieces while going from your box into the tub; also have a screen in the bottom of your tub with two iron rods, as shown in Fig. 3. As soon as your box is dumped take hold of these rods, and keep your screen on an up-and-down motion so as to let your fine charcoal and bones go to the bottom and cool your pieces quicker, thereby preventing soft spots on your case-hardened pieces.

*Rochester, Minn.* W. G. LOTTES.

### A Pinless Pull-Rod for Driver-Brakes.

*Editors:*

I enclose you a sketch of an improvement in pull-rods for American Steam Brake Company's driver-brakes which, if



you think of sufficient interest to your readers, you may publish.

Instead of having the pull come on pins as formerly, the end of the rod is made solid and the rod is slipped over the lever, being held in place by a loose-fitting key-bolt through hole shown. The cost for a set of rods will be slightly more than to ream the holes and renew the pins, but once done there is no necessity for more expense.

F. W. PETERSON.

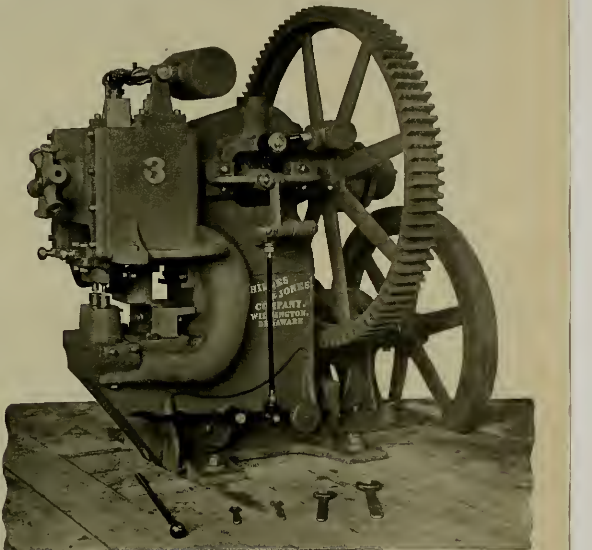
*Boone, Iowa.*

### A New Punch and Shear.

The illustration shows a single punch and shear with both punching and shearing tools attached to the sliding-head at the same time. This machine was designed for special punching and shearing of street rails, but can be adapted to many kinds of work.

Frequently there are a few holes to be punched, then a little shearing and again more punching, each change requiring the removal and substitution of proper tools. The combination illustrated would, in many cases, save the time in changing, and this accomplishes better results.

The construction of this tool has been very carefully looked after, as will be seen on examination of the cut. The sliding-head is of cast-steel, with taper brass shoes for taking up wear. The punching and shearing tools are rigidly held in place by through bolts and tongues, the blocks being also of cast-steel.




NEW PUNCH AND SHEAR FOR REPAIR SHOP.

The general features of our standard single punches and shears have been retained, such as substantial gearing, machine self-contained on one foundation, driving-shaft easily removable, well-designed steel-faced clutch operated by improved adjustable automatic stop which brings the sliding-head to rest at any desired point in the stroke, etc., etc.

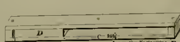
This machine is one of the many boiler repair and shop tools made by the well-known works of the Hilles & Jones Co., Wilmington, Del.

### Filing Rod Brasses and Lining Rods.

A correspondent writes us asking for full directions how to file side and main-rod brasses and how to line them up. This is to a great extent a question involving manipulative skill, which can be acquired only by practice. No man need expect to learn to do machinist work by studying directions about how the work is done, any more than he can expect to learn writing by looking over letters written by other people. He must put his hands to the work and learn by practice.

But we will give a few hints on filing brasses and lining rods by one who has been there. As a preliminary to filing side-rod brasses, put up the wedges of the engine and set the cranks on the eighths, where they should be trammed with driving-wheel centers. Should the crank-pin centers be found a little out of true, the difference can be divided by making crank-pin centers a little longer than dividing-axle centers on one side and a little shorter on the other side of the engine. To prevent binding, make the back and side-rod brasses as much larger than the crank-pin as the rod centers are longer or shorter than the axle centers. File the brasses so that when keyed they will bear brass to brass, the joint being square with the body of brass; that is to say, at right angles with the upper surface.

To line up main-rod, move the crosshead until the piston strikes the cylinder-head,




then mark on the guide the point reached by the crosshead *A* in sketch. Then move the crosshead to the back end of guides till the piston strikes the back cylinder-head, and mark the piston on guide, as at *B*. Place the crosshead at one end as shown in cut, and measure distance between end of crosshead and striking point, which, in the case illustrated, is 24¼ inches. As the stroke of crank is 24 inches, there is ¼-inch clearance, which will make the clearance at each end ⅛-inch. Pinch the engine upon the dead-center and line up the rod until the end of crosshead is ⅛-inch from the striking point, and the clearance will be evenly divided.

Apart from the danger of the piston striking the cylinder-head when the clearance is not evenly divided, there are other reasons why the piston should be made to travel to the same distonce from the two cylinder-heads. If in this case there is only $\frac{1}{16}$-inch clearance at one end and $\frac{3}{16}$-inch at the other end, the engine is likely to have excessive compression on one end and too little on the other. The smooth working of the engine and economy in the use of steam require that the clearance space should be evenly divided.

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The Baldwin Locomotive Works are building a double-ended locomotive for the New York and Brooklyn Bridge. This engine will be about twice as heavy as the little saddle-tank engines used at the bridge terminals to switch the trains. It is not generally known that the cable on the bridge is stopped at 1 o'clock A. M., and for three hours, during the lightest travel, the trains are hauled by locomotives. This has heretofore required a double-header. The bridge is an arch, the grade being 3½ per cent., and the new engine is guaranteed to haul 120 tons over this mile-and-a-quarter of the handsomest bridge in the world.

### A Chance for a Broker.

We are in receipt of the following letter:

DEAR JOHN A. HILL—I thought I would write a few lines asking if you could help me get a job as fireman on the Lake Street Elevated Line of Chicago, Ill., and, if so, let me know. I will send you $25 in return. Yours truly,

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### New Air-Brake Pressure Regulator.

The Air-Brake Pressure Regulator Company, of Chicago, has lately brought out a device designed to proportion the braking pressure to the load, thus making available for braking purposes a large proportion of the weight of the freight carried, as well as the weight of the car itself, without danger of skidding the wheels.

It has been the aim in designing this device to make no change either in the cars or trucks as now commonly used, in the general design and proportioning of the brake rigging, or in the present automatic air-brake devices; also to make the apparatus as simple as possible and the braking device of each truck of the car independent of those of the other truck.

The apparatus consists of two distinct devices, the first of which accomplishes an increase in the braking pressure without an increase in the train-line pressure or the piston travel. This increase is made by increasing the leverage of the cylinder-lever and introducing between the push-rod *A* and cylinder-lever *G* the combination of levers shown. It will be readily seen that with the combination the first part of the stroke of the piston gives a very rapid motion to the cylinder-lever, but that after the joint between links *D* and *F* drops into the socket on the corner of the triangular lever, the motion of the cylinder-lever is greatly reduced and the leverage correspondingly increased.

The second device is designed to prevent the skidding of wheels, and it consists of a system of levers so arranged that an application of the brakes tends to raise the ends of the car, and so proportioned that the end of the car does rise when the braking pressure amounts to about 70 per cent. of the weight of the car and load. Any further increase in brake-piston travel will only raise the car, and any increase or decrease in load will correspondingly increase or decrease the braking pressure. The arrangement of levers is such that even with a load unequally distributed in the car, the braking pressures at each end will be proportioned to the load above. This is accomplished by relieving the brake-shoe pressure by the introduction between the truck and car body of the lifting-lever *I*' and the bent lever *L* to which latter the brake levers are connected and through the movement of which, by the lifting of the car, the braking pressure is prevented from increasing above a predetermined maximum.

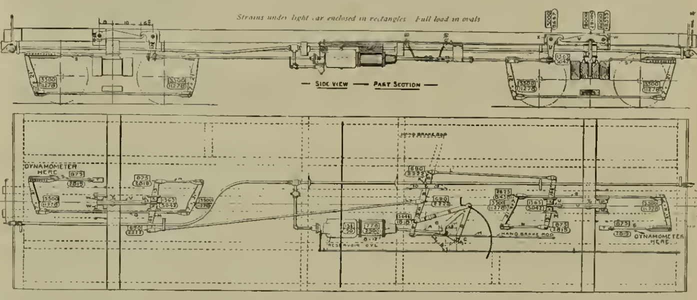
It will be seen that the air-brake reservoir and cylinder remain in their usual position, and that between them and the cylinder-lever are interposed the triangular lever and links, to which previous reference has been made; also, that in order to make the braking pressure on the two ends of the car independent, the cylinder-lever *G* is pivoted at *K*¹, and the lever-rods *L* and *L*¹ connected to it at equal distances each side of the fulcrum. These rods are shortened, and instead of running to the farther brake-lever, they are connected to an equalizing-lever situated between the brake-levers. From the opposite end of the equalizing-lever a short link connects it with the end of the inner brake-lever, and from there on the connections are as commonly used. The equalizing-lever is fulcrumed on the lower end of the bent lever *L*'. The upper end of the bent lever bears on the top of the lifting-lever *I*', the opposite end of which is fixed between the center-sills. The fulcrums of this lever is the top of the kingbolt, which is provided with a heavy collar bearing upon the lower center-plate.

It will be observed that though a number of pieces have been added to the braking equipment in this apparatus, there are several standard parts which have been dispensed with, among which are the elevating-lever with its rod and brackets

This company has in the Transportation Building at the World's Fair two cars equipped with its devices These are a Wisconsin Central freight car of 40,000 pounds capacity and weighing 28,000 pounds, and a freight car of 40,000 pounds capacity, built by the Harvey Steel Car and Repair Works, weighing 25,700 pounds.

Upon a test table near by are eight gauges, divided into sets of four each, one set being connected to each car Two gauges in each set are connected to water dynamometers, of which there is one at each truck so placed and proportioned that the braking pressure applied to the truck-wheels is indicated by the gauge The third gauge is connected with the braking-cylinder, showing the pressure applied there, and fourth gauge to the reservoir, thus indicating the train-line pressure. A Westinghouse engineer's valve furnishes the means of applying brakes

A test made on the Wisconsin Central car gave the following results The car at this time was loaded with four small trucks filled with scrap-iron, each truck with its load weighing 2½ tons, or 10 tons in all, the loads being so arranged that they could be moved from one end to another of the car at will




— PLAN —

| Kind of Brake | Air pressure in lbs per square inch: Train Line. | Final in Cyl'r | Kind of Application | Total braking pressure in pounds: West Truck. | East Truck | Distribution of load in tons: West Truck | East Truck |
|---|---|---|---|---|---|---|---|
| Brake Pres. Regulator ... | 72 | 47 | Service | 16,600 | 8,000 | 10 | 00 |
| Quick Action Auto .. | 72 | 55 | do. | 5,200 | 5,000 | 00 | 00 |
| Brake Pres. Regulator .. | 71 | 53 | Emerg. | 19,000 | 8,200 | 10 | 00 |
| Quick Action Auto...... .. .. | 71 | 62 | do. | 7,200 | 6,500 | 00 | 00 |

### Arbitration Committee Decisions.

It requires careful study of the Rules of Interchange of Cars and clear judgment to decide who is in the right when a dispute arises about damage or repairs done to foreign cars when they are away from home. Cases occasionally arise in which it is exceedingly difficult to do justice between conflicting interests. But these cases are the exception. Nearly all cases that cause contention would be readily settled if both parties to the dispute were properly informed about the rules The rules have been established on a system of mutual concession, and a man cannot tell what his rights are under the rules by mere exercise of common sense. Yet this inclination to use common sense in discussing questions of car interchange leads to many disputes when the common sense is not fortified by a knowledge of the exact wording of the rules. To those who are annoyed with disputes about interchange of cars we would say, study the rules and you will always come out the winner.

The Arbitration Committee's decisions form very valuable reading for those who are interested in avoiding disputes with connecting lines It is surprising how often in these decisions we find the same subject of dispute being referred again and again to the arbitrators. The following are abstracts from a few of the latest decisions.

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A dispute arose between the Alabama & Vicksburg and the C., B. & Q because the latter company charged their shop cost price for an air-hose The A & V. claimed that the other company's charge was 32½ cents above the market price. The Arbitration Committee held the market price to be the basis of the correct charge

---

An inspector belonging to the Aransas Pass Road issued a defect card for a broken transom on a car belonging to the Cudahy Packing Co. Under the rules of interchange owners of cars are responsible for breakage of transoms and body bolsters unless the damage results from derailment or wrecks, and therefore the carding was not necessary in this case. But the owners of the car claimed cost of the transom on the card, and on payment being refused the case was referred to the Arbitration Committee. They decided that the railroad company was not responsible because an inspector made a mistake, and the charge was not allowed.

---

The Pittsburg & Western put two new truck timbers in a Union Pacific car, and the owners claimed that green timber had been used which shrunk three-quarters of an inch and was still shrinking, so they were removed and a claim made for the involved expense The P & W claimed that the timbers put in were the same size as the old ones, and therefore all had been done which the rules required. On the case going to the Arbitration Committee it was decided that the work was not done with the thorough care enjoined by the rule. Consequently the P. & W were held liable for new timbers.

---

One of the worst-known cases of ignorance of the Rules of Interchange was displayed by the Intercolonial Railway in a dispute with the Canadian Pacific The latter road had an I. C. car which had badly decayed bolsters. A request was sent to the owners for a home card, but it was refused, and the case was referred to arbitration. The decision was a quotation from Rule 11, which says that when a car is unsafe, from age or decay, to run, the owners must provide a home card for the return of the car.

---

A dispute arose between the Newport News & Miss. Valley and the Austin & Northwestern, of a character difficult to settle justly to both parties The former road made a charge against the latter on account of having renewed certain journal bearings. The payment was refused on the ground that the cars were new on their way from the makers and that the journal bearings were not worn out, but that they broke through being permitted to run hot The N N & M V held that the heating was due to bad material or bad workmanship. The Arbitration Committee decided that the latter road was responsible, the inference being that careful attention to oiling would have made the bearings run cool. The decision is probably the fairest that could be given, but it leaves railroad companies to bear the loss, delay and annoyance caused by the car builders who turn out journals as rough as files

---

The Atchison, Topeka & Santa Fe destroyed a car controlled by the American Refrigerator Transit Co , and agreed to return the trucks, but claimed that delivering them at the point on the A. T & S F nearest St. Louis, the headquarters of the A R. T. Co , was performing their part of the agreement. The owners of the car would take nothing short of delivery of the trucks in St Louis and the case


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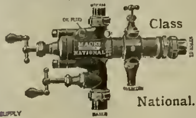


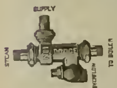


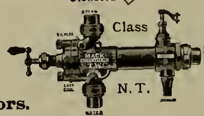


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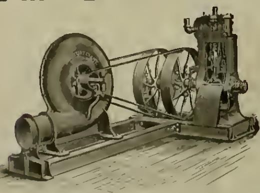

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went to arbitration. The decision was that in equity a railroad company destroying the car of a private company was bound to return the trucks to the repair shops of the owner.

In a transaction connected with the changing of wrong draw-bars, the Keokuk & Western would only allow the Atchison, Topeka & Santa Fé credit at the rate of ¼ cent per pound for the value of wrong draw-bars removed. The latter road claimed that according to the rule in effect at the time they were entitled to a credit of two cents a pound for cast iron and four cents a pound for malleable iron. The Arbitration Committee sustained the claim.

The American Refrigerator Transit Co. raised a dispute with the Erie over a case that was very clear under the rules. The Erie people removed a bent axle from a car controlled by the Refrigerator Company, and the owners refused to pay the usual charge, on the grounds that the axle was up to the M. C. B. standard, and must have been bent by derailment, or that the M. C. B. standard size is of no value. There was no evidence of maltreatment, and the Erie people insisted that the bill should be paid. On the case going to the arbitrators, they gave decision according to the clause of rule 9, which says that owners of cars are responsible for charges caused by bent axles.

A considerable portion of the disputes sent to last meeting of the Arbitration Committee were raised by owners of private cars. Some of these companies are very unreasonable in their dealings with railroad companies.

## Reports of Timber Getting Scarce.

A report published by the Forestry department of the Government gives many useful suggestions about the economy and preservation of our timber supply, which ought to receive the attention of those interested. The Forestry department is doing useful work on this question and, although sending out warnings, does not deal in sensational alarm statements. There have been so many sensational fallacies published about the impending disasters from the destruction of forests that the people are getting to consider all such alarms false.

The alleged meteorological results of so-called denudation, as touched upon in the paragraph quoted above, have been time and again exploded by well-known facts. Saying that the destruction of the forests is exerting an "unfavorable influence" as to water and soil conditions is putting the case more mildly than denudatics usually do, since they ascribe to the fact all sorts of climatic extremes.

But to start out with, the denuding of forests has not resulted to the extent usually implied. While white pine has disappeared rapidly, and continues to so disappear, from the forests of the Northwest, large amounts of untouched hardwoods remain, and important hardwood growths have followed the removal of pine in many localities. Thus the forests have not in all cases been denuded at all, nor deprived of trees sufficiently to have any potent influence on rainfall, soil moisture, drouths, cyclones, floods, earthquakes, volcanic eruptions and various other nightmares of the denudatic intellect. It may be accepted as a fact that the actual and complete denuding of forests is seen in clearings made for agricultural purposes, and not through the domain of saw-mill timber cut over for the available pine, where a rank undergrowth often flourishes. If forests are necessary to rainfall and proper soil conditions, it does not follow that a particular kind of tree is any more essential than another kind. An oak or ash belt is likely as good as a pine grove for that purpose.

## War Time Reminiscences—Captured by Confederate Cavalry.

BY JAMES H. HEVES.

The exact date of this incident in my experience while running an engine for the Federal Government has slipped my memory. My recollection is that it was extremely hot and the year 1864. I left Chattanooga with a full train (fourteen cars) of horses for the use of the line officers of Sherman's army. Nothing occurred until we stopped at a water-tank between Tilden and Resaca, where a lieutenant and several private Confederate soldiers mounted the engine, at the same time informing myself and fireman that we were their prisoners. They immediately proceeded to tie us in such a manner that escape was impossible. While the little party were securing us, the balance of the command were busy securing conductor Kelly (died in insane hospital at Nashville of patent smokestack on the brain), and his crew. After securing the crew and driving to the bush the train-guard, they opened the doors of the cars and jumped the horses out.

I was ordered to fill the engine's furnace full of wood and leave her to her fate. Now, the damper shut very tight, and the wood, green pine, luckily did no damage to the flues, and the next train south pushed engine and train into Resaca. I asked Captain Jim O'Niel why he did not burn the train, and was informed that it was too near a d—d Yankee post, and that a big smoke would have Captain Callahan and his Third Indiana Cavalry in his rear in twenty minutes, and the good haul of horses he had made was enough for him if he succeeded in getting them into General Forrest's camp.

For some reason which I never learned the command divided; one company in command of Captain Martin, came down the west bank of the Oostanaula River. This is the one with which myself and fireman were destined to eventually have a rather exciting experience. It was several months before we again saw Kelly or any of his crew; how long they remained prisoners I never learned, as Kelly always refused to speak of it. From the tank we marched through the woods, perhaps five miles, where we struck the old Georgia dirt road; here they sent out scouts, and we had a lunch of "corn pone" and fat bacon. By this time "Old Sol" was pouring his effulgent rays down with a pressure of about 95 degrees. I think eggs buried in the dust of the road would have roasted. In these days I think North Georgia is blessed with more pure spring water than any other State in the South, but that day it was hours between springs. Then the party escorting us were bent on putting as many miles as possible between the scene of their good fortune and Dan Callahan's cavalry as possible. After making about twenty-two miles and being within three miles of Rome we went into camp for the night, the spot chosen was on the bank of the river, in a fine grove, where Sherman's men had left several good chimneys to build houses around.

After a supper of what we lunched on at noon our entertainers for fear we would in our extreme modesty at being so royally entertained, in the hours of the "stilly" night fold our tents and stealthily scout back to the "Yanks," proceeded to very securely secure us to a large oak tree, our hands were tied behind us and a rope passed through the cords on our wrist, which was passed around the tree and made fast so it would not slip. I was soon in the land of dreams, not so with Burnett. It seems that he in some manner got one hand loose and made his way around the tree so that he could awaken me by pinching my arm. As soon as I realized who he was I whispered and asked if he was loose. "No, but have you got a knife?" I told him where it was and he got it, opened it with his teeth and cut me loose. Being free we proceeded to reconnoiter. Everything was still; we could hear no tread of any sentinel and commenced rolling toward the river, at the foot of the hill.

A roll and a look and listen, then another roll, etc., until we reached the water edge. A quiet sneak along the bank soon brought us to a drift; here we found a slab from a saw-mill; this we launched, proceeded to strip and bundle our clothes, which we secured to the slab with our suspenders. Hearing no noise in the camp of our captors we quietly took to the water and headed for the other shore, which we reached after being carried down the stream—which had a very rapid current—some distance. Safely landed on the other side we took a star for a guide and started eastward, destination Kingston.

Traveling a few miles, we crossed the grade of a railroad that had some ties piled along it—this was the Selma, Rome & Dalton, now a part of the Georgia Div. E. T. V. & G. We must have crossed it near Harper's Station, three miles north of Rome; I know we traveled in a ravine a long time, until we came to a small creek (branch); this we followed to the mouth, where it emptied into a river. This we concluded was the same stream we had crossed when making our escape from the "Johnnies." We finally concluded to travel up it a ways, and see if we could find the Rebel camp we had just left. After a time, we noticed such a difference in the lay of the country, we made up our minds to crawl in the bush, and await for daylight before we tried going further.

In the bush, we got some sleep, in spite of the mosquitoes and ants. Morning came at last, when we took a survey of our surroundings. We found ourselves on the banks of the Etowah River, and close to the Rome Railroad. This road we knew would take us to Kingston, if we could succeed in keeping out of the way of the Rebs. There were several houses and many negro cabins on the bluff, about a quarter of a mile from the river, there was also quite a number of men circulating about the houses; also a few saddled horses, which were soon mounted and ridden away.

Now was our opportunity to skirmish for a breakfast, as we saw nothing but women. Burnett said he would take the chances of getting a bite of something to eat. From the river to near one of the cabins there ran a deep, dry ditch—I have learned since, to drain a low spot back of the houses after an overflow—up which Burnett made his way to nearly opposite the house, where he succeeded in attracting the attention of a good old negro woman, who for one of Uncle Sam's greenback promises to pay, gave him a bountiful supply of good pone and bacon; also informed him "Dat dar want no trouble 'bout gettin' to Kingston except at Mars Wooley's, but dat Mars Wooley's two boys war mighty bad after de Yanks."

We breakfasted and proceeded on our way, keeping well under cover of the river bank until we arrived at Dike's Creek, where there is a house very near the bank of the river and close to the track. In front of this house two horses were hitched, ready saddled and bridled. It would be impossible to pass them on that side of the river, so we crossed to the other side, which was densely covered with cane. After proceeding about a mile up the south bank we crossed back to the north side, which brought us out on the Hargrove plantation, where we met a negro who had been a slave on the Johnstone place, who agreed to pilot us around the Eve and Wooley places, but while talking to the negro we heard the rumble of wheels of an engine, and very soon one came in sight, it was "U. S. 134," Sam Laird engineer.

I stepped on the track and with my hat gave him a stop signal, as soon as he saw us he reversed and went back to Kingston, where he reported the woods full of guerillas. Great excitement prevailed, the iron-clad car was got out and put in front of the engine and about forty men detailed to go out on the road and annihilate the bushwhackers, at the same time three companies of cavalry were mustered to scour the countries for Johnnies. All this time our little party were patiently toiling up the road, keeping well under cover of the river bank and near the railroad. It was well for us I suppose that we did, for about three o'clock P.M. we again heard the rumble of wheels; our party crouched low in the cane-brake. This time the engine passed before we made any sign of our presence.

Perhaps, before concluding, I had better, for the benefit of your readers, describe this iron-clad car. It was an ordinary long flat car, with rounded ends, the sides and ends were built of heavy oak timber, plated with boiler iron, in which, at convenient intervals, loop-holes were placed, only large enough to conveniently let a musket work freely.

After the car and engine had passed, I again jumped onto the track and signaled them to stop, which they did. When I informed the captain that there were no Rebs in the vicinity, he said a few cuss words about the man who would get up such a scare on such a hot day. It was a long time before Laird heard the last of the woods full of Johnnies.

On our arrival at Kingston, I found the "U. S. 126" O. K., except the tool-box, which was empty, the most highly-prized tool taken being my Smith & Wesson.

## The Beneficent Railroad.

The *Weekly News*, of Dundee, Scotland, makes the following comment on railways in connection with the sending of a railway engine-driver to Chicago to make notes about American railroads:

"The swift appliances of modern civilization—the locomotive, the telegraph and the steam printing-press—have effected a transformation of the face of the earth. New territories have been opened up, and an abundance of cheap land has in consequence relieved the pressure that existed in congested countries, and done not a little to promote the general welfare of the people. Barbarism has disappeared before their advance, and they have been able to impress their stamp upon the character of communities.

"The railway in our time has done more in one generation than the slow evolutions of many centuries had brought about, and in the Western States of America we have this illustrated. There was first the railroad, then the town, then the farm.

"Chicago itself owes more than any other city in the world to the locomotive, for it was the railway companies which chiefly helped to build it up. Fully one-third of the railway systems of the United States centers there, and, with its branches, comprises over 60,000 miles of permanent way. Here, then, is afforded an opportunity for investigating the methods of railway labor unequaled in the whole world. Such inquiry is of interest to the general public as having a direct bearing on its safety and its comfort. Public opinion claims a right to express itself regarding the hours of railway men, the fitness of appliances, and the facilities for rapid and comfortable traveling. These are matters that require looking into, for nobody pretends that there is not ample room for improvements and reforms, and it may be sufficient to mention that the systems of machinery in use in mines and private works are in many cases far more effective than those on our railways.

"Another matter of universal interest connected with this department is the working of insurance against death, accident, etc., something of which nature in a general way has been recently advocated in Parliament. The insurance of workmen by their employers is certainly worth knowing something about. It is also worthy of mention that the engine-drivers have one of the most successful organizations in America, and their society has, during its thirty years' existence, evolved many difficult labor problems, and settled not a few.

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### Brooks Suburban Locomotive.

Gauge—4 ft. 9 in.
Fuel—Bituminous coal.
Weight in working order—166,000 lbs.
Weight on drivers in working order—102,-000 lbs.
Weight on forward truck—16,000 lbs.
Weight on rear truck—48,000 lbs.
Driving wheel base—15 ft.
Total wheel base—35 ft. 9 in.
Diameter and stroke of cylinders—18 x 24.
Diameter of driving-wheels—63 in.
Diameter of boiler—58 in.
Number of tubes—250.
Length and width of firebox—102 x 32 in.
Coal capacity—4½ tons.
Capacity of tank—2,600 gals.

We would especially recommend the ample and substantial hand holds and steps on this locomotive. It also has a large, comfortable and handy cab, set up so high that the engineer can see as he ought to.

### Brooks Consolidation Freight Locomotive.

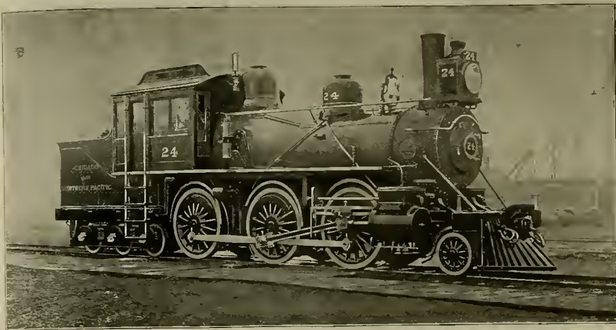
Gauge—4 ft. 8½ in.
Fuel—Bituminous coal.
Weight in working order—147,000 lbs.
Weight on drivers in working order—130,-000 lbs.
Rigid wheel base—15 ft. 6 in.
Total wheel base—23 ft.
Diameter and stroke of cylinders—13 x 26, 22 x 26 in.
Diameter of driving-wheels—55 in.
Diameter of boiler—63 in.
Length and width of firebox—114 x 32 in.

TENDER.

Coal capacity—8 tons.
Capacity of tank—4,000 gals.

ENGINE AND TENDER.

Total wheel base—49 ft. 11¾ in.




Brooks Heavy Suburban Locomotive. Now at World's Fair.


Brooks Tandem-Compound Consolidation. Now at World's Fair.

The National Machinery Co., of Tiffin, Ohio, has issued an illustrated circular showing a new rock-crusher which the company has put upon the market. The machine embodies the Lowry patents, and is of the gyratory type, which is conceded to be the best for stone-crushing where uniformity of product is desired. The ball-bearing or fulcrum is below the head, thereby giving maximum power and leaving the concave entirely open. A variety of other superior features are claimed for the machine. It is made in a remarkably substantial manner, and is likely to prove durable under the severe strains and shocks of service on hard rock.

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James Murray, a noted mechanic of Baltimore, who in 1848 built the curious old freight engine "Mt. Clare" for the B. & O., was the first man to design and build a roundhouse, having radial stalls arranged around a central turntable. He went to Russia with Winans and spent many years in the service of the Czar as master mechanic.

### Motors Taking the Place of Locomotives.

The cities of Louisville, Ky. and New Albany, Ind., are divided by the Ohio river and they are connected for purposes of intercommunication by certain bridges and railroads. The principal means of transit between the two cities has been by a suburban steam railroad, operated by the Kentucky and Indiana Bridge Co., which is a controlled interest of the Louisville, New Albany & Chicago Railroad. Trains over this company's lines and bridge were run about every half hour, pulled by dilapidated Forney locomotives, that looked as if their day of cleaning came only once a year. We do not know how it was that the transportation company got tired of locomotives, whether it was the general slovenliness displayed by the men in charge or the limping discords made by the exhausts, or the smoke, or the rattle of the loose machinery. Certain it is that the company got tired of locomotives and determined to try electric motors.

The resolution in this direction was quickly put into practice and the locomotives have been pushed for good into the back stalls of the engine-house and neat electric cars put into their place. All told there are fourteen new electric motors put upon the service, and each propels a car which seats forty-eight persons and gives standing room to others in proportion to their clinging characteristics.

The novelty of this change is principally notable because steam locomotives and trains continue to be run over the bridge and part of the track used by the electric motors. The latter receive power through a trolley connection with an overhead wire, which is raised high enough to allow common trains to pass. The only radical difference between these electric cars and those generally found on street-car service is that they have large wheels like an ordinary railroad car and flanges made on the M. C. B. pattern.

The men who operate these cars are not so fortunate as the enginemen and conductors of the steam locomotive and train. There is one motorman and one conductor employed in the new service, and they are paid 16½ cents and 15 cents an hour respectively. The motorman appears to have about as responsible a position as the engineer of a suburban steam train, and we do not see the fairness of paying him half the other man's wages.

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We often see, says the *Tradesman*, a boy drilling cast iron for the first time, and when the drill squeals a little he naturally treats it the same as any other metal he has drilled, and squirts a little oil into the hole to stop the squeak, and nearly always stops the drill from cutting also, as the oil on the cast iron forms a glaze, which the drill slips over instead of cutting through. Sometimes clean water will stop the squeak and not glaze the iron, and then sometimes it will act almost as bad as oil, so the best thing to do is to keep the drill sharp enough to cut in good shape and also to relieve the gliding sides so as to take off as much friction against the sides of the hole as possible. Of course, this must not be overdone, and enough must be left to give the drill stability, so as to drill a round hole instead of a polygonal one, which is usually three or five sided.

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The Boyer speed-recorder is making its way slowly into popularity in this country, but its merits seem to be more thoroughly recognized abroad than they are here. The company has just received an order from Russia for a number of instruments, and there are good prospects of its being adopted as a standard attachment for locomotives. About 300 recorders are now in use on English railways, and several have recently been ordered by the New York Central.

# ? A. What You Want to Know. ? A.

**Don't ask questions that simply require a little figuring to determine; make each question separate. No notice taken of anonymous questions.**

(87) English, Chicago, Ill., asks

Please tell me the weight of the train of the Lake Shore "Exposition Flyer," there is a dispute about it here. *A.*—The cars of this train weigh 80,000 pounds each; there being four of them, the weight of the train is 320,000 pounds when running without the dining-car; when this is attached the train weighs 400,000 pounds, or 200 net tons.

(88) C. B. W., Savannah, Ill., asks:

What is meant by cylinder condensation? *A.*—The steam that enters the cylinder contains only sufficient heat to keep it in a gaseous condition. The least abstraction of heat causes part of the steam to turn into water. The metal of the cylinder being cooler than the steam causes some of the latter to fall to water, and this is called cylinder condensation.

(89) Gobo, Helensville, Auckland, New Zealand, writes

I am running a six-wheel coupled saddle-tank engine without a bogie, and we'll suppose we have a leading tire broken. If I jack up the leading wheels clear of the rails can I run home with a light train after having taken down leading coupling-rods? *A.*—It would hardly be safe, especially if the main or center wheels had no flanges; if they had flanges it would be.

(90) D. O'Brien, Mancelona, Mich., asks

1. How can a person find the speed a train is running at by sight? Have heard it was possible, but never learned how. *A.* There is no way. Engineers and other trainmen of long experience learn from daily practice to know by looking at the ground very nearly how fast they are running. 2. What keeps one of those velocipedes on the track when the rider sets over the two larger wheels? The wheels are conical and the flanges do not touch the rail. *A.*—The cone of the wheel keeps the machine centered on straight track.

(91) John S. Clemons, Albany, N. Y., asks

1. Is there any book published on accidents and remedies to W. air brakes? If so, what is the price and whom can I get it from? *A.*—The best work on this subject is "Air-Brake Practice," by J. E. Phelan, or the Westinghouse Instruction Book. The first can be obtained from the Debs Pub. Co., Terre Haute, Ind.; the second from the W. A. Brake Co., Pittsburg, Pa. 2. In beaking a main tire on an American or mogul engine must the spring of the driver be taken out to block it clear of rail? *A.*—Yes. 3. Must engine be jacked up off of wheel and wheel then be jacked clear of rail to block, or can the wheel be run on a wedge and blocked after spring is taken out? *A.*—It is not necessary to jack up at all; run the wheel on blocks. 4. If the engine D wheel have to be jacked, where would you place jack? *A.*—Don't jack. 5. When conductor's valve is open on train or hose blows off while running at high speed, should engineer's valve handle be thrown full on (fifth stop), or should it be placed immediately on lap (third stop)? *A.*—On lap, as this saves the air in main reservoir to release brakes when repairs are made. 6. When an engine's spring-hangers are cutting into boiler, how can it be remedied? *A.*—Change them. 7. When an engine is too low on one side, how can that side be raised? *A.*—By putting shims on the spring-hangers or packing up under driving-box saddles. 8. What is best way to fix an engine's driving-box when it is broken vertically through center, so as to get engine to shops without cutting bearing? *A.*—Relieve that bearing of most of its load. 9. If a spring to a pony-truck breaks and you have not got another, can it be blocked over top of box like a driving-spring was broke? *A.*—Yes. 10. In jacking a mogul engine to put a spring in back driver, which is best, to cut engine loose from tender and put jacks to rear (one on each side), or leave engine and tender coupled together and put both jacks on same side (one front and one back)? *A.*—If you have surplus energy and muscle that must be used, it might do to leave the tank on and lift it. If you want to get the spring in, jack up the engine square; if you want to tip her over, jack on one side only. 11. When double-headers are being run and head engine handling brakes, and from some accident the head engine's brakes fail and engineer wants to signal rear engine to handle brakes (air, I mean), what whistle-signal does he blow, and how should rear engine answer? *A.*—A special rule is used on each road where double-headers are run. Usually a call for brakes from the head engine puts the second man on guard. 12. If you started on a trip at 12.00 o'clock at night, in making out your report what would you put after 12.00 to designate it? If it was 12.00 at night you could not put 12.00 A. M. or 12.00 P. M.? *A.*—12 night or 12 midnight.

(92) R. L. V., Columbus, Ga., writes

1. What is the best way to get an exact dead-center on the road without a tram? *A.*—A dead-center close enough for all practical purposes on the road may be found by watching when the crosshead is at the end of its travel. Here is a more elaborate and more accurate method: Pinch engine until crosshead is near end of travel. Place two-foot rule on end of crosshead, and with a pencil draw line on guide at that point. Then open rule to make a right angle, and put one side flat on wheel cover and push other end as flat as possible on tire. Draw lines at the edge of rule on wheel cover and tire. Pinch engine till the crosshead comes back to the mark made on guide. Then place foot-rule exactly in position it was in before on wheel cover, and make a mark on tire where other end of rule comes. There will now be two marks on the tire. Bisect them—that is, make a mark half-way between. Lay rule on wheel cover again and pinch the engine. When the half-way mark on tire comes to edge of foot-rule the engine will be on dead-center. This is making a rule take the place of trams. 2. Why is it that machinists file rods and brasses without finding out striking point of piston? *A.*—Some machinists are like some other careless people, and will take chances to save work. Men with an interest in their work never put up a main-rod without finding the striking points of the piston. 3. In jacking up one pair of wheels of a tender-truck to chain them clear of the rails for a broken flange, where would you place the jack? *A.*—Take some weight off by jacking up tender, then put jack under axle. It is better practice to take wheels from under a box car and change the tender-wheels. 4. In jacking a pair of driving-wheels up for broken flange or axle, where would you put the jacks? If they were put under the axle, how would the top of jack be fixed to prevent axle from slipping off? *A.*—Run the engine on wedges, or frogs, and avoid jacking. In jacking up an axle, put piece of wood on top of jack to form seat for axle, as may be seen done in nearly all engine-houses daily. Keeping your eyes open when visiting the roundhouse is not a bad way to obtain information of value. 5. If the front springs of mogul engine broke and you had none to replace them, is there any other resort than blocking on top of front boxes? *A.*—No. 6. Suppose you broke the radius bar-bolt of a mogul engine and had no chain, what would you do? *A.*—Block the bar in position, or run slow till a chance could be got. The answers to the other questions ought to be obvious.

### To the Foremen Blacksmiths of the United States.

Your committee appointed to ascertain the number of foremen blacksmiths favoring the establishment of a national organization for mutual benefit have received such a large number of favorable replies that we are decidedly of the opinion that we are justified in calling a meeting for that purpose, to be held at Chicago, on the 5th of September, at 10 o'clock A. M., at 901 Rookery Building.

We hope to have a large attendance, and respectfully solicit the hearty co-operation of our friends, the master mechanics and other railroad officials, who have heretofore been alive to our interests, and who, so far as we have been able to communicate with them, have expressed themselves as favorably inclined to our laudable undertaking, and we feel confident that we can rely on their advice and assistance.

We cordially invite representatives from the mechanical press, and iron and steel houses, who may be interested in our better education as to the manipulation of their products.

Hoping that those who are eligible will make strenuous efforts to be present with proper credentials, we remain,

Very truly yours,
J. J. Thornton,
C. H. Williams,
W. G. Lories,
Geo. F. Hinkens,
Committee.

### Could Not Break Him.

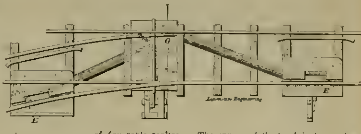
The telegraph operator at X. had a reputation for never "breaking." The boys at Bu. had tried it over and over again. Finally Charlie H., who had recently come to Bu., and who was considered a rapid sender, concluded he would try it on X., and accordingly gathered up a batch of thirty-five or forty messages for the occasion. X. answered with his usual promptness, and was informed that he might expect them to come red hot. Charlie took off his coat and sailed in. Ten messages off and not a break, twenty, and no signs of being hurried at the X. end, although Bu. was sweating at every pore; later on, the whole batch had been sent without a break. This was wonderful, and Charles was crestfallen. Half an hour later the manager at X. called Bu. on another wire and asked that office as a special favor to let them know any time they had such a heavy business for X., as the operator had about 4,000 yards of paper strung out on his instrument, and the instrument itself was not in very good fix. This "fly" operator had an old-fashioned Morse register that done its own "taking."

No further efforts were ever made in Bu. to break a register.

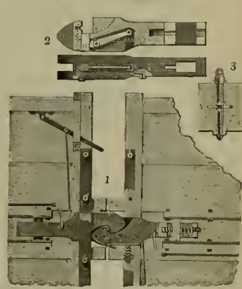
### A Safety Switch Lock.

O. W. Tew, of Rome, Ga., an engineer on the E. T. V. & G., has recently patented a switch lock that prevents the turning of the switch except in the presence of a train—thus preventing malicious persons from tampering with switches away from stations.

He accomplishes this end by putting a lock under the throw-rails, which can only be opened by pushing down the spring of a track instrument, one of which is located fifty feet or so in front of the switch on the main line, and the other the same distance on the siding.



The spring of the track instrument can only be compressed by the flange of a car or locomotive. The sketch makes the device plain; if the track instrument is compressed it releases the lock by moving the piece *G*, when the switch is moved to the main line again it locks itself automatically. This device has been tried on one of the steam tram-roads of Rome, Georgia.



### A New Combination Car and Air-Hose Coupler.

Mr. Robert N. Ervin, an engineer on the G. C. & S. F., at Temple, Texas, has recently taken out a patent on an improved form of Miller coupler.

He has special arrangements for attaching his device to the car, but the most radical departure from general practice is in the formation of an air connection through the coupler and the doing away with air-hose.

The drawheads are made of malleable iron and have interlocking tongues and grooves to prevent vertical movement. The air connection is made through the center of the casting to the face of the hooks, where an adjustable plug forms the joint. Provision is made for coupling an ordinary hose to this draw-bar.

The best device in the combination is the means for uncoupling the hooks. Instead of jerking the drawheads apart by moving them bodily, there is provided inside each head a push piece operated by a lever, as shown in Fig. 2. When these are forced in they unlock the hooks. This might stop some of the jerking and profanity now employed to uncouple Miller hooks.

# Locomotive Engineering
## A Practical Journal of Railway Motive Power and Rolling Stock.


VOL. VI, No. 10. NEW YORK, OCTOBER, 1893. 20 Cts. Monthly $2.00 Per Year.

### Historical Locomotive.

**The First Locomotive Built in New Jersey, Now Famous for their Manufacture.**

One of the most ingenious men who ever lived in America was Seth Boyden, of Newark, N. J. Mr. Boyden made many inventions in textile machinery, invented the governor that controlled by handling the valve instead of throttling the steam, invented malleable iron, invented patent leather and devices for its manufacture, and built the first locomotive turned out in the State.

He only built two locomotives, the "Orange" and the "Essex," both used on the Morris & Essex road, now the D., L. & W. His first locomotive was unlike anything before built, and modern writers have given him credit for making the first outside cylinder locomotive; this, of course, is a mistake, for the "Rocket" herself was an outside cylinder machine. Boyden's locomotive was the first outside cylinder engine that had her cylinders fast to the frame instead of the boiler or smokebox, and the cylinder-chest and guide arrangement was closely followed for years.

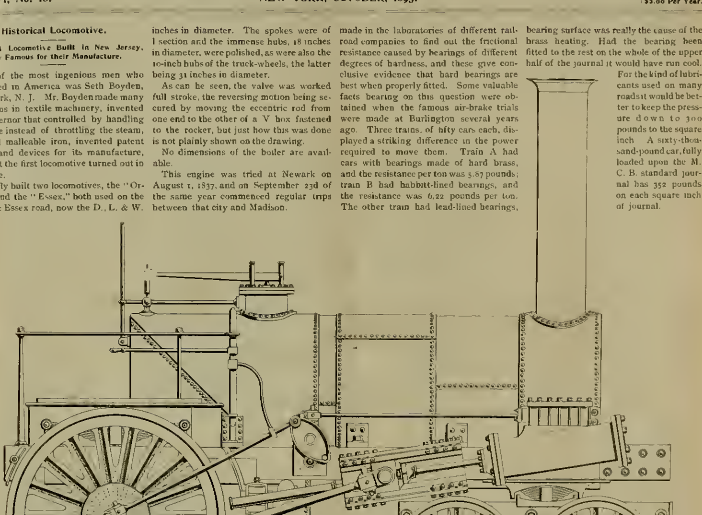
The original drawing from which our engraving was made, is the work of Mr. P. I. Perrin, still living, who at that time, 1837, worked for Seth Boyden as draughtsman and machinist, and was for forty years connected with the Taunton Locomotive Works.

The cylinders were 8¼-inch bore and 26-inch stroke. The driving-wheels were solid cast-iron, flanges and all, no tire, 53½ inches in diameter. The spokes were of I section and the immense hubs, 18 inches in diameter, were polished, as were also the 10-inch hubs of the truck-wheels, the latter being 31 inches in diameter.

As can be seen, the valve was worked full stroke, the reversing motion being secured by moving the eccentric rod from one end to the other of a V box fastened to the rocker, but just how this was done is not plainly shown on the drawing.

No dimensions of the boiler are available.

This engine was tried at Newark on August 1, 1837, and on September 23d of the same year commenced regular trips between that city and Madison.



First Locomotive Built in New Jersey. Seth Boyden, 1837.—From the Original Drawing.

### Soft Bearings Cause Hot Boxes.

There is a mistaken belief among many railroad men that a soft bearing causes less friction than a hard one, and that on this account a mixture that produces a soft bearing is best to use, since there will be less annoyances from hot boxes. This belief is largely due to the success with lead-lined bearings, but it ought to be understood that a soft lining does not reduce the friction, it merely presents a surface which quickly conforms to the journal or pin. When a journal has to grind down a brass bearing to make it a good fit, the resulting friction is likely to cause a hot box. When the brass is made a perfect fit before being put into service, it runs with less friction than a lead-lined bearing.

Very exhaustive experiments have been made in the laboratories of different railroad companies to find out the frictional resistance caused by bearings of different degrees of hardness, and these give conclusive evidence that hard bearings are best when properly fitted. Some valuable facts bearing on this question were obtained when the famous air-brake trials were made at Burlington several years ago. Three trains, of fifty cars each, displayed a striking difference in the power required to move them. Train A had cars with bearings made of hard brass, and the resistance per ton was 5.87 pounds; train B had babbitt-lined bearings, and the resistance was 6.22 pounds per ton. The other train had lead-lined bearings, and the resistance per ton was 7.51 pounds. This makes a material difference in the power required to move trains with hard bearings, and those with lead-lined bearings considered by many people the ideal bearing for cars. Between the axial resistance of the hardest bearing and that of the softest there is a difference of 28 per cent. in favor of the former. This means that when well-fitted hard bearings are employed, an engine will pull several cars more to the train than it will do with soft bearings.

Trainmen will not readily believe this, because very hard brasses frequently cause heating and have to be removed on the road. When these are examined it is found that the journal has made very small impression upon the brass, and that the bearing was confined entirely to a narrow strip across the top. This limited amount of bearing surface was really the cause of the brass heating. Had the bearing been fitted to the rest on the whole of the upper half of the journal it would have run cool.

For the kind of lubricants used on many roads it would be better to keep the pressure down to 300 pounds to the square inch. A sixty-thousand-pound car, fully loaded upon the M. C. B. standard journal has 352 pounds on each square inch of journal.

The secretary of the Traveling Engineers' Association sent out a letter in August asking forty-eight general managers to grant leave of absence to traveling engineers and furnish transportation to the fraternity to the meeting in Chicago. All answered, forty-seven of them granting what was asked and writing encouragingly about the new educational association. One, I. A. Sweigard, of the Reading, wrote a regular Reading letter, refusing to let his traveling engineers take part or to grant any favors to the men who, at their own expense, are trying to increase the engine economy on railroads by a systematic education of the men. The Reading management are opposed to education for men who work, or direct work, they want wooden-headed men with dry rot, and they have one—he's general manager.

## *Railroad Coppersmithing—II.

By John Fuller, Sr.

MAKING COPPER AND BRASS PIPE.

Copper and brass pipes are made when it is necessary to do so, in lengths of from 10 to 12 feet, and from ½ inch in diameter to any required size. With the invention of the steam engine the demand for copper pipes and brass tubes increased so rapidly that it created a contingent trade, and many men were employed exclusively making copper pipes and brass tubes, who were called by the trade pipe-makers. Their apparatus, however, is not adapted to a locomotive shop, and so will not be treated of here. Locomotive and marine coppersmiths are now supplied with all the smaller sizes of straight pipes, both copper and brass, ready to their hand; but formerly we made them all. There have been rapid strides made in this line, and like all other arts, that of the coppersmith has had to succumb to the advance of scientific and practical investigation. Copper pipes and brass tubes are now drawn solid, that is, made without a seam, yet it often happens, either from choice or an emergency, that the coppersmith is called on to make a few lengths of pipe, and the most efficient method of doing this work by hand will now be described. We must first have the circumference of the pipe wanted. If the sheet of which the pipe is to be made is heavy—that is to say, an eighth of an inch in thickness—then the diameter with the thickness of the metal added multiplied by 3.1416 gives the circumference, thus. Let the pipes required be 4 inches in diameter inside, and ⅛ inch in thickness; then $4 + .125 \times 3.1416 = 12.9591$, or 13 inches. Now to begin, we cut out the strip 13 inches wide and the length wanted, then with a thinning hammer, Fig. 5, thin the edges to a feather edge on the opposite sides of the strip, it is then turned and lapped only. If, on the other hand, the sheet is light, the edges must be cramped before thinning. If the pipe is less than 5 feet long and 2 inches in diameter we use a forming board 6 feet long and 12 inches wide and 2 inches thick, reinforced on each side with pieces 5 inches wide and 2 inches thick; the inside edges are then beveled off so as to form a trough 5 inches wide at the top and 2 inches at the bottom. Fig. 6 is intended to show this trough.

Fig 5

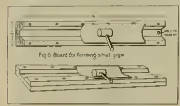


Fig 6 Board for forming small pipe

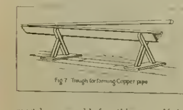


Fig 7 Trough for forming Copper pipe

The sheet, after being annealed and scoured, is laid on the trough and sunk in it with the mallet used in the manner shown in the illustration. This gives the first form. If the pipe is more than 5 feet long and 4 inches in diameter, then we use a trough (Fig. 7) made of two long 2-inch oak planks, placed in crossed pieces similar to a saw-buck, and laying at right angles to each other. The sheet of metal, after being properly prepared as before described, is laid in the trough, and a straight iron bar of sufficient weight is let fall on the metal in the middle, which yields to the falling bar, and thus the first move is made in forming large pipe. It is then placed the other side up over one of the edges of the trough and brought further together with a mallet, then closed in the trough. When it has been brought together sufficiently, the joint is laid even on a steel bar, fastened at the end in the mandrel block as in Fig. 2, Chap. 1. If the pipe is made of thin sheet-metal—say,

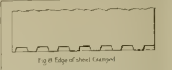


Fig 8 Edge of sheet Cramped

16 to 18 gauge—then the joint should be cramped together. This is done by cutting one edge about every two or three inches with a sharp chisel held slantingly, so that the cramp will form a lap where it is cut, as shown in Fig 8. The edge is now suitably thinned, after which the sheet is turned round. The outside cramps are to be lifted with a tweezer (Fig. 9), so as to admit the other edge that is not cut, and which is put between the cramps, one going inside and the other outside. The pipe (Fig. 10) is then bound together with binding wire, placed about two feet apart and pulled up tight. The cramps are now closed down and the joints laid even with a hammer or a mallet to suit the joint required. The joint must now be made to chatter—that is, jarred to loosen it enough so that the solder may have room to flow freely through the joint when it is being brazed.

All the foregoing directions having been followed successively, we now proceed to charge the joint with spelter. The spelter is first washed clean, then mixed with clean water and borax, equal parts by measure of spelter and borax being used. It will be found that the best results are obtained if the mixture is made ready a few days before it is wanted for use. To charge the seam with solder, take a strip of metal a foot longer than the pipe and form it into a V-shaped reed (Fig. 11), large enough to hold a sufficient quantity of spelter to fill the joint. Fill the reed evenly with the mixed spelter, and then slide it through the pipe, laying it evenly on one side of the seam. Then turn the reed over on the seam, jar the solder out of it and carefully remove the reed, being watchful that none of the solder is dragged from the seam while it is being removed. The pipe is then ready for the fire. The fire must be clean and made of clean coke, care being taken that no lead or soft solder is laying about on the forge nor in the fire. The pipe is now taken to the fire and the solder gradually dried, being laid on the supports (Fig. 12), which are made of suitable angle-iron and bolted to a heavy broad foot so as to stand firm. The angle-irons have holes punched in them about 1 inch apart, and a 1½-inch rod is run through with a wheel between the standards, having a groove in it large enough to carry the pipe in, so that as the joint is being brazed or soldered down it can easily be drawn through the fire without any unnecessary friction. During the process of soldering, a pan of finely powdered borax must be at hand in case at some point the spelter should need more to flux it. After the pipe has cooled it is taken to the mandrel for rounding, and the seam laid up for filing, after which the seam is cleaned off by a sharp file, and if there be any faulty places in the seam they are made good. The work now being perfect, the pipe is finally smoothed up true with a bright top swage ready for use.

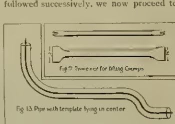


Fig 9 Tweezer for lifting Cramps

Fig 13 Pipe with template lying in center

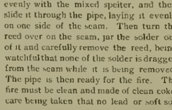


Fig 10 Pipe bound for brazing

Fig 11 Reed for placing Spelter on Seam

TAKING TEMPLATES.

Taking templates for bends is one of the most important features as an adjunct to the successful performance of the operation of bending, for if the template be taken without the necessary knowledge, trouble often ensues. Many a good piece of work in other ways has been mutilated and spoiled by ignorance on the part of the maker of the bend, or the maker of the template, or perhaps it would be said from the want of a mutual understanding between them, when it happens that the coppersmith does not take the template himself, nor sees the position the pipe is to occupy. Templates for use at the bending-block should be made from an iron rod which is stiff enough to retain its form without fear of alteration while being handled at the bending-block. It should be formed so that it will run through the center of the pipe after being bent, as shown in Fig. 13. Templates for large work are better and more safe and satisfactory when made of wood by a pattern-maker, showing the exact curve by cutting boards and nailing the flanges to them in the position desired. Three of these templates are here shown. Fig. 14 represents a single bend, Fig. 15 a double or S bend, and Fig. 16 a double bend, one end of which is made to stand at right angles with the other, and shows clearly how these templates are made. When the position the pipe is to occupy affords sufficient space, due regard, care and attention should be exercised so that the pipe, when finished, will hang perpendicular and lie horizontal, and the bends occupy as near as practicable the center of the space through which the bends run, that is to say, neither cramped nor straggling, but filling the space with a flowing ease. Having the templates now all in proper shape, we will proceed to filling and bending.

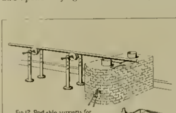


Fig 12 Portable supports for holding pipes while brazing

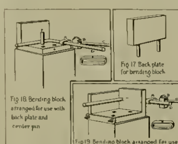


Fig 17 Back plate for bending block

Fig 18 Bending block arranged for use with back plate and center pin

Fig 19 Bending block arranged for use with Lead piece and Back plate

Locomotive Engineering N.Y.

FILLING AND BENDING.

All copper pipes and brass tubes should be carefully annealed before bending, that is, that part which is to be bent. The other ought to be left hard. The part to be softened should, when hot, be cherry red, in a clear north light (not sunshine); when cold, the part to be bent is filled with lead or resin, whichever is the most suitable to the particular bend it is required to make. We usually put the end not to be bent in the pit for convenience in filling, if a long end. (There are a great many different kinds of compositions used in as many different shops, but after using them all I have concluded, for general work, lead or resin answers for all purposes.) If the bend required is short, that is, part of a small circle, lead is the best for the purpose; new, soft lead, without any foreign substance mingled with it. If, on the other hand, an easy flowing bend is desired, then resin is best adapted to the purpose. It is necessary here to say, for the benefit of the learner, that, after continual heating and cooling, resin loses its rigidity and becomes soft, therefore it should be kept fresh by renewing occasionally as it may be necessary. If the bend is to be made on the end of a long pipe it is not necessary to fill it the whole length. We usually roll up a hard ball of paper or cotton waste, and ram it in tight as far as it has been annealed for the bend, and then pour in the resin or lead as the case may be. When the work is done, and the lead is all taken out, heat the pipe a blood red and the wadding will fall out, or it may be blown out by applying the blast pipe to the cool end. We will now proceed to the bending-block. The block is used with the center-pin, when, from the nature of the work, nothing else will answer in its place. It will be found especially adapted to a great many forms of bending which practice and close attention alone can teach the learner. It will be noticed, Fig. 17, that the back plate is a piece of iron, usually about 1½ inches thick, with two legs, the top of the bending-block having four holes an equal distance apart to receive the two legs on any side, so that with either the lead-piece or the center-pin the bending may be done on whatever side of the block is most convenient to the operator. Fig. 18 shows the block ready for bend-

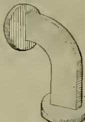


Fig. 14

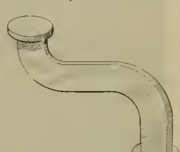


Fig. 15

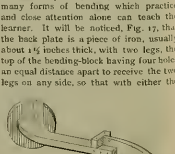


Fig. 16

*Copyrighted by John Fuller, Sr., Seneca, Kan. 

ing. *A*, loop; *B*, packing; *C*, lever; *D*, pipe to be bent; *E*, center-pin; and *F*, back plate in position for work. The pipe is first marked by laying the straight part of the template on the pipe and running the curved part along until the straight part of the other end of the template lies level on the pipe again, and marking with chalk where the bend begins and terminates on the pipe. It is then laid between the pin and back plate (Fig. 18), or put through the hole in the lead-piece, as shown in Fig. 19. Between the back plate and pipe is put a soft piece of wood or lead; these are to save the pipe from being marked by the pressure exerted against the pin and back plate in the operation of bending. (It is always necessary to have a helper at the block when bending.) Now put the loop *A* on the pipe and slip the lever *C* through it, which may be of iron or wood—in some cases a wooden lever is best, in others an iron one. Then put a block of soft wood, *B*, between the lever and pipe. After the loop is on one mark and the other behind the pin, or just inside the hole in the lead-piece, apply the necessary pressure to bend it to the required curve, giving it attention as it goes round that the curve is going evenly and not one place more than another. The rope loop *A*, Fig. 18, is made of one strand of rope, and is formed like a sailor's grummet. The copper loop shown at the side of Fig. 19 is made of a strong piece of sheet copper. Sometimes the rope is best adapted to the job in hand, at other times the copper loop; experience must dictate this. With the apparatus described, pipes as large as 5 inches may be easily bent. If anything larger is needed, a hydraulic press must be provided.

BENDING IRON PIPE.

In a locomotive shop it often happens the coppersmith is called on to bend iron pipe which is used for sand pipes, or when iron is preferred for hand rails in place of brass. I have seen unpleasant things occur when the workman was deficient in the requisite knowledge to perform the work without filling the pipe. Iron pipe may easily be bent without filling if the proper precaution is used while the work is being performed, upon which a few hints are here offered. In the bending of pipe it should be observed by the operator that as the bending proceeds the outside of the bend must be stretched (and in the case of copper pipe, the inside is correspondingly upset), but in bending iron pipe we contrive to get all the stretching out of the back of the pipe, thus. Lay the template on the pipe in the center, as before described, and mark the length of the bend. Now warm the pipe and flatten it a little with a mallet, making it an oval along the portion to be bent; then have a soft wooden block like a two-pronged fork, of sufficient strength, screwed fast in the vise, and make the pipe hot at the back, a bright cherry red, and the front or inside of the bend keep as cold as possible. If the inside should get hot, cool it with water, always having a pailful at hand. Now having the pipe hot, put it between the prongs of the wooden fork and apply sufficient pressure until the pipe has a tendency to flatten the other way; then make it a little oval again, and repeat the process until the bend is made the curve required. Iron pipe may also be filled and bent in the same manner as copper pipe, or by putting it through a hole in a block of soft wood.

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## What the Vice-President's Chief Clerk Does, While He Is Resting.

Expressing a longing for a "soft snap," such as our friend, the chief clerk to the Vice-President had, he shocked us by affirming that he had more business to attend to than a lone dude at a watering place. We asked him to take a memorandum of his routine work for one day, and the result is given below.

"At the desk at 8.40 A.M.; open mail and handle ordinary current business; examine morning reports showing work of the Traffic and Transportation Departments of the previous day; submit these reports, together with such correspondence as requires his action, to the chief; comply with his instructions in reference thereto and reply to mail. During the day much time is spent in approving vouchers, examining reports and requisitions, taking necessary action thereon, countersigning passes, answering telegrams, etc.

The first caller is the chief clerk of the Passenger Department, with one of the soliciting passenger agents, to discuss the securing of a large party of World's Fair excursionists.

Then comes a general agent of the Passenger Department, who wants to know how we are getting along in convicting the "other fellow" of manipulating rates.

Then comes our old standby, the railroad man hunting a job, who is easily gotten rid of with a promise to bear him in mind when a "suitable" vacancy is heard of.

The head of the Operating Department now strolls in for a little general talk.

He is closely followed by his chief clerk who comes to answer an inquiry, and to explain how he overlooked doing something that he should have done.

He is followed by the President's secretary, who brings a complaint from the Board of Railroad Commissioners, requesting us to abolish a grade crossing because a man was injured who tried to cross the track at the same time the locomotive was crossing the county road.

Now comes the President's stenographer, who wants the chief to say what character of reply should be sent to a communication he submits.

He has not received his answer before a car builder turns up with a statement that he has lost all of his original papers relating to a recent purchase of equipment, and would like to have duplicates executed.

The next fellow to turn up is an old friend, who is running the "best" railroad paper published. He wants a pass for one of his assistants to attend the Lakewood Convention. This case is not a difficult one to handle, and he is soon disposed of.

Next comes the auditor, with some passes which have been honored after expiration.

Then we have the porter of the private car which is going to the World's Fair with one of the high muck-a-mucks. He gets his instructions and goes.

Then we have an engine-builder, who drops in to explain why he is behindhand with his deliveries, and to make promises.

The next is the coal freight agent, who thinks the general situation is bad, and wants to know how "the other feller" gets so much coal to haul.

Then comes the grain agent, who discusses the situation generally, and tells us why the grain is not coming to the seaboard in as large quantities as it did last year.

The general freight agent then comes in to tell us about a request he has had for a special rate.

Next we have a pass fiend who wants his pass made good on the Limited.

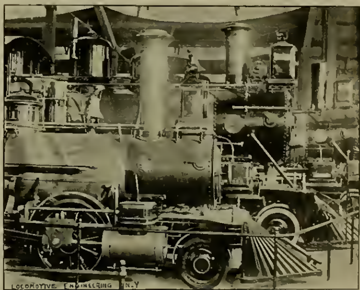
He is followed by a man who says he would like to get his bill paid, and who is respectfully referred to the treasurer.

The head of the Operating Department again turns up to impart a little information, and to invite us to look at a new car-float he is having built.

The next is the coal sales agent, who drops in for his daily chat.

Then we have a member of the legal profession, who wants us to give him the record of an ex-employé.

He is followed by one of the company's tenants, who wants permission to assign his lease, and while we are discussing real-estate matters with him in comes a man to sell the chief a country place.




A CORNER IN THE TRANSPORTATION BUILDING AT WORLD'S FAIR.

The chief clerk of the Operating Department again turns up to tell us why some empties were not gotten around as quickly as they might have been.

The company's attorney now drops in to get some facts which are, of course, made to fit the law.

Then comes the purchasing agent, who wants to explain why he doesn't buy everything from everybody, and he is followed by the superintendent of motive power, who comes to report upon a new mechanical device and discuss the advisability of making a test. Then comes the real estate agent, who wishes to confer about the sale of some of the company's land.

Then the treasurer walks in and comments upon the tight money market.

He is followed by an ex-officer, who simply drops in to say howdy-do.

Next is one of the executive officers, who wants to talk over the best method of handling a particular matter.

The chief clerk of the general manager's office again turns up with information, and he is followed by an insurance man, who comes to tell us why rates are not lower, etc.

The superintendent of motive power again turns up to talk over Convention matters.

Another railroad man now comes in, of course, "the best" paper also, with a request for two passes to the Convention.

The superintendent of telegraph then drops in and tells me I am wearing a pretty cravat. He gets the cravat the next morning.

The day is wound up with a call from a supply man, who expects us to express the usual admiration and astonishment at his new suit of clothes and his diamonds.

As the clock is now quite close to 5 P.M., we sign the mail and close up for the day.

## Promotion of Traveling Engineers.

The rapid upward movement of the men who hold the position of traveling engineer on our railroads may be judged from an item in the address of President Conger at the Traveling Engineers' Convention. He mentioned that since the organization of the association the following members have been promoted: Geo. H. Brown, master mechanic of the Chicago, Milwaukee & St. Paul; J. H. Burns, assistant master mechanic of the Burlington, Cedar Rapids & Northern; James Fitzmaurice, master mechanic Chicago Terminal & Transfer Co.; T. J. Hennessy, master mechanic, Michigan Central; Theodore P. Jacobs and James Tobin, master mechanics, Mexican National. Secretary Thompson has also been promoted to be engine dispatcher at Elkhart, on the Lake Shore road.

## Noticing Things.

A roundhouse foreman who has to perform the functions of a physician in diagnosing all the maladies that locomotives are heir to requires to be of exceedingly observing habits, or he is likely to fail in detecting disorders. The habit of noticing things can be greatly developed by practice. Some men will walk through a shop and take a mental note of everything to be seen, while others with equally good eyesight and equally interested in the place will merely have a vague idea of the kind of tools and material that were seen. People have practiced, as an amusement competition, in trying how many articles they could enumerate in a shop window after a passing glance, and it is wonderful how expert they became. If an enginehouse foreman practices going quickly around his buildings and training himself to note as many things as possible about the engines, he will soon come to perceive at a glance everything that requires attention.

Mr. R. W. Bushnell, master mechanic of the Burlington, Cedar Rapids & Northern, has a wonderful faculty for noticing things out of order about an engine or in a shop. The writer was foreman under Mr. Bushnell for some years, and it was amusing, and sometimes unpleasant, to find how certainly he would find out everything that was wrong in his daily tours through the shop. He would come striding in as if time was of the utmost importance. If there was something you did not wish him to see, you would walk with him and try to divert his attention in the other direction from where your weak point was, and just when you thought he was steered safely past he would glance back and find out what you had been trying to hide.

The advantage to an enginehouse foreman of this capacity for noticing things was lately brought freshly to my attention while visiting a large enginehouse near New York. As I was walking round with the foreman, an engineer came up and began complaining about his tender riding so hard that it shook the coal off. The fireman had to ride the greater part of the time on the tender, and he complained that the rough riding was shaking his teeth loose. The foreman remarked that there had been a great deal of trouble lately with rough riding tenders. There had been complaints of this kind ever since they began using springs from a maker whom he named. He believed that the springs were too stiff. By this time we had got to the engine, and the springs were examined. They did not look too heavy for the load carried, but the foreman concluded that he would put in a lighter set. I noticed that the springs reached almost to the edge of the end pockets, and suggested that the ckets were cramping the springs and preventing free movement. Close examination proved that this was the cause of the rough riding and the proper remedy was applied. It seemed strange that several tenders were being shaken to pieces from this defect, without the trouble being detected at once. A new make of springs had been introduced, and a mistake had been made in specifying the length with the result stated. A. S.

## Organization of the Traveling Engineers' Association.

In his address at the First Annual Convention of the Traveling Engineers' Association, President Conger said:

"For two years past the preliminary work for our organization as a society was being done in a very thorough manner by our energetic secretary, who corresponded with all the traveling engineers he knew or heard of, with a view to getting them in line for the first start. Some took hold enthusiastically, others were a little backward, and some thought they would see about it later, after it was shown it would be a success. Thanks to his executive ability as well as persistency in sticking to it for so long a time, enough were interested to promise him their support and attendance to make a fair start.

"In October, 1892, he called a preliminary meeting for November 12th, at the L. S. & M. S. engine-house in Chicago, in which fifteen took an active part. A committee to draft a constitution and by-laws was appointed, also a committee to arrange for the meeting to be held in New York, shortly after which a call was issued to meet in the office of LOCOMOTIVE ENGINEERING in New York to perfect the organization. On January 9, 1893, eighteen members were there in person and thirty others by written application. The present constitution was adopted, officers elected, subjects for investigation selected, and committees appointed to attend to the questions, and all hands went to work with a will, the result of which you see to-day.

"In this work we were very ably assisted by Messrs. John A. Hill and Angus Sinclair, who gave us the use of their office to meet in and helped us in various ways. Mr. Hill kept the question alive in the columns of LOCOMOTIVE ENGINEERING, and sent out our circular calls everywhere. On the first night of our meeting they gave us a banquet, which was enjoyed by all present. Ever since the first start these gentlemen have helped us along, and we are proud to have them with us as members. The thanks of the association are due them."

"We are now on a good foundation, have money enough in the treasury for our moderate expenses, 109 members on the roll hailing from all sections of the country, all of them bright, active go-ahead men, who believe in being progressive in their vocation and keeping up with the procession of improvement. To be successful as an association we must keep up this gait, interest ourselves in the joint work we meet to do, exchange ideas on the best methods of doing the work of the traveling engineer, keep our hands off the work that properly belongs to others in charge of different branches of the locomotive department, and strive to make ourselves useful to our superior officers. Our motto, 'To improve the locomotive engine service of American railroads,' shows what we mean to do; the next thing is to show each other, and railroad men generally, that we can do it.

"This association expects to give opportunities to all its members, by interchange of opinions and reports of results of different methods, to profit by each other's experience whether success or failure. If all take the proper interest and are prompt in showing it we can, as an association, do a good work, which will be appreciated both by officials and employés."

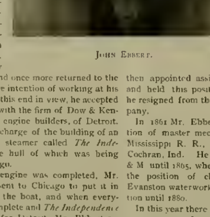
## Sketch of the Life of John Ebbert.

BY LEWIS GLEASON.

The man whose photograph appears in connection with this article is one of the oldest, if not the very oldest, locomotive engineers in the country.

John Ebbert was born in Westmoreland County, Pa., June 19, 1815. His father, who kept a tavern on the Philadelphia and Pittsburg turnpike, was also the keeper of the toll-gate, and when not busy at either one of these avocations he worked at his trade of harness making.

At the early age of fifteen years John Ebbert was apprenticed to McClurg & Wade, machinists, of Pittsburg, and served five years' apprenticeship. At the expiration of that time he left Pittsburg and went to work for the Alleghany Portage R. R. as a journeyman machinist in the company's shop at Johnstown, Pa. He remained in the shop but a few months, and was then transferred to the road as engineer of an engine running between Plane 1 and Plane 2. This was in 1835, and from this time dates his career as an engineer, now fifty-eight years ago. Mr. Ebbert remained for two years in the service of the Alleghany Portage road. He left the company in 1837 to accept a similar position on the Michigan Central R. R., and ran an engine between Detroit and Ypsilanti. He remained with the Michigan Central for five years.



JOHN EBBERT.

In 1842 he entered the service of the Boston & Albany road and had a run between Springfield and Worcester. He remained with the B. & A. Company only six months, and once more returned to the West, with the intention of working at his trade. With this end in view, he accepted employment with the firm of Dow & Kendrick, marine engine builders, of Detroit. Here he had charge of the building of an engine for a steamer called *The Independence*, the hull of which was being built in Chicago.

When the engine was completed, Mr. Ebbert was sent to Chicago to put it in place aboard the boat, and when everything was complete and *The Independence* left Chicago for Detroit, Mr. Ebbert returned aboard of her as a passenger. After his arrival in Detroit he was engaged to take a steamer called *Porter* from that city to Chicago, where the boat was to remain over winter.

Immediately after his arrival in Chicago he made arrangements to enter the employ of Hollister Bros., of Buffalo, who were the owners of a fleet of lake steamers. After a long and weary journey by stage coach, he arrived in Buffalo and entered upon his new duties.

His first work for the Hollister Bros. was to overhaul the engines of steamer *Hercules*.

On the opening of navigation in the spring of 1844, Mr. Ebbert was placed on steamer *St. Louis* as chief engineer, and remained on that boat during one season. In 1845, when navigation was resumed, he was appointed chief engineer of the steamer *St. Joe*, and remained on that boat for four years.

On the last trip for the season of the *St. Joe*, from Buffalo to Chicago, there was aboard the boat as freight a small, quaint-looking locomotive, intended for use in the construction of the Galena & Chicago Union R. R., the first railroad built out of Chicago. At the time of which we write this railroad had four miles of track laid, and from this germ, planted in 1848, has sprung the magnificent system of railroads now known as the Chicago & Northwestern Railway!

On the arrival of the steamer at Chicago, the locomotive was unladen and placed on the track, and duly and appropriately named "Pioneer."

The position of engineer was offered to Mr. Ebbert, by the then president of the road, Mr. William B. Ogden, and was accepted. Once more we find John Ebbert as a locomotive engineer and the first man to open the throttle-valve of a locomotive in Chicago, which city was destined to be (and through the agency of the little machine) the forerunner of its numerous kind.

The Chicago of 1848 and the Chicago of 1893 very aptly illustrate the push and energy of the American character: with a population then of 25,000 inhabitants, four miles of railroad with one little locomotive, the Chicago of to-day with its 2,000,000 of inhabitants, the greatest railroad center in the world, the railroads centering here counting their locomotives by the thousand; and all this accomplished in forty-three years. Well may the World's Fair visitor from other countries gaze with wonder on all the marvels that Chicago presents to his view.

Mr. Ebbert, after one year's service as engineer, was appointed master mechanic, which position he retained four years. He was then appointed assistant superintendent, and held this position until 1860, when he resigned from the service of the company.

In 1861 Mr. Ebbert accepted the position of master mechanic of the Ohio & Mississippi R. R., with headquarters at Cochran, Ind. He remained with the O. & M. until 1865, when he resigned to take the position of chief engineer of the Evanston waterworks and held that position until 1880.

In this year there was organized a company composed principally of Western capitalists known as the Rockaway Beach Improvement Company. The object of this company was to make Rockaway Beach, L. I., the finest summer resort in the world.

The largest hotel ever constructed up to that date was built, and a railroad was constructed to connect the beach with New York and Brooklyn. Gas and water plant was put in, and to superintend and operate the waterworks the company secured the services of Mr. Ebbert, who put in the plant and operated it for eight years.

The company got into financial difficulties, their magnificent hotel was never opened, the Long Island R.R. Co. got their railroad; the gas-house went to ruin. The water-works remained longest of all, but finally they had to go; and, consequently, Mr. Ebbert was out of employment in 1888, after having lost much money through the failure of the company.

In the death of Mr. Ebbert's wife, which took place in 1889, he sustained the heaviest affliction of his long and busy life. Since that event he has not engaged in any active service. He makes his home in Chicago with his children, of whom he has six, four sons and two daughters. All of his children are married, and vie with each other as to who can make happiest the declining years of their honored father.

A few months previous to the opening of the World's Columbian Exposition at Chicago, the officers of the Chicago & Northwestern Ry. thought they could send no more interesting object to the Fair than the old "Pioneer." Accordingly, the dust of years was brushed off, the old boiler, long empty, was filled up once more; fire was started in the quaint old firebox, and in due time steam was generated, and the old engine started for Jackson Park. Mr. Smith, superintendent of motive power of the Chicago & Northwestern Ry., acting as engineer.

General Manager Whitman, of the Chicago & Northwestern, requested Mr. Ebbert to look after the old "Pioneer" at the Fair, and tell the many people who look with admiring gaze on the old engine of the part it played in the development of Chicago, the Northwest, and the Chicago & Northwestern Ry.

At the World's Fair the writer renewed his acquaintance with Mr. Ebbert, having previously known him at Rockaway Beach, and was glad to find this grand old man in vigorous health and in the possession of all his faculties. He has now passed the seventy-eighth milestone of his life's journey. During his long and useful life he has seen—and also has in no small manner contributed to—the grand and glorious upbuilding of our country. In his youthful days the little engines which are brought to the Fair as curiosities for his grandchildren to look at, were considered powerful machines and gazed upon with awe by the populace.

Truly he has seen the evolution and development of the locomotive. What a contrast to his "Pioneer" of 1848 are the monster locomotives of the Brooks works and other builders with which the "Pioneer" is in company.

The poet T. Buchanan Reade, in his verses of "Sheridan's Ride," expressed the wish that when a monument would be raised in Sheridan's honor the horse should not be forgotten; so might we express the wish that, if the Chicago & Northwestern Ry. Co. should erect a pedestal on which to place the "Pioneer," the name of John Ebbert be also emblazoned thereon.

In conclusion, it is the wish of the writer, and this wish will no doubt be voiced by all readers of LOCOMOTIVE ENGINEERING, that John Ebbert may live many years yet to enjoy the fruits of his long life of usefulness to his fellow-men.

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The Jacksonville, St. Augustine and Indian River management have a way of their own, and it is a quiet, unassuming way of accomplishing their ends. The great changes wrought are noticed on each visit. An additional 100 miles or more of road constructed, ditched, bridged and trestled in a first-class manner; stations of a style and cost which would do credit to any pioneer road. First-class train service instituted; new equipment, both engines and cars, luminous with gold and varnish, all looking new, is the result of each summer's work. The excellent condition of the equipment has given this road the title of "Gilt Edge," and it is well bestowed. Crawford, general superintendent, and Silvius, the master mechanic, deserve abundant praise for their success.

Watch dials of a form invented by Mr. A. G. Leonard, of the New York Central Railroad, are now manufactured and sold by Mr. C. K. Colby, 11 John street, New York. The dial is arranged with figures which show very plainly how many miles an hour a train is running according to the number of seconds required to pass between mile-posts. The dial can be applied to any watch, and is a great convenience to engineers, conductors and others interested in the speed of trains.

### List of Engineers Present at the Engineers' Convention, Baltimore, Md., November 6, 1855.

Mr. E. N. Underwood, one of the engineers who met to form an association in Baltimore, Md . in 1855, recently came East from his home in California, and, while here showed us a list, printed at the time, of the men who attended the first engineers' convention. An association was formed there, but it lasted only a few years, and little interest was taken in it In 1863 W. D. Robinson formed the Brotherhood from which grew the present great organization Very few of these old-timers are alive to-day, still a few of them are doing business at the old stand. John Brunton is librarian of the railroad reading room at Pueblo, Col. W. T. Osborn is foreman at the Hoboken shops of the D., L. & W. E. N. Underwood is M. M of the Colusa & Lake road in California Jas. R. Smith is roadmaster of the P. R.R. out of Jersey City, and John Sexton is foreman of the P. R.R. shops at South Amboy, N. J. There are probably others alive, but we do not know them.

Martin R. Alley, Richmond, Va ; Isaac A Morse, No. 429 Fourth avenue, New York , Charles McKean, No. 572 Third avenue, New York , Levi Huston, Harrisburg, Pa.; Joseph Miller, Chambersburg, Pa , Thomas B. Askew, Baltimore. Md.; A. M. Brown, Dayton, O.; R. M. Gregg. Northfield, Vt., Otis Freeman, Keene, N. H , Earl Hawley, Jamaica, L. I.; John M. Whitney. Springfield, Mass ; Richard B. Duncan, Kensington, Philadelphia, Pa.; Edward Prentiss, Sandusky City, O., William H Thompson, Fitchburg, Mass.; Austin Matson, Jr., Greenbush, N Y.; William P. Furnold, Great Falls, N. H.; H. L Garrett, Portsmouth, N. H., Ormand Butler, Jr., Martinsburg, Va , Robert T. Walker, Watertown, N. Y , W H. Green, Buffalo. N. Y.; U. B. Williams, Baltimore, Md.; John Donahue. Susquehanna, Pa ; John Sexton, South Amboy, N. J., Thomas Kenley, Baltimore, Md., James M. Simmons, Fall River, Mass ; Ed. Hawley, Erie, Pa.; Volney Tyrell, Chicago, Ill ; J. R Smith, Baltimore, Md , William D. Robinson, Rochester, N Y, Benjamin Hoxie, Port Jervis, N. Y ; William Hoyt. Syracuse, N. Y., S. S. Cheney, Laport, Ind.; John Quinc, Buffalo. N. Y.; A H. Felton, Baltimore, Md. ; D. P. Carter, Adrian, Mich.; Wm. Bryan, Baltimore. Md. ; Henry Brown, New Haven, Conn. ; J. D. Bradford, Wilmington, Md. ; A. H. Somers, Ohio & Penn. R. R. ; Malcomb Hassan, Northern Central R. R. Pa. ; A. L. Smith, Alexdria, Va. ; William Pollic, Wheeling, Va. , J. King, Baltimore City ; Moses Doty, Altoona, Pa , John Brunton, Pittsburg, Pa. ; A. Curtiss, Cleveland, Ohio; C. M. Davis, Canton, Stark Co., Ohio; A. H. James, Massilon, Ohio , J. P Robinson, Hornellsville, N. Y. , A. H. Monroe, Providence, R. I. ; L. Crossman, Elizabethport, N. J. , C. T. Ham, Cincinnati, Ohio; Royal Cheney, Worcester, Mass. ; Minard Banister, Boston, Mass. ; George Sargent, Corning, N. Y , D. B. Goodall, Waverly, N. Y. , Sherman Bates, Hartford, Conn. ; James R. Smith, Newark, N. J. ; W. T. Osborn, Hackettstown, N. J. ; L. G. Patterson, Northfield, Vt. ; W. Sterling, Bridgeport, Conn. ; Joseph Blanchard, East Cambridge, Mass. , George Vandanker, Baltimore, Md. ; C. Smith, Harper's Ferry, Va., William D. Winters, Harper's Ferry, Va. ; Henry Milliken, New York , Nelson Underwood, Greenbush, N. Y. ; Daniel N. Anderson, Cameron, Va., David H. Derrick, Portsmouth. Ohio ; William Hayden, Rochester, N. Y. ; Joseph Hoffman, Rochester. N Y

### Chief Arthur and Others Sued.

A press dispatch from Pittsburg says that Attorney Carney has filed the papers in a suit for $20,000 damages for libel in the United States Circuit Court against P. M. Arthur, of Cleveland, Grand Chief Engineer of the Brotherhood of Locomotive Engineers , A. B. Youngson, Grand Assistant Chief , T. S. & D Everett, publishers of the *Journal*, the official organ of the order ; J. G. Owston, Chief Engineer, and R. M. Rhodes and H. B. Schafer, officers of the Keystone Lodge of the Brotherhood of Locomotive Engineers of Allegheny. The plaintiff is Jeremiah Evans, who is now employed as foreman in Elba Iron Works.

Evans was formerly employed on the Pittsburg, Fort Wayne and Chicago Railroad as an engineer, and was a member of the Keystone Lodge, Brotherhood of Locomotive Engineers. He withdrew from the organization to accept a position of foreman.

When a strike was declared at the Elba Works it was declared closed to union men by the Amalgamated Association. Because Evans went there to work, the officers of Keystone Lodge caused to be published in the *Journal* a notice that Evans had been expelled for "scabbing." Evans claims that as he had withdrawn from the lodge he could not be expelled, and for the reason that no labor organization makes a pretence of controlling the position or regulating wages of foremen, he could not be guilty of "scabbing." The case will likely be tried at the next term of the Circuit Court, and is of great importance to unions, nearly all of which publish notices of expulsions.

### A Fine Bridge in Danger.

One of the most handsome railroad bridges in the country spans the Mississippi at Memphis, Tenn., and is used by the tracks of the Kansas City, Memphis & Birmingham Railroad. A thoughtful visitor standing on the bluffs at Memphis, looking critically at the scene below, is likely to be struck with a potential danger which may leave the bridge standing over an abandoned sand bed. Owing to a freak which the Father of Waters is notorious for, it deserted its old channel above Memphis some years ago and took a long sweep inland, returning to its old channel just above the city. All along the new bend it keeps threatening to cut out a short cut, which would leave Memphis several miles away. The engineering authorities who have charge of such matters have been spending hundreds of thousands of dollars in rip-rapping with rock the threatened bank, and still the danger grows. Half the money expended in opening up the old channel would prove an effectual remedy. but the engineers (?) cannot accept such a simple means of solving the difficulty When the river comes down in a big flood some day, and leaves the bridge which connects Arkansas and Tennessee a useless highway, the people concerned will have something strong to say about the engineering imbecility responsible for the disaster

### The Poor Flagman.

The absolute block system, rigidly applied, will absolutely preserve a stated interval between following trains, but the great cost of its construction and maintenance precludes its use on by far the largest part of the railroad mileage in this country. Where this consideration prevents, reliance is placed upon the watchfulness of the flagman, who is expected, when in his judgment it becomes his duty to secure this interval of safety, to leap from the rear of the moving train and, armed with red lantern and torpedoes, to plunge boldly into the darkness of night, perhaps facing rain, snow or sleet, hastening toward the headlight of the following train, which glares at him as he feels for his footing on the cross-ties upon some lofty bridge or long trestle. At length he reaches the prescribed distance of twenty-six telegraph poles, or about one mile, plants his torpedoes and listens with eager ear for the signal of recall. If, through haste to depart or inadvertence, the signal is not given and his train moves off without him, that flagman may pass the night in solitude, perhaps wet, cold and hungry, or until some train stops at his signal and picks him up. Such are the duties required of a flagman, and it takes pluck and endurance to fulfil them.

### Ingenious Cut-Off Motion Designed by W. A. Foster.

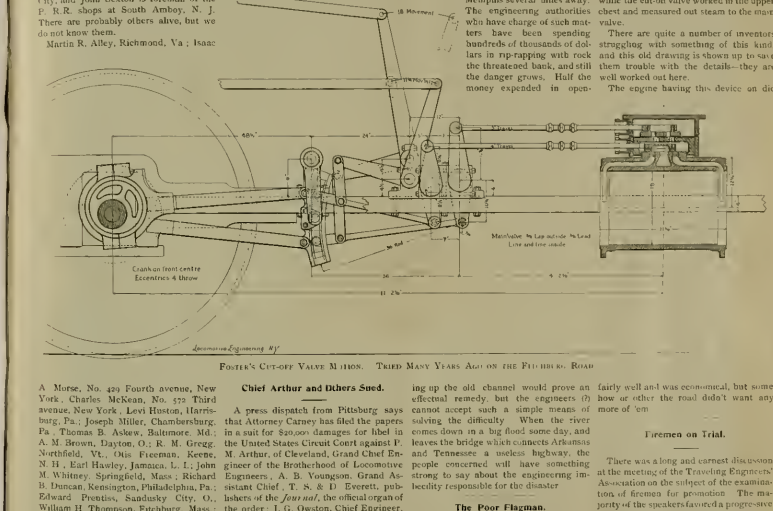
The valve motion shown herewith was designed some twenty years ago and tried on the Fitchburg road by William A. Foster, now superintendent of motive power of the Fall Brook Coal Co.

As can be seen, he used what is called a stationary link, the hanger being pivoted to the frame. In this link were two blocks—one moving the cut-off valve, the other the main valve , each having its own rocker and its own reverse lever, so that one could be varied without the other.

The chest was double, the main valve working in what might be termed the lower chest, this chest being very small, while the cut-off valve worked in the upper chest and measured out steam to the main valve.

There are quite a number of inventors struggling with something of this kind, and this old drawing is shown up to save them trouble with the details—they are well worked out here.

The engine having this device on did fairly well and was economical, but some how or other the road didn't want any more of 'em




FOSTER'S CUT-OFF VALVE MOTION. TRIED MANY YEARS AGO ON THE FITCHBURG ROAD

### Firemen on Trial.

There was a long and earnest discussion at the meeting of the Traveling Engineers' Association on the subject of the examination of firemen for promotion The majority of the speakers favored a progressive form of examination, but were opposed to any set of stock questions, and all were in favor of asking *Why?* after each question. This, of course, to prove that the candidate understands the subject, rather than the answer to a question. The whole body agreed that the great point to be made was to secure the right kind of material to start with, and that examinations on color-blindness, education, etc., should take place before the fireman is employed at all — you can't examine brains into numskulls

The following resolution, offered by Geo. H Brown, of the C . M. & St. P , was adopted, and if carried out by railroads would give a splendid chance to sort out the no-goods early in their career

*Resolved*, It is the opinion of this association that firemen should be hired on probation for the first six months, they being given to understand when entering the service that, for cause, they are subject to be discharged without question before or at the end of six months.

A committee was appointed to offer a plan of standard examination questions at the next meeting.

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*The editors reserve the right to use or discard matter for the reading columns entirely on its merits. The reading columns will not be sold.*

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## Cutting Wages and Working Hours.

The present depression of business gives a very striking proof of the patience and tolerance of the great body of men who constitute the working forces of railroads. A year ago the country was stirred with wild rumors of war and strife that the wage-earners of railroads were about to engage in against their employers to compel a large increase of pay as soon as railroads were busy with World's Fair business. These reports were without foundation and originated with those who were likely to profit from a conflict between railroad companies and their employés and with those who feared that the temptation to strike railroad companies when a good opportunity for victory came would prove too strong to be resisted. The employés, however, without exception discountenanced the counsel of those who recommended that they avail themselves of the opportunity to compel an increase of wages, and there was not the least indication that labor troubles would have come had business come up to the promise at the beginning of the year.

The unexpected money stringency and prostration of business, however, turned the tables, and instead of the employés having an opportunity to force an increase of wages the railroad managers were in a position to reduce the same. Have they displayed the forbearance manifested by the employés? No fair-minded man will say that they have. There are some exceptions, but on most railroads wages have been reduced either directly or by decrease in the working hours in the most savage and inconsiderate manner. The loss of business has compelled many railroad companies to discharge men and reduce the working hours, but this has been done absolutely without cause on not a few roads. Some managers have been influenced by a panicy feeling, and contributed to the making of hard times by buying nothing and stopping all work where it was possible to do so. Others were guided by different motives, but the result was the same. They perceived the opportunity to strike a blow at their employés and have availed themselves of it. The president of one road, which is doing a better business than it did a year ago, gave orders that the employés' time should be cut until the men began to feel the steel of hard times, and then he said squeeze again until they scream. It is needless to say that they are screaming. The man responsible for this action poses as a philanthropic friend of workingmen. Others are following a similar policy to punish their men for previous independence.

The fact is that several railroad companies are using the general depression of business to increase the net earnings of the roads. They seldom have the opportunity to cut wages, and they are making the best of the chance. It matters not to them what suffering may be inflicted upon the families of faithful employés. They gamble with human lives with the expectation of gaining a few points on Wall Street. A representative case is that of the Manhattan Elevated Railroad Company This company is carrying as many passengers as it did last year, and the entire business is done on a ready-money basis, but the talk of money stringency was no sooner heard than the working hours of the shops were reduced to nearly half the regular hours. Some of the larger passenger-carrying roilroads are receiving heavy earnings from the extra travel to the World's Fair, but that does not prevent them from laying off every man not absolutely essential to keep the trains running. Some of them are purchasing nothing but coal, oil, waste and wheels. The temporary saving effected in this way will have to be paid for eventually in increased expenses. Business wisdom would require the work on rolling stock and track to be kept up, and the dictates of humanity demand that employés dependent on the companies for a livelihood should be kept at work, but sentiment and good sense have little consideration with those who are under the influence of the stock market

Trainmen have been more fortunate than other classes of railway men, for it was impossible to dispense with their services or to reduce their hours on roads that are doing a good business; but shopmen and all others have suffered shamefully. Railroad mechanics are worse paid, as a rule, than skilled men in other employment. The pay at the best is too low for the skill required. When the hours of labor are reduced, the pay earned is scarcely sufficient to keep a family alive. Manufacturers and others employing mechanics have, in very few instances, made reductions of wages, but railroads have nearly all done so. In some cases the reduction has been made in a novel form by the discharge of all the higher-paid men. In most shops there are exceptionally skilled men who receive more than the current wages, because their work is of greater value. In private shops, men of this character receive about a third more than a common hand, but in railroad shops only from ten to fifteen per cent. more is given. This is now leveled down by the discharge of the high-class men with the expectation that they will return to work at the wages of common hands.

Railroad men are very ready to bear their share of the privations that result from hard times, but it is too much to expect that they will tamely submit to reductions where they are not necessary. This class of men are too intelligent not to understand the true condition of affairs when reductions are made without cause. They read the newspapers which publish railroad earnings, and they know how many trains are running and the amount of passengers and freight handled. In too many instances the men have obtained convincing evidence from the decreasing traffic that business was prostrated, and they cheerfully bowed to the necessary reduction or suspension of employment; but on other roads they have been compelled to accept loss of income when all indications said that the cut came without cause. Managers talk glibly about loyalty of their employés and of the superior service obtained from loyal men, but many of them are following methods which are certain to kill the cultivation of a loyal spirit, and to root out any that exists. Men engaged in this business are not wise in their generation. They are sowing seed that after not many days may be reaped in great tribulation.

## Prospects of Electric Locomotives.

The exhibition of an electric locomotive at the World's Fair has been the cause of a new flood of articles giving obituary notices of the steam locomotive, which is soon to be superseded by one driven by electricity. If our railroads could be operated more cheaply with electric locomotives than they are by steam, the change would be made very quickly. Commercial considerations would bring about the change with as much certainty as they are putting in electric apparatus to displace horses in the hauling of street cars. But there is nothing yet in sight to indicate that electric motors would not cost twice the expense incurred in moving passengers and freight by direct steam locomotion. There may be cases like the Niagara Falls Canal, which is going to supply immense power, where electricity could be generated and transmitted for the moving of railroad trains so cheaply that its use would be economical. Waterfalls and rivers may in this way be used to supply power for railroad purposes, but there are comparatively few places where such sources of power are available. So long as the dynamo that generates electricity has to be driven by a steam-engine, there is small likelihood of an electric locomotive taking the place of the steam locomotive unless under exceptional circumstances.

It appears to us that an electric locomotive is a mistake, anyhow. Those who work on this line of invention attempt to perpetuate the worst feature of a steam locomotive, which is the big percentage of dead weight added to the train. To exert a starting power of 20,000 pounds on the draw-bar a locomotive must weigh over fifty tons. A steam locomotive has a heavy boiler to carry, which does much to give the necessary adhesion. A boiler is not required in an electric motor, so the weight necessary for adhesion would have to be carried on the form of useless metal. An ideal railway train would be one in which the vehicles would be utilized to give adhesion to the driving power, but this is impracticable with steam. When electricity is employed the case is different, and the wheels of the cars can easily be made the drivers as in the case of street cars. A train operated in this way would not have a heavy locomotive to be lifted up every hill and to add nearly as much weight as the remainer of the vehicles. If ever electricity should come into use for the operating of surface roads, we anticipate that every car will carry its own means of applying power. The prospects of seeing electric locomotives in the front of trains are not good

## Slipped Eccentrics.

A correspondent from California mentions a rather novel way he followed in setting a slipped eccentric. The engine was put on the dead center and the eccentric set as near to its proper position as the engineer could get it. Then he removed a set-screw, and putting his finger through the hole kept moving the eccentric until his finger found the impression that the set-screw had made in the driving-axle. The set-screws were then fastened and no more adjustment was necessary, for the eccentric was set in its old position.

It is surprising that at this period of advanced practice and prevalence of common sense how many particulars we receive of difficulties occurring on the road through the slipping of eccentrics. The roads that depend upon set-screws alone to hold eccentrics are tempting the annoyance and delay which inevitably occur when an eccentric slips while an engine is hauling a train. The men who are wedded to the ancient practice of securing eccentrics by set-screws insist that the set-screw is much more convenient than a key when any change has to be made on the valves, and they cannot understand why set-screws should not be as efficient and reliable now as they formerly were. This is very lame reasoning. It is all very well to have locomotives in such shape that repairs can be made readily, but the convenience of the shop should not be considered for a moment in comparison with security on the road.

It is simply criminal to send out locomotives of modern size and steam pressure with merely set-screws to hold the eccentrics. Over and over again the story has been told of how a train was speeding safely toward its destination, everything favorable to its arrival on time Without the least warning, an eccentric slips and the train suddenly stops. What is the matter no one knows to a certainty, but it is expected that the delay will be short, and all the trainmen have their attention directed to the engineer, who is under the engine trying to locate the trouble. No one has gone back to protect the rear end, and suddenly wild whistling is heard, then a crash, and a slipped eccentric is again responsible for the blotting-out of human lives and the destruction of much property.

Some day the authorities will learn enough to trace backward to the person who is really responsible for this kind of accident. It will then be a black day for the man who prefers set-screws because they are handy in case of changes being made on the valves.

## Charging Oil to Engines.

One of the most interesting discussions at the late meeting of the Traveling Engineers' Association was on the subject of economy in oil. A great diversity in practice soon pointed out that any comparison between roads as to miles run per pint or quart was unfair. One member stated that shop men packed cellars and driving-boxes and that the oil so used was *not charged to the engine*; another did not charge oil used on tender, while a third issued oil to wipe the engine with and charged oil used in wiper's torches to the engine.

The amount of oil used by the engineer must vary with the weather, trains, country and service. It was generally agreed that the best way to check extravagant men was to limit the supply, but not to judge of the amount necessary by what they did on another road with altogether different conditions.

The following resolution, proposed by John A. Hill and adopted by the Association, seems to be a fair and honest way to regulate the standard of consumption. It puts every engineer on his mettle and interests him in proving that he has some judgment, if allowed to use it, for he has no means of knowing what the average of the best half of the men will be, and an engineer who would not *want* to be one of the best half wouldn't be much of an engineer:

*Resolved*, That, in the opinion of this association, there is no reliable comparison between roads as to the use of oil per mile run. Each engineer must make his time and be allowed some judgment in the use of supplies. We believe that the standard should be the monthly average of the best half of the engineers. This makes allowance for local differences in the roads, climate and experiments in oil.

## Measurements in Brazil.

We have lately seen a statement published to the effect that the makers of American and English machinery are placed at a disadvantage in the markets of Brazil because the workmen in that country are accustomed to metric measurement and therefore prefer machinery made in France and Belgium where metric measurements are followed. This seems a very reasonable thing, but there is nothing in it, nevertheless. The principal article about a machine that a workman will get confused with if he has to apply a strange measurement, is a screw. It is easily seen how a workman measuring after the meter standard would be puzzled by having to figure on the number of threads to an inch. But this is what he has got to do even with French and Belgian screw-threads, for they are made after the Whitworth standard and the threads are reckoned by the inch. It is a little hard on the metric system followers that the world's standard of screw-threads is based on inch measurement, but they must put up with the inconvenience or adopt a new standard for themselves. There is no cause, however, for American and English makers of machinery becoming panic-stricken and changing their standards of measurement to suit Brazilian workmen.

### The Machinist.

A highly interesting article on "The Machinist," by Mr. Fred J. Miller, one of the editors of the *American Machinist*, was published in the September issue of *Scribner's Magazine*. The article is profusely illustrated by sketches made by Otto H. Bacher, who evidently has an eye more for striking pictures than for portraying the real work done by machinists. There are picturesque scenes of operations in blacksmith shops and foundries, but very few pictures of what one sees in a machine shop proper.

Mr. Miller tells in a very attractive fashion how the machinist trade has grown up, till now the man engaged in this business not only performs the most important functions in the peaceful arts, but actually does more than the soldier to render warfare destructive. Details of the machinists' work, as performed under a great variety of circumstances, are given. The article contains so many readable paragraphs that we should like to quote pages of it, but want of space compels us to be satisfied with the following extracts that relate to railroad work:

"In the railroad town the machinist performs much the same office with respect to locomotive and train service, a great deal depending upon his knowledge what to do and how and when to do it. Here the character of his duties usually requires that he be in readiness to be called upon at any time. In the roundhouse there is always employed the regular 'night gang,' which includes a number of machinists whose duties consist of making such slight repairs as may readily be made during a few hours of darkness, made visible by a brace of kerosene-burning torches, remarkable much more for their smoking than for their illuminating powers. But the other men employed in the roundhouse and in the 'back shops' by day, may be called out in emergencies from bed, from church, or even from a visit to their sweethearts; for railroad trains, like Tennyson's brook, must go on forever, and locomotives must be ever ready to pull them. If a rod-brass heats during a run, or if anything else about the engine goes wrong, the engineer very properly sacrifices every other consideration to making his time, and leaves the defects to be permanently remedied at the end of the run by the machinists. Usually the defects are real enough, but it is a regular article of faith with the machinist to charge that many of the complaints entered against engines by their runners are founded upon imaginary defects, and many of the jobs of repairing are accordingly equally imaginary; experience showing that the imaginary repairs often completely cure the imaginary defects—a simple case of adapting the remedy to the disease—something which all true machinists make a specialty of.

"Another effect of the circumstance that the machinist is not so much in evidence as other men, is seen in his connection with railroad work. We see the locomotive engineer, for instance, and understand something of the important duties he has to perform; there is a far less adequate conception of the importance of the work of the machinist in making and keeping in repair the locomotive and its appurtenances. To the traveling public it is as important that the engineer should have an engine ready to respond to his guidance as that the engineer himself should be ready to perform his duty; but the highly skilled and exacting work of the machinist, executed perhaps at night, and often under the most disadvantageous and discouraging conditions, yet necessary to be performed in order that the resplendent machine may be able to take out its early morning express, is little thought of, because unseen."

### Care of Air-Brakes on Freight Cars.

The New York Central people are putting in a plant at Buffalo, to be used for the testing of freight-car brakes. The necessity for plants of this character is every day becoming so urgent that a general movement must soon be made to provide means for making certain that brakes are in operative condition when the cars leave terminal points. So many freight trains are now handled with the air-brake that their safe movement requires the brakes to be in good working order. As the exact condition of a brake cannot be ascertained until air has been applied, hundred of cars pass ordinary inspection when the brakes are not in working order. Many railroads pay no attention to the brakes of freight cars till they are found useless, a careless practice which causes great annoyance to trainmen and danger in handling trains.

The whole question of care of air-brakes on freight cars is badly in want of thorough investigation. Under existing rules of interchange, the careless companies impose the maintenance of brakes upon those that strive to keep in good order the rolling stock passing over their lines. Rules ought to be adopted which will help to spread the expense of brake maintenance more evenly among those deriving the benefits.

### A Law to Punish Train Robbers.

A bill has been introduced into Congress which proposes to make the growing business of train robbing and wrecking more perilous to those who engage in it than it is to-day. The act provides that any person who does or causes to be done any act whereby any car is stopped, obstructed or injured with intent to rob or injure any one passing over any railroad engaged in interstate commerce, and where in consequence of such acts any person is killed, shall be guilty of murder. If the attempt does not result in murder, the guilty person, on conviction, shall be imprisoned at hard labor for from ten to twenty years. Circuit and District Courts of the United States are given jurisdiction of all cases arising under the act. The bill has been referred to the Committee on Interstate Commerce.

Train robbing and wrecking have been so outrageously common of late that vigorous suppressive measures are necessary, and Congress will not act fairly towards the traveling public if the bill does not promptly become the law of the land. The train robber is the successor of the old highway robber, with the difference that murder or violence nearly always accompanies his thieving attempts. Under existing laws train robbers who commit murder generally escape the supreme punishment on the plea that murder was not premeditated. It is high time that strong laws were enacted to meet existing conditions of transportation, for most of the State laws appear to protect rather than punish this class of criminal. Many scoundrels who are now ready to shoot trainmen who interfere with their raids would be less inclined to kill people if they understood that it would lead them to the gallows.

### Colenour Disaster.

The handling of trains on single tracks is so skilfully and carefully done that collisions due to mistakes in orders are now happily rare, but they happen at times, and always will happen while a mile of single track remains. One of the worst accidents of this kind that has occurred in recent years happened on the Western lines of the Pennsylvania at Colenour, Ind., on September 6th. Two south-bound trains had the right of way, and it was determined to hold them for a north-bound milk train. The train-dispatcher gave orders to hold one of the trains, but evidently forgot about the other one. He gave the milk train an order to proceed, and a disastrous collision was the result, twelve persons having been instantly killed and many injured. The railroad company intimated that a searching inquiry would be made into the cause of the accident. It looks as if very little investigation was necessary. The train-dispatcher acknowledged that he alone was responsible, and left for parts unknown.

### Notice.

Owing to failing health Mr. Jos. W. Curran has resigned the position of advertising agent of this paper and will remove to a milder climate; his future home will be at Prescott, Arizona.

Mr. Geo. W. Wollaston will hereafter have charge of the advertising pages of LOCOMOTIVE ENGINEERING. Mr. Wollaston is not without experience in this line, as he was "raised in the business," his last newspaper connection being with the *Railroad Gazette*. For the past three years Mr. Wollaston has been on the road selling machine tools for Pedrick & Ayer, of Philadelphia.

We are flooded with communications, *pro* and *con*, on the subject of seniority. To open this door will let in a flood of uninteresting argument that will do no good; neither side will be convinced. The seniority men argue that seniority is right, *merit and efficiency* being equal, forgetting that this equalism is very seldom, if ever, balanced, and also forgetting that some one must be the judge as to whether they are equal or not. And who will be this judge but the responsible officer? On the other hand, the opponents of the seniority rule are apt to think that the absence of their bugbear will cure all the ills of the great body of working railroaders. If the railroad officials who have the making of engineers would only select with greater care the material of which they make firemen, and do their heavy examination act *before* they want them for engineers, there would be no objection to the promotions being made on a seniority basis. As the matter stands, it's a choice on many roads between seniority and nepotism—both undesirable. Any way you fix it, it's not the place of a mechanical paper to quarrel about it.

It costs less than $1 to mine a ton of anthracite coal. The selling price of this material varies from $5 to $6 a ton within a range of 100 miles of the mines. The prevailing money stringency has not resulted in any reduction in the price of coal, but the mine owners appear to be worried lest something should happen to make their profits less than 300 or 400 per cent. Recent press dispatches intimate that "the coal operators of the Wyoming and Lehigh region met at Glen Summit and talked of forming a pool of $2,000,000 for the purpose of protecting themselves during the depression in the coal trade. Each operator will contribute a pro rata share, according to his output, to form the pool, and the money will be used to store the coal at tidewater until such time as the trade will take it." This means that an unlawful combination has been formed to maintain the existing scandalously high price of a prime necessary of life.

During the year ending with June, 1891, 531,183,998 passengers were carried by the railroads in the United States, on which 784,285 persons were employed in their operation. In the same year 293 passengers were killed, and 2,972 passengers injured, or one passenger was killed for every 1,811,042 carried, and one passenger injured for every 178,604 carried, while for the same period 2,660 employés were killed and 26,140 were injured, or one was killed for every 296 employed, and one injured for every 30 employed.

### PERSONAL.

Mr. John Mackenzie, superintendent of the New York, Chicago & St. Louis, celebrated his silver wedding on Sept. 22.

Mr. C. W. Hedges has been appointed road foreman of engines of the Northern division of the Burlington & Missouri River.

Mr. W. P. Raidler has been appointed master mechanic of the St. Louis & Hannibal Railway. His headquarters are at Hannibal, Mo.

Mr. T. W. Younger has been appointed master mechanic of the Oregon lines of the Southern Pacific, in place of Mr. A. Brandt, resigned.

Mr. E. C. Hiser, who has been master mechanic of the Adirondacks & St. Lawrence division of the New York Central, has been transferred to Utica, N. Y.

Mr. D. A. Fleming has been promoted from the cab to be traveling engineer of the Lake Shore & Michigan Southern in place of Mr. W. O. Thompson, promoted.

Mr. George P. Wilson, who is well known to railroad men as agent for the U. S. Packing Co., has become agent for the Columbia Metallic Packing Co., of Philadelphia.

Mr. J. C. Morrison has been appointed chief clerk of the motive power department of the Northern Pacific. He was for some time purchasing agent of the Great Northern.

Mr. C. W. Walker, master mechanic of the Seaboard & Roanoke, has been appointed master mechanic of the Raleigh & Gaston road, which belongs to the same system of roads.

Mr. Frank Hernandez has been appointed general foreman of the shops of the Florida Central & Peninsular at Fernandina, Fla., to succeed Mr. M. M. Adams, who has resigned.

Mr. E. M. Luckett has been appointed master mechanic of the Salt Lake division of the Southern Pacific in charge of work and employés, locomotive and car departments, with headquarters at Terrace, Utah.

Mr. T. Freeman, who has been for several years with the National Tube Works, has accepted the position of sales agent of the Detroit Lubricator Co. Mr. Freeman is chairman of the Railroad Supply Men's Association.

Mr. John T. McBride has been appointed manager of the Everett & Monte Cristo railroad with headquarters at Everett, Wash. Mr. McBride was for several years superintendent of terminals of the Illinois Central at Chicago.

Mr. J. S. Seeley, traveling engineer of the Wisconsin Central road, has been appointed to a good position with the Galena Oil Co. Mr. Seeley is the third traveling engineer from this road who has been captured by the Galena.

Mr. G. W. Evans, one of the able foremen whom Mr. T. W. Gentry, master mechanic of the Richmond & Danville, developed in his shops at Manchester, has gone to the Richmond Locomotive Works to take charge of one of their departments.

Mr. W. W. Monroe, who was recently appointed superintendent and traffic manager of the Beattyville & Cumberland Gap road in Kentucky, with headquarters at Versailles, was formerly secretary of the New Orleans Freight Traffic Association.

Grand Chief Arthur, of the Brotherhood of Locomotive Engineers, has settled for $2,500 and costs the suit brought against

...m by the Toledo & Ann Arbor Co., on account of the strike. The suit was for 100,000. The Brotherhood will pay the bill.

Mr. Daniel Coxe, superintendent of motive power of the Delaware, Susquehanna & Schuylkill, has been appointed superintendent of that road with headquarters at Hazelton, Pa. Mr. H. J. Davis has been appointed assistant superintendent.

Mr. C. W. Card, trainmaster of the Chicago division of the Chicago, Burlington & Quincy at Aurora, Ill., has been appointed superintendent of the St. Joseph & Grand Island, with office at St. Joseph, Mo., in place of Mr A M. Morey, transferred

Mr. R. B. Fowler has been appointed superintendent of the White & Black River Valley road, with headquarters at Newport Ark. Mr. Fowler rose through a variety of positions on the St. Louis & Iron Mountain and is spoken of as a man of decided ability.

Mr H. L. S Bean has been appointed secretary to General Manager Doddridge of the Missouri Pacific. He was formerly with President Fordyce of the St. Louis Southwestern, and was selected for the decided abilities he displayed for promptly handling the world of business referred to a general manager.

Mr W. C. Pennock, master mechanic and road foreman of engines of the Cincinnati division of the Pennsylvania lines, has been appointed master mechanic of the Chicago division of the Pittsburg, Cincinnati, Chicago & St. Louis, with headquarters at Logansport, Ind., in place of Mr. W. W. Reynolds, transferred.

Mr S L Bean has been promoted to be master mechanic of the Minnesota and Lake Superior divisions and branches of the Northern Pacific, with headquarters at Brainerd, Minn, vice Mr. A Bardsley, resigned. Mr. Bean's jurisdiction is extended over the car department at all points on above divisions, except St. Paul and Minneapolis.

Mr. W W. Reynolds, for eleven years master mechanic of the Pennsylvania lines at different points, has been removed to the office of the superintendent of motive power at Columbus, O., where he will be assigned to special duties. Mr. Reynolds has been a regular attendant at the Master Mechanics' Conventions, and has numerous friends among the members.

Mr. L. H. Palmer, traveling engineer of the C., St. P., M & O., has been appointed traveling engineer for the Galena Oil Co., in charge of the Alton road—his old home. The Galena people are picking up a lot of good traveling engineers and are getting live, intelligent men. The "Omaha" is one of the roads that practice economy at the wrong end, and have abolished the office of traveling engineer

Mr H. C Ives, assistant to Vice-President Robinson, of the Santa Fé, was among the unfortunates killed in the Boston & Albany bridge accident. Mr. Ives was long associated with the late President Manvel, of the Santa Fé, and was highly popular among a large circle of railroad and railroad supply men. As president's secretary and as purchasing agent he was always ready with a kind word. If he had to disappoint people sometimes he treated them like a true gentleman.

It is reported that Mr. Charles Neilson, late general superintendent of the Cincinnati, Hamilton & Dayton, is striving to be appointed superintendent of mails under the government. Mr. Neilson is an excellent railroad man, but his inclination to monopolize authority is so decided that we should not be surprised if, on being appointed superintendent of mails, he took charge of the White House and all its authority as a department over which he had the right to wield sway.

Mr. A. Brandt, who has just resigned the position of master mechanic of the Oregon lines of the Southern Pacific, on account of failing health, is one of the oldest railroad men in the country. He had been closely associated in railroad work with an elder brother, who was in 1855 superintendent of the Lancaster Locomotive Works, and before that was assistant superintendent of motive power of the Erie, having risen from the position of engineer on the same road. Both brothers were on the Erie, and both were known as remarkably able mechanics.

Mr. Alexander Mitchell, who was superintendent of motive power and rolling stock of the eastern and northern divisions of the Lehigh Valley under the lease to the Philadelphia & Reading, has been appointed superintendent of motive power and rolling stock of the entire Lehigh Valley system under the independent management. From 1864 to 1871 Mr. Mitchell was master mechanic of the Mahanoy division of Lehigh Valley and from 1871 to 1892 superintendent of the Wyoming division. Of course, all our readers known that Mr. Mitchell was the designer of the first consolidation locomotive.

Division Superintendent J. C. Sanborn, Roadmaster Emory Bryant and Detective Christopher Bailey, of the New York, New Haven & Hartford Railway, have each been sentenced to one month's imprisonment in the House of Correction by the judge of the District Court at Abington, Mass., on the charge of inciting a riot. This was the outcome of a bitter crossing

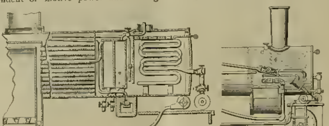
PORTER'S "MIDGET," NOW AT WORLD'S FAIR.

fight at North Abington between the New Haven road and the Electric railroad. The case was summarily disposed of and no appeal was taken. This seem hard, but it is an emphatic intimation that the barbarous practice of trials of physical strength in establishing a grade crossing are contrary to law and justice.

Mr. Lucius Tuttle, who has been vice-president of the New York, New Haven and Hartford, and is one of the most energetic railroad managers in the country, has been elected president of the Boston & Maine. Mr. Tuttle was for several years on the Eastern Railway, now part of the Boston & Maine, first as general passenger agent and subsequently as assistant to the general manager. The greater part of his railroad life has been spent on New England roads, and in every position held he has displayed commanding abilities The opportunity of his life has come now, for he has become the chief executive officer of a railroad with splendid resources, that have been dwarfed by miserly narrow-minded management.

### The Latest Thing in Car Heating.

The appliances illustrated in the annexed engraving embrace the very latest invention for heating railroad cars. A superficial observer might conclude that it was some engineering invention with a locomotive attachment as a side issue, but the locomotive is really intended to be the controlling element in the machine shown. The apparatus is declared to contain new and useful improvements in car heating and ventilating. It relates to that class of car-heaters and ventilators in which the air used for the purpose is taken from the front of the locomotive and is heated by the stream of hot gases produced therein. The object of the invention is said to be

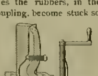


the producin' of simple and inexpensive means for utilizing the wasted heat and gases received in the smokebox of a locomotive, and also the caloric power of the exhaust steam. The purpose of the invention is to take air in through the smokebox, where it will be heated and pass it throughout the cars. This is accomplished by the use of the rotary pump seen at the side of the smokebox. The steam from the cylinders is exhausted into a water-heater shown in front of the tube-plate, and from thence passed throughout the train in a pipe placed inside the air-pipe. Appliances are provided for conveying the cinders out of the smokebox into the firebox. The invention comprises a car-heater and ventilator, a spark-conveyor and a feed-water heater. It might do all these things, but our conclusion is that the locomotive would have very little steam to move trains with.

### Device for Cleaning Air-Brake Couplings.

In the course of a ramble through one of the large railroad shops, recently, says Paul Synnestvedt, I ran across a device which may be of interest to other air-brake men. As Mr. Fred. Meyer, of West Chicago, the man who showed it to me, had no drawings of it, I have made the accompanying sketches from memory, and think they will serve to show the construction and method of operation with sufficient clearness to be understood by most of our readers.

Sometimes the rubbers, in the latest form of coupling, become stuck so tightly



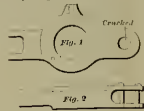
in the groove that they have to be dug out in pieces, and without some kind of a special tool it is very hard to get the groove clean enough to make a tight joint with the new rubber. This tool does the work quite easily and satisfactorily, but in making it great care must be taken that the cutter is of such a shape that it will not do any damage to the shape of the groove or the coupling will be spoiled.

Another method of fixing these couplings is to burn out the old rubber, a very low heat being all that is necessary. If they are put in a hot fire it will spoil them. I know of one place where this method has been tried with considerable success.

The next meeting of the Traveling Engineers' Association will be held at Denver, Col., September 12, 1894.

### Repairing Broken Rod-Knuckle.

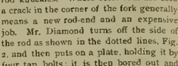
The sketch shown herewith illustrates a trick used by General Foreman W. A. Diamond, of the Lake shops at Cleveland, O., in repairing broken fork ends for side-




rod knuckles. Where steel rods are used a crack in the corner of the fork generally means a new rod-end and an expensive job. Mr. Diamond turns off the side of the rod as shown in the dotted lines, Fig. 2, and then puts on a plate, holding it by four tap bolts; it is then bored out and bushed. This makes a good job and is done quickly without heating the rod.

### McNaughton's Nut-Lock.

The bolt, with nuts applied, shown herewith, is the invention of Mr. James McNaughton, of the Wisconsin Central, and forms a most secure nut-lock. This form of bolt is used on eccentric-straps, pedestal-binders and other places where the loss

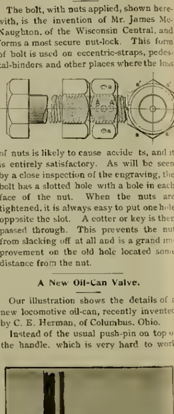


of nuts is likely to cause accidents, and it is entirely satisfactory. As will be seen by a close inspection of the engraving, the bolt has a slotted hole with a hole in each face of the nut. When the nuts are tightened, it is always easy to put one hole opposite the slot. A cotter or key is then passed through. This prevents the nut from slacking off at all and is a grand improvement on the old hole located some distance from the nut.

### A New Oil-Can Valve.

Our illustration shows the details of a new locomotive oil-can, recently invented by C. E. Herman, of Columbus, Ohio.

Instead of the usual push-pin on top of the handle, which is very hard to work



when the can is tipped up, the valve of this can is opened by pushing to one side the small lever on the back of the handle.

The valve itself is larger than usual and is located in the lower end of the spout; it has side openings that prevent foreign substances from clogging the valve; the valve will close even when there are a great many cinders in the can.

The economy of oil from using a valve-can is undisputed; the trouble has been to get a valve-can that would keep in order.

## Stupendous Stone Breaking.

Away in Southern Illinois, when the weary stretches of level prairie are left behind, a traveler going south on the Illinois Central reaches a varied upland country with bold knolls and low hills that mark an irregular upheaval of sub-car-

boniferous rock. There are finely wooded hillsides, with many a grassy vale, clear running brooks and ponds gay with water lilies and suspicions of malaria. This is the land that is contemptuously spoken of as Egypt. It borders the Ohio river and dips down to Cairo, that semi aquatic town where Dickens in his novel led Martin Chuzzlewit and Mark Tapley to be poisoned with malaria, and to give excuse for picturing America as a good place to stay away from, which thousands have done on account of that story.

While still among the uplands, the line passes the high perpendicular quarry and plant shown in the annexed view. This is a rock-crushing plant used by the Sinclair Construction Company, of Chicago, in preparing ballast for the Illinois Central Railroad Company. The plant was established three years ago, and has a capacity for crushing about 600 yards a day of stone fine enough for ballasting. The railroad company has been in a position to take the product of the crusher only for a few months each year, but during the three years it has been in operation a little over 260,000 cubic yards of rock has been placed under the track. It makes a splendid roadbed, and some of it has borne the heavy main line traffic for three years with next to no attention.

The quarry, whose face is seen in one of the views, is very systematically worked under the direction of Mr. Donald Sinclair, a member of the construction company, who has enjoyed extensive experience in quarrying and tunneling. Beginning at the top, a layer of the rock is drilled with Ingersoll 3½-inch steam drills, and the holes charged with forcite powder, a compound of dynamite. The charge is fired with electricity, and an immense volume of the quartzite rock, of which this quarry is composed, is torn into fragments. Next layer is worked in the same way until the bottom is reached. It is greatly to the credit of the superintendent, Mr. William More, that accidents from the handling of the large quantity of explosives employed in this work are almost unknown. Constant vigilance is necessary to keep the men handling the powder from becoming reckless. Familiarity with dangerous material always breeds contempt. When a man in charge of the explosives begins to manifest the least carelessness he is sent to other work.


After the explosives have done their work on the rock, it is broken by hand and loaded into narrow gauge ballast cars, which are drawn by horses to the inclined plane leading to the crusher, up which they are drawn by cable and dumped beside the mouth of the crusher. This is a Gates No. 7, which crushes the stone by a revolving serrated cone. The work is done very expeditiously, for this machine crushes about a yard and a quarter a minute. As a yard of stone weighs about 2,700 pounds, the stone-chewing capacity of the machine is very great. On passing through the crusher the rock falls over a screen through which the sand and dirt passes, while the clean ballast slides into a Rogers ballast car, which can be seen receiving its load in one of the views.

A small village has sprung up round the quarry, for about 150 men are employed in doing the work. Besides the men doing manual labor, there are ten horses, the boiler and steam engine for driving the crusher, a boiler on the top of the quarry for supplying steam to the boring drills, and a great deal of miscellaneous machinery.

The Rogers ballast car carries about 20 yards of rock, and is admirably adapted for this kind of work. Its use has cut nearly in two the expense of putting ballast under a track. On a train of these cars being loaded, an engine is ready to haul it to the place where the ballast is to be distributed. While the train is slowly moving the car drops the stone in a ridge between the rails, and a plow attached beneath the last car on the train spreads the ballast in the state where it is right for track-raising. No hand work is required. The trainmen become wonderfully expert in unloading the correct quantity of ballast, and they say that it can be spread out at a speed of ten miles an hour, but half that speed is preferred, because it does not scatter the material. About ten inches of the rock is put under the track, and at this depth it takes about 3,000 cubic yards to the mile. About ninety miles of the southern lines have been ballasted with this rock, and the railroad company expect to finish the greater part of their main line in this way. The railroad company employs about 100 men, raising track and changing ties, when they are receiving 600 yards a day. This quantity of ballast supplies about 1,000 feet of track.

The Sinclair Construction Co. have another rock-crushing plant near Dubuque, Ia., which has been used to supply ballast for the northern lines of the Illinois Central Railroad. It is similar to that shown. Three years ago thirteen miles of double track between Portage Junction and East Dubuque, which is used jointly by the Illinois Central, the Chicago, Burlington & Northern and the Chicago & Great Western trains, were ballasted. A very heavy traffic has hammered over this track in wet and dry weather—mostly wet, yet the track has received very little repair and is still in excellent order.

There is very little rock-ballasted track west of Chicago, but the enterprise displayed by the Illinois Central in doing this work is convincing many railroad men that stone ballast is the cheapest and best. The indications are that when business revives the prairie country will soon be dotted with stone-crushing plants preparing ballast that may be depended upon to keep the rails out of the mud.

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In another column we publish a communication from Mr. John H. Cooper, a well-known mechanical engineer, on "A New Unit of Measure." Mr. Cooper argues that the decimal system of graduating rules and scales should be maintained. He also holds that the basis of the existing inch is better adapted than the millimetre for a new unit of measurement, and he proposes to make a new unit 1½ inches long, to be divided into 100


equal parts. The arguments given are very good, and the proposal is well worthy of consideration. We should be glad to received the views on this subject of other readers interested in standard measurements.

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The progress being made by the Cambria Iron Co. in the introduction of their high-class quality of Open Hearth steel, reenforced by the Coffin process of toughening, must be most gratifying to them. While the temptation during the last few years to meet the market price and quality—which meant just what the railroads offered to pay—has been great, they seem to have adhered to quality and price evidently from a conscientious motive that it would win and be recognized in the end. This material, we note from a recent circular, has found its way to about 125 roads in the shape of axles, crank-pins and piston-rods.

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The Order of Railway Train Dispatchers, at its annual convention, recently held in Chicago, propose to adopt measures which will lead to the enforcement by the roads of a requirement that each train-dispatcher shall pass a competitive examination and hold a certificate of competency before he becomes eligible to the position of train-dispatcher.

## EQUIPMENT NOTES.

The Beech Creek Railroad have ordered 200 cars from the Buffalo Car Co.

A chattel mortgage for over half a million of dollars has been given by the Baltimore and Ohio to the Baldwin Locomotive Works on fifty locomotives purchased.

On the C. & N. P. engine, shown last month, there is a Golmar bell-ringer, worked by air; when the whistle is blown the bell is automatically set to ringing and keeps it up until shut off by hand.

The Jacksonville, St. Augustine & Indian River have ordered seven additional engines, making ten in all, from the Schenectady Works. The axles, crank-pins and piston-rods are of the Coffin toughened steel.

The Boston & Albany are receiving steadily from the South Baltimore Car Works between fifty and sixty box cars per week on their order for 700 cars, with which they express themselves as very much pleased.

The Buffalo Car Co. are building 200 gondola cars of 60,000 pounds capacity for the Goodyear Lumber Co. for use on the Sinnemahoning Valley Railroad. They will all have M. C. B. couplers and Westinghouse air-brakes.

The Rogers Locomotive Co. are building two 14 x 20 moguls for the Ferro-Carril Santafecino, Argentine Republic. The engines are entirely American but the tanks are the regulation European six-wheel, plate-frames, horn-blocks, etc.

The Fitchburg have called a halt on the construction of the 1,000 cars in their own shops, but it is stated that the check is only temporary, that they will, in all probability proceed with them as soon as they can work off some cars needing repairs.

The Ramapo Iron Works, of Hilburn, N. Y., are building 250 narrow-gauge freight cars for a number of plantations in Cuba. Mr. Snow has a great reputation in Cuba for car building—he cuts all his wood in the decline of the moon, it never will rot—so the Cubans say.

The Mt. Vernon Car Mfg. Co., Mt. Vernon, Ill., have secured the order for 300 fruit cars for the Florida Central & Peninsula. This concern have been running their shops full time during the dull season, and have orders enough to keep them busy until Jan. 1st.

The Brooklyn, Bath & West End Railroad, a suburban line that has been doing a good passenger business, are about to begin operating with trolley electric cars. All the steam-operated rolling-stock is offered for sale, including seven locomotives and forty passenger cars.

The prosperity of the Florida roads is most gratifying, and is indicated by the fact that in addition to the ten engines ordered by the J., St. A. & I. River, they are about to order fifteen first-class passenger cars. The Plant System is also considering additional equipment.

A neat illustrated catalogue has been published by the Brake Pressure Regulator Company, Chicago. It gives a very clear description of the working of the brake pressure regulator and illustrates how the power transmitted varies according to the weight on the trucks.

It is surprising to find how many roads there are, especially in New England, that fail to have a first-class lens lamp carried in a uniform position at the rear end of train. The use of lamps, with the same colors and classification as rear end signals, is a measure of safety, and ought to be generally adopted.

Dixon's graphite is making steady progress into favor as a lubricant for air-brakes, and is much less objectionable than oil. The Joseph Dixon Crucible Co., Jersey City, N. J., have issued a pamphlet on the subject, which all men interested in the lubrication of brakes ought to read. It will be sent free on application.

The Central Railroad of New Jersey, the Erie and several other railroads in the East are using the Smith exhaust-pipe on several of their locomotives. The officers of the mechanical department and the engineers running the engines speak very favorably about this exhaust-pipe. It reduces the coal consumption and gives a soft exhaust that makes remarkably little noise.

### To Build Raub Locomotives.

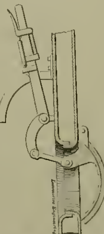
A press dispatch from Elwood, Ind., says: "The papers have been signed for the location of the Raub Locomotive Works in this city. The buildings will cover sixty acres, and employment will be furnished 2,500 or more workmen. A free college with $500,000 endowment for the benefit of citizens of Elwood is in the contract."

This looks like an ambitious scheme for these times. If the promoters succeed in building one Raub locomotive it will probably keep 2,500 men busy trying to make it work.

As most of our readers may know nothing about the Raub locomotive we reproduce a description of the engine which appeared in the *Locomotive Engineer* several years ago.

"Out back of the Erie shops, at Jersey City, stands a monument to the memory of the wasted dollars of a man who thought he could improve the American locomotive. The monument consists of one complete 'Raub Central Power Locomotive.' Just what the inventor of this miscarriage of ingenuity was trying to do it is very difficult to understand—what he actually made is very plain. At a glance, end on, the engine looks like a pile of air-drums, tankboxes and ashpans around a boiler front. There are two separate and distinct small boilers of the regular pattern mounted on four drivers each, making eight in all; the boilers have a door on each side of both fireboxes, and none in the ends. The frame is continuous, mounting both boilers. Between the firebox ends of the boilers there is a round iron dome or tower, and on each side of this dome there are mounted vertical cylinders; these are in the cab, the heads being taken off through the roof. The main rods are coupled to disk cranks on a master shaft running in boxes on the frame, and rods run from this pin to the crank-pins on the wheels, the links are inside the central dome. From the top of each smoke arch a large square pipe leads back to the central dome, and one smoke-stack answers for both boilers. The water tanks are hopper-shaped affairs, located on the four corners of the engine, and there are also four coal bins, holding about a ton each. The air-pump and other rig is all in the cab, and the fireman can dodge around over the engine and use any of the four doors; he has to go out doors to go from one to the other. There is no tender. The water tanks are connected across the frame by 6-inch pipes running within a few inches of the track—sure to break off and cause a drought if the engine drops off a switch. Last summer they had this contraption out, and, as might have been expected, she suffered from chills from the start, and was something like five days getting ten cars over a division. But then, she is 'different.' The inventor, we believe, is a physician. As an improver of railway motive power he is a failure—not an ordinary, every-day failure—but a ripping, howling, sizzling failure."

COOKE TEN-WHEELER NOW AT WORLD'S FAIR



INSIDE OPENING FIRE DOOR, F. & P. M. RY.

We are glad to state, upon reliable information, that the recent report in one of the trade papers, to the effect that the Latrobe Steel Works had shut down for an indefinite period, and had discharged its hands, is without the slightest foundation, as they have been running continuously since their works were first started, and are prepared to execute all orders with promptness.

In addition to the 1,000 freight cars to be built by the Fitchburg, orders have been given for fifteen first-class coaches to be worked through their shops this winter. The ability of the Fitchburg car department to build this equipment as advantageously as contract shops could build it, becomes self evident on a visit to their works at Fitchburg. They seem to have every possible facility, both for repairs and construction, possessed by the average contract shop, with the additional advantage of intelligent high-class labor at perhaps a trifle less cost.

A new air-brake company is in the field. It was recently incorporated under the laws of New Jersey under the title of the Bothwell Compressed Air Improvement and Construction Co. The company propose to make air-brakes, steering apparatus, hoists, and other air-brake devices. Many of the incorporators are locomotive engineers from roads around New York. The officers of the concern are as follows: W. T. Bothwell, Jersey City, N. J., president; Geo. W. Waite, Jersey City, vice-president; Fremont Wilson, New York, secretary and treasurer; Jas. R. Naylor, Brooklyn, N. Y., general manager; A. R. Boluss, Jersey City, chief engineer, and J. W. Rosencranse, Brooklyn, N. Y., superintendent of construction.

The Bangor & Aroostook new equipment, consisting of engines from Manchester, passenger coaches from Delaware and freight cars from Berwick, is being rapidly delivered. This road is being pushed forward to completion, and ninety miles of the 209 will be put in operation in November. In our judgment, no more promising enterprise than this has been floated in many years. This county (Aroostook) contains some 60,000 people, and is almost as large as the entire State of Massachusetts. Much of the land is heavily timbered, the soil is rich and wonderfully productive. Charming country interspersed with beautiful lakes, abounding in fish and game, and withal only twenty-nine miles of railroad in the entire county.

The examiners-in-chief of the United States patent office, before whom the appeal of the interference case between the National Hollow Brake Beam Co., of Chicago, and the American Brake Beam Co., owners of the Pungs patent, had been carried, have decided in favor of the American Brake Beam Co., and the concluding paragraph of their opinion reads as follows: "Pungs remains unimpeached and uncontradicted in any important item, and as to matters in which he could be refuted by other testimony, he is as competent as any other witness. We find that Pungs is the first to conceive of this invention, and the first to reduce it to practice, and affirm the decision of the examiner of interferences that he is the prior inventor."

On September 22d our well-known contributor, Mr. Cy. Warman, started from New York on the Exhibition Flyer, and rode on the engine right through to Chicago. This was done for the purpose of collecting material for an article for *McClure's Magazine*. He was accompanied by a special artist, who made a great variety of sketches to illustrate the article. No one is better equipped to write an article of a correct and interesting character on this subject than Mr. Warman, for he is an old engineer, which keeps him straight on the technical part, and his general literary ability is of a high order.

The National Malleable Castings Company's car in the Transportation Building of the World's Fair contains several styles of malleable iron drawheads, center-plates, journal-bearing keys, door-hangers, dead-blocks, oil-box covers, truss-rod saddles, side-bearings, swing-hanger bearings, swing-hanger pivots, truss-rod washers, cup-washers, transom end castings, driving-box castings, door fasteners (old and new), brake-beam castings and other minor castings for car construction.

One of the P. R. R.'s new class "P" engines, with a 78-inch wheel, made a good record the other day, reaching a speed of 90 miles per hour between Stanton and Wilmington. On one run 65½ miles were made in 63 minutes, including six slow-ups. The 10$\frac{1}{10}$ miles between Bay View and Chases was covered in 9 minutes and 40 seconds. The boys call this good work for the P. W. & B., and the new "P's" are voted a success.

The C. W. Hunt Company, of Chicago invite everybody interested in the handling of coal, ore and similar material to examine their exhibit at the World's Fair. It will repay the time taken for a careful inspection. Those who have not got satisfactory means for coaling locomotives should not fail to study the Hunt exhibit.

The Society of Railway Superintendents meets in convention at the Grand Pacific Hotel, Chicago, October 10th. They have a long list of subjects which will be discussed, and there is every prospect of a profitable meeting. Secretary Hammond extends a cordial invitation to all railroad superintendents to attend the meeting.

The *Railway Age* has been investigating the lines through which railroad general managers have risen, and finds that of 125 managers, 31 began as clerks, 29 as civil engineers, 26 as operators or station agents, 23 as officials through financial connections, 12 as trainmen and 7 from the mechanical department.

The Chapman Jack Company continued to receive orders during the late financial disturbance as though nothing was wrong with the market, being a proof of the jack's superior construction and usefulness.

Indictments have been made at Tacoma, Wash., against President Van Horn, of the Canadian Pacific, for violation of the Interstate Commerce Law.

The Pennsylvania Railroad Company have commenced on an order of 100 box cars in their own shops.

# Practical Letters from Practical Men.

**Facts Wanted. There's a glut of Opinions.**

Write on one side of the paper, state your point plainly and briefly, and then quit. We supply the generalities. No letters noticed unless name and address accompany.

### Suggestion for a Simple Device to Warn Engineer that Air Was Shut Off Part of His Train.

*Editors:*

In your August number W. M. Pipkin speaks of the danger of angle-cocks becoming turned while train is in service, thereby cutting out back end of train and making of it a sort of battering-ram to run into the front end when a quick stop is made.

Now, I would like to suggest an instrument that would (on trains equipped with air-signal) indicate to engineer whether all of train was cut in or not.

My plan is to have a valve—operated by a piston—coupled in between air-signal hose and train-pipe hose on end car of train, and so arranged that when a reduction of pressure was made in train-pipe (such as that when brakes are applied) the valve would be opened and let a little air out of signal-pipe, thereby indicating to engineer that the reduction had taken place in train-pipe on rear car, and therefore that all angle-cocks were open. This device, while it would not give its warning at the really proper time—namely, *before* the application of brakes—would be a constant watch on the angle-cock business.

It has the recommendation of simplicity, and one only would be required for each train. Perhaps this device has faults which I do not now see, or, as there is nothing new under the sun, it may have been tried in the forgotten past and proved a failure.

GEO. E. RHOADS.

*Weatherly, Pa.*

### Cases That Require More Than Twenty Pounds Reduction of Air.

*Editors:*

Mr. Ellis finds considerable fault with the requirement that engineers should not reduce over 20 pounds for a full application, and cites a case which I should call an *emergency*, implying that the rules do not permit him to make a full reduction of train-pipe pressure when needed. I know of no direct instructions anywhere which forbid him to use over 20 pounds of air in case of emergency. If he is aware of any such I should like to have him refer us to them, so as to give us an opportunity to attack them until they are corrected.

While Mr. Ellis is certainly correct in his statement that there are trains on which the best stop can be made by more than 20 pounds reduction, the reason which he gives, *i. e.*, dry and dirty triple-valves, comes far from being the correct one. Careful inspection proves that the triple-valve which will not work for 20 pounds reduction is a very rare specimen.

The trouble is more apt to be found in excessive piston travel, leakage in cylinders, or insufficient capacity of auxiliary reservoir, as is the case with many driver-brakes. Any of these defects will require a greater than 20 pound reduction to make the quickest possible stop. Let us take a specific case for illustration

We have a suburban train of three cars and engine, fully equipped with air. Suppose that one car (the first) had the brake in good shape, piston travel 7 inches, and cylinder well oiled and tight. A reduction of 20 pounds from 70 would apply the brake fully on this car.

Suppose the second car had 11 inches of piston travel. A reduction of nearly 25 pounds would be necessary on this one.

Suppose that the third car had a slight leak in the cylinder. A continuous reduction until the train came to a stop would get the most braking force out of this one, as thereby a part of what the cylinder lost could be replenished from the auxiliary reservoir.

Suppose that the driver-brake had only one auxiliary reservoir to supply both the tender and two driver-brake cylinders. The chances are that a reduction of nearly or quite 40 pounds would be necessary to secure full braking power, or more properly the limit of braking power that could be obtained here, because these three cylinders together would contain nearly as much capacity as the auxiliary reservoir itself, or even more in case the piston travel was very long.

A reduction of 20 pounds on this train would only apply one brake fully, and leave the others only two-thirds or half applied.

A reduction of 40 pounds would give, perhaps, one-third more braking power, and a reduction of all the air in the train-pipe would possibly add a little more to this in the case of the leaky cylinder.

Of course, such a heavy reduction would cause some leakage back to the train-pipe from the cylinders of the brakes which were fully applied, but this could hardly be sufficient during the short time of the stop to cause any material loss.

Such a train as this may be said to be a very exceptional case, but I question whether it is not more common than is generally supposed. While the benefits derived from a greater than 20 pound reduction may not compensate for the loss of pressure in the case of ordinary service stops, they are a great consideration in cases of emergency, or what might be called semi-emergency, such as arise sometimes after the service application has been applied to the extent of 20 pounds reduction.

PAUL SYNNESTVEDT.

*Chicago, Ill.*

### How to Apply Brakes—A Question.

*Editors:*

I would like very much to find out, through the columns of your valuable paper, the proper way to handle the engineer's brake and equalizing discharge-valve, used in connection with the Westinghouse standard freight triple-valve having the quick-action attachment, in making an emergency application to apply the brakes in the most effective manner possible. In the Westinghouse instruction book we are told that to apply the brakes with their full force a quick reduction of 10 to 12 pounds should be made and the automatic attachments will do the rest. In another chapter of the same book we are told to make an emergency application, push the valve handle to the extreme right and the brakes are instantly applied with their full force. The statement has been made through the columns of LOCOMOTIVE ENGINEERING, and to the best of my knowledge has not been disputed, that as a general thing the reduction of pressure caused by placing the brake-valve handle in service-stop position was not rapid enough to cause the quick-action attachment to work. If reduction in train-pipe pressure is made in any other way than service application, how are we to know when we have made a reduction of 10 or 12 pounds? An answer and explanation will greatly oblige

MARK PURCELL.

*East Grand Forks, Minn.*

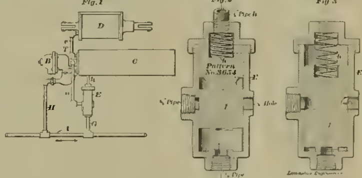
[In making an ordinary stop, of course, a reduction of pressure of six or eight pounds through the service-stop will do the business. When it comes to an emergency, use the emergency-stop, *and don't worry about the amount of air you get out of the train-pipe.* Of course, a ten to twenty pound reduction will cause the quick-action valves to work, and a further reduction of train-line pressure is waste, but if it's a real emergency, don't let that worry you. If, however, you want to stop as quickly as possible, and then go on, you can save much of your train-line pressure, and, consequently, the time it takes to restore it, by making a quick, heavy reduction of pressure and then putting the valve on lap. But you will have to guess at the amount you draw off, if you do so through the emergency port, for after the valve handle passes the service-stop, the passage to the small reservoir and the gauge is blanked, and the gauge doesn't register the fall of pressure in the train-pipe—this has scared many a man who thought the emergency was not taking hold. Rest assured that, if there is a rush of air out of the emergency port there is some heavy wheel-squeezing being done back under the train. Trying to trip the quick-action through the service-stop is an uncertain business.—EDS.]

### An Automatic Pressure-Retaining Valve.

*Editors:*

In reading an article by Paul Synnestvedt, in your August number, page 364, I notice he mentions several patents which were granted for the purpose of recharging the auxiliary reservoirs while brakes were applied, all which patents changed the feed groove or the release groove. Experience has demonstrated that the ports and grooves in the triple-valve are about just what is needful. When the Westinghouse Company improved their triple-valve, they did not alter the grooves or ports, but added thereto the quick action. While many patents have been granted on improving the triple-valve, whereby the train may be recharged while brakes are applied, I wish to call attention to patent No. 416516, issued December 3d, 1889, for an automatic pressure-retaining valve, which accomplishes the same purpose.

Fig. 1 Fig. 2 Fig. 3




When air and vacuum were first used, their chief merit was that the engineer had full power to regulate the speed of his train.

The automatic brake at present is automatic only when on a level road, or when the pressure-valves are not required. If on a mountain road, I would ask has the engineer full control of his train?

On mountain roads few grades are continuous, there being short distances which are almost level, where, if the brakemen fail to turn off the pressure-cocks, brakes will either drag or stop train. Also, at regular or flag stops on down grade, the engine has got to drag brakes when starting, if pressure-valves, as now used, are cut in.

This valve is connected with the discharge passage $T$ from the brake-cylinder. This opening $T$ as ordinarily employed allows the air to escape from the brake-cylinder $D$ when the triple-valve is so moved as to make connection between the train-pipe $A$ and train-reservoir $C$, but in the present case this escape opening $T$ is connected by a pipe $a$ directly with the side of the valve-chamber $E$ and the transverse passage $I$ through the valve $f$.

$V$ is the pipe which connects the brake-cylinder with the triple-valve chamber, and through which, when the triple-valve is in proper position, air passes from the reservoir $C$ to the brake-cylinder $D$ so as to apply the brake.

In the ordinary construction, when the triple-valve is moved so as to admit air from the train-pipe to the reservoir, it also allows air to escape from the brake-cylinder through the pipe $V$ and the opening $T$.

The operation of this device will then be as follows: Air is pumped into the reservoir on the engine to a pressure of say 100 pounds, and by means of the brake-valve it is allowed to pass through the train-pipe $A$ into the train-reservoir $C$, which are beneath each car. The triple-valve, which is already in use, is so arranged that when the pressure from the train-pipe $A$ is admitted into the triple-valve chamber $B$, it moves the valves so as to open communication directly with the reservoir $C$, so that the air may flow into this reservoir to any desired pressure.

This movement of the triple-valve also opens communication between the brake-cylinder $D$ and the opening $T$, which is a discharge passage, but which, in my invention, communicates through the pipe $a$ with the side of the cylinder $E$ (and the transverse passage $J$).

When it is desired to apply the brakes, suppose the air-pressure in the reservoir $C$ to stand at 70 pounds, by means of the engineer's valve the pressure in the train-pipe is reduced to something less than the pressure in the reservoir.

When running down grades the leakage and gradual escape of air will reduce the pressure in the train-reservoir until it is below what is necessary for the proper control of the train. It is then necessary to recharge the train-reservoir from the engine-reservoir, air is allowed to pass through the train-pipe $A$, and acting on the valves in the chamber $B$, communication is opened between the train-pipe $A$ and the reservoir $C$, and at the same time communication is opened through the brake-cylinder $D$ and the discharge opening $T$.

As formerly arranged the air would be allowed to escape from the brake-cylinder and the train would be temporarily out of control, and would be liable to attain a dangerous rate of speed.

In my invention, however, the pressure in the train-pipe, acting through the pipe $G$ upon the bottom of the valve $f$, forces this valve up until the passage $J$ in the valve is out of line with the pipe $a$ and the openings of the valve chamber $f$.

The pressure in the brake-cylinder is thus retained because this valve cuts off its escape.

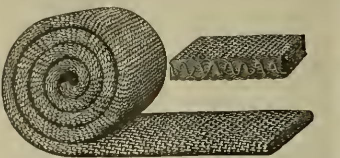
When the pressure in the reservoir $C$ is such as to balance the pressure in the train-pipe $A$ it acts through the pipe $h$ which connects the cylinder $E$ with the reservoir $C$, and pressing on the valve $F$ forces it down until the passage $J$ is on line with the pipe $a$, when air is allowed to pass from the brake-cylinder.

In order to insure the prompt movement of the valve $F$, when the air in train-pipe

### Maddox Cotton and Wire Belting.

The kind of belting illustrated in the annexed engraving is coming rapidly into favor in railroad planing mills and machine shops, and is reported to be stronger, more durable and lasting, more flexible and capable of transmitting more power than the best oak-tanned double leather belting.

This belting is made of cabled soft steel wire and cotton, woven solid together, making it the strongest, most durable and powerful belting made. The cables of wire are each composed of six soft steel wires, twisted together like a cable, giving each separate cable immense strength. The cables are laid lengthwise in the belting, about one-eighth of an inch apart, forming part of the warp, the cables composing about one-half of the warp, the rest of the belt being composed of the strongest, toughest and best cotton yarn, spun especially for this belting. The rough surface given to the belting by the cotton forms an elastic rough face, which prevents any air-cushions from forming between the belt and pulley, causing it to take a tenacious hold and preventing any tendency to slip. The cost of this belting is about the same as for single leather belting. It is handled by H. N. Green, general agent, 254-8 Fulton street, Brooklyn, N. Y.



In examining the higher class of freight cars at the World's Fair, such as refrigerator, live stock and fruit cars, we noticed that no less than ten of them were equipped with the Butler drawbar attachment, which indicates how well the merits of this device are recognized. The simplicity of the attachment forces it into favor. No other expensive castings or forgings have to be made to complete the device.

There will be just sixty volumes for the year 1893 bound up next December. These are for sale at $3 per volume, and no more will be bound, as there are no back numbers. The first applicants will get these volumes. Selah!

Mr. E. W. Baker has been appointed purchasing agent of the Mexican Central in place of Mr. Theo. Nickerson, who resigns to go into private business.

At the recent meeting of Traveling Engineers, C. W. Poole, of the Nickel Plate, asked the pertinent question: "How many of you traveling engineers have passed recent examinations on machinery and time card?" Mr. Poole stated that the practice on his road was to examine traveling engineers as well as the men under them. The tendency of the day is toward rigid examination of all responsible persons.

The "German" engine shown on page 307, of last issue, turns out to be French. A correspondent who "speaks in the Frinch" called our attention to it—we knew it was a foreigner, anyhow.



### Answers to Some of the Questions Received About The Correspondence School of Mechanics, Scranton, Pa.

*Question.* What is The Correspondence School of Mechanics?

*Answer.* It is an educational institution intended to meet the wants of Machinists, Mechanics, Locomotive, Stationary and Marine Engineers, Firemen and others interested in mechanical pursuits, who cannot afford to quit work to attend the regular technical schools in order to obtain the education which they need. It teaches Mechanical Drawing and the theory of Mechanics by correspondence.

*Q.* What are the branches taught?

*A.* Arithmetic, Algebra, Geometry, Trigonometry, Elementary Mechanics, Hydromechanics, Pneumatics, Heat, Mechanical Drawing, Steam and Steam Engine, Strength of Materials, Applied Mechanics, Boilers, Machine Design, Electricity and everything included in a complete mechanical engineering education.

*Q.* Are all these branches taught by mail?

*A.* Yes. There are now over 600 students studying in this school, who are making good progress.

*Q.* What qualifications are required to enroll as a student, and when can students commence?

*A.* The only qualification necessary is to know how to read and write; students can begin at any time.

*Q.* How is instruction given by mail?

*A.* In place of the text-books of the regular schools, the students receive carefully prepared and liberally illustrated Instruction Papers and Mechanical Drawing Plates covering all the subjects embraced in the complete course. These are accompanied by Question Papers containing questions upon the subjects treated of and problems based upon the principles explained. The student studies the first Instruction Paper and writes the answers to the questions and problems in the accompanying Question Paper and sends his work back to the school. This work is carefully examined by competent instructors and if errors have been made, the necessary help is given, and it is returned to be done over. The student is furnished with blanks with which to write for an explanation of anything in the Instruction Paper he may not understand. The student is kept studying each Instruction Paper until he has a thorough knowledge of the subject treated of, when he receives a passing mark on the records of the school and is advanced to the next Instruction Paper.

*Q.* Is it possible to teach Mechanical Drawing by mail?

*A.* Yes. The information given is full and clear, the exercises are practical and instructive and the drawings furnished to be copied are worked out in detail. Persons who will apply themselves can learn not only to draw but to design machinery.

*Q.* What advantage has this method of study over that of the regular schools?

*A.* An education is procured without leaving home or losing time from work. The student can take his own time to study. He has his teacher always at hand. He can advance according to his ability and time without reference to other students. Should sickness prevent him from studying he does not lose standing. The cost of the Scholarships is less than tuition in other schools. The best way to remember a thing is to write it down.

*Q.* What are the Scholarships?

*A.* The branches taught are divided into two so-called Scholarships—the Complete and the Mechanical Drawing Scholarships. Holders of the Complete Scholarship are entitled to instruction in all the branches taught in the school. The Mechanical Drawing Scholarship includes the first nine branches mentioned above.

*Q.* What are the prices of Scholarships?

*A.* The Complete Scholarship costs $35 in advance, or $40 in installments. The Mechanical Drawing Scholarship costs $25 in advance, or $30 in installments.

*Q.* How are the installments paid?

*A.* Ten dollars with the application for admission and the balance in monthly installments of $5 each.

*Q.* If a student is unable to pay his installments promptly, does he lose his Scholarship and the money he has paid?

*A.* No. If on account of sickness or any reasonable cause a student is unable to pay promptly, the time of payment is extended.

*Q.* What are the expenses connected with the course?

*A.* Only those of postage, stationery, and that of instruments and material to do the Mechanical Drawing work. By an arrangement with the Technical Supply Co. of Scranton, we are able to furnish students with these at very reasonable prices.

*Q.* Are students required to purchase text-books?

*A.* No. The Instruction Papers form a complete text-book, and are all that are necessary.

*Q.* Are diplomas given to students completing the course?

*A.* The graduate receives a diploma stating that he has completed the course of study embraced in his Scholarship, and that he has successfully passed an examination in all the branches.

*Q.* For whom is this School intended?

*A.* Machinists, Mechanics, Draughtsmen, Engineers, Firemen, and all connected with the mechanical industries who are anxious to advance. It is an opportunity for them to obtain the technical education necessary to secure better positions and better pay. It is the only way to get an education without leaving home or quitting work.

*Q.* Does it require a long time to complete the course of study?

*A.* No. The Instruction Papers are carefully and concisely written by competent mechanical engineers. Everything unimportant is omitted, and only that retained which is necessary to make clear to the student what he must know. The course is as short as is consistent with thoroughness. The Complete Course requires, for those who can only devote a few hours after work to study, about eighteen months, the Mechanical Drawing Course, about nine months.

*Q.* How can I obtain more information about the School?

*A.* By writing to The Correspondence School of Mechanics, Scranton, Pa. They will gladly send you a free circular of information, which contains all particulars of the course of study, method of instruction, terms, etc.

and reservoir are equalized, a light opening is placed in the valve chamber *E* so as to press on the top of the valve *f*.

The object of this device is to keep the brakes applied while the train-reservoirs are being recharged, without in any way disturbing the triple-valve mechanism now in use.

This pressure-valve is operated from the engine with the engineer's brake-valve. If brakes are applied on train while running, and it is desired to recharge and release the brakes, the valve-handle will be put in full release to get the triple-valve piston up to open charging groove; then place the handle on lap, giving time for air to equalize between auxiliary reservoir and train-pipe, the valve *f* is forced down, allowing air to escape from brake-cylinder; then place valve-handle in full release. There being no air in brake-cylinder the train will be recharged in the usual way.

With this automatic pressure-retaining valve, whenever a train is running steadily with either 10, 20 or 30 pounds pressure in brake-cylinder, having a high pressure in main reservoir, the train can be recharged without allowing air to escape from brake-cylinder.

If an air-gauge was attached to driver-brake reservoir, so that the engineer could see when the pressure in reservoir and train-pipe were about equal, he could then lower the pressure in train-pipe and the air in brake-cylinder would still be held in brake-cylinder by the triple-valve. Trains run on our hill division with straight-air had very few broken, cracked or flat wheels. One reason to account for this is that, with straight air, when brakes were released the brake-shoes were clear of wheels; there being then no 10 or 15 pound pressure-valves used, the brake-shoes and wheels cooled off some before air was again applied. This automatic pressure-retaining valve does this same thing, the engineer having the brakes and pressure-valves under his control.

This valve has been tested on a train on the mountain division of the Southern Pacific and done everything claimed for it. This is written for the information of those who may think of improving the pressure-valve. It may not be what is wanted. Let others keep trying

The triple-valve has proved itself to be almost perfect; the pressure-valve now in use is not. There are many, probably, working and thinking on improving the automatic brake The triple-valve being good, leave it as it is; let them turn their attention to the pressure-valve, for the only way it works good is when cut out.

THOS. P. SWEENEY.

*Sacramento, Cal.*

### That Cylinder Head that was Knocked Out by Compression.

*Editors*:

On page 411, in September number, I noticed an article headed "How the Breaking of a Rocker-Arm Could Cause the Knocking-out of a Cylinder-Head," and signed "A. A. Brown," in which Mr. Brown goes on to explain how it was done. He says, when arm broke it left valve with front port open; pressure on valve held it there; steam followed piston on backward stroke, and was forced back into boiler on forward stroke as long as throttle was open; when throttle was closed piston was at back end of cylinder, which was full of steam at 80-pounds pressure, and there being no way for it to escape it was compressed by forward stroke of piston to a pressure of 1,920 pounds. I should like to have Mr. Brown explain how he kept the steam in that cylinder until it was compressed to 1,920 "pounds." Admitting that throttle was closed when piston was at back end of cylinder, which was full of steam at 80-pounds pressure, when piston has moved half the stroke we have forward half of cylinder full of steam at a pressure of only 160 pounds, without making any allowance for the dry pipe, steam pipes in smoke arch, steam passages in saddles and steam chest, as a receiver of their share of the compressed steam. But, without making any allowance for this, we will suppose we have forward half of cylinder full of steam at 160-pounds pressure. At this point the valve would open port to cylinder on other side, and compression would be stopped, as the advance of piston to front end of cylinder would simply force the steam from that side into the same amount of space in the other cylinder. But if we make due allowance for the pipes, passages and chests, the pressure would be a great deal less.

Now, let us suppose that the dry pipe, steam pipes in smokearch, passages in saddles, and steam-chests are equal to the volume of one cylinder, which I do not think is putting it any too large. When piston has moved half the stroke it has reduced the volume one-fourth instead of one-half, as in the other case, and increased the pressure in proportion, which would be from 80 to about 107 pounds instead of 160. Now, at this point, as I said before, the valve opens the port to the other cylinder, and compression is stopped, and the steam is forced by the advance of piston to front end of cylinder to same space in the other cylinder.

Again, Mr. Brown says, if both ports were covered, the compressed steam would raise the valve, and allow it to escape through exhaust. Here he is mistaken again, in my opinion, as the steam in cylinder would only have about 20 square inches of surface to work on against about 150 inches on top of valve with 80 pounds pressure to hold it down; so it is plain that compression would have to run up to a very high pressure before it would raise the valve, and if there was a weak spot in cylinder-head it might be broken in this way.

CHARLES A. GREENE.

*Saginaw, Mich.*

### What Sticks These Triples?

*Editors*:

I would like to ask some of the air-brake M.D.'s. who read *our* paper if they ever have brake-valves to stick? I have to take them apart often, grind them in with fine grindstone mud, put tallow on the valve and seat, make them work nice and easy. When a heavy pressure of air is pumped up they will get so tight that a person can hardly move them. These are the valves shown on plate D8, 1890 catalogue. The 1892 valve has not given me any trouble in this direction; probably this is due to the '92 valve having an iron seat. Brass and iron is, I believe, supposed to work together better than brass and brass. I attribute the trouble to the nature of the lubricant so commonly used on air-pumps, and the large amount of it used. Do you know of any railroad company who adhere strictly to the kind of oil prescribed by the Westinghouse Air-Brake Co.? I do not.

FRED B. ARMSTRONG.

*Camden, N. J.*

### Pump Disorders.

*Editors*:

As there seems to be a scarcity of pump problems, I offer the following to those interested

Pump No. 1. A passenger engine was coupled to train and ready to leave, when suddenly air-pump stopped. Enginemen failed to locate the trouble, and it being after night and no one at roundhouse capable of attending to such work, engine was held in, another substituted and another crew called.

The next morning I was told to locate and remedy the trouble. After a few minutes maneuvering I found it, and in twenty minutes engine was ready to go out, as far as pump was concerned. Pump stopped on downward stroke and would not reverse. Trouble was above center-piece. Reversing valve-stem was all right. The above was a 6-inch Westinghouse.

Pump No. 2. A pump was sent in to headquarters to be remedied of an evil which it was said to possess.

As I was then under the tutorship of Mr. Wm. Wright, motive-power air-brake overseer at the point in question, I thought I would "get one on the old man" by solving the mystery connected with this pump; but I was doomed to disappointment, for, after repeated trials on the test rack, William finally bested me.

When steam was given, pump-piston repeatedly persisted in remaining at rest. But when piston was lifted to top of pump and secured by tightening gland-nuts, it would descend in the usual manner when given steam and then stop. There was quite a perceptible blow through exhaust.

All working parts were carefully examined and found to be intact.

All bushings and packing rings, where it was thought the trouble might lie, were thoroughly inspected.

After the—I nearly told it—had lain in the corner a week, it was determined to give the pump a final examination. With this success crowned our efforts, for there, but of Liliputian dimensions, lay the seat of operations of the hitherto cancealed oppressor. What was it?

This was an 8-inch Westinghouse.

*Topeka, Kan.* GEO. BAILIE.

### Uncertain Action of Triple-Valve.

*Editors*:

In experimenting with new triple-valves, claimed by the inventors to be the best in the world, etc., I have many times encountered the same difficulty that Mr. Horton describes in the last issue of your paper. Emergency setting when it was not wanted, and then sticking open so as to blow the air out of the train-pipe when the main piston went back to release position. It is not stated in the problem what kind of a brake it was that gave the trouble, so it is hard to ferret out the cause. Supposing it to be a Westinghouse triple-valve, the quick action must have been caused either by a broken pin in the graduating-valve, a large quantity of gum around the graduating-valve or slide, or a weak graduating spring; but the refusal of the quick-action valve to seat again must have been due to some different cause, such as a weak spring under the emergency-valve or a sticking of these parts from dirt. If the offending valve was a New York triple the trouble might have been caused by a weak spring under the emergency piston. The fact that the brakes were afterwards successfully pumped off shows that the emergency-valve finally got back to its seat, for had it not done so it would have been impossible to get the brakes to release at all.

PAUL SYNNESTVEDT.

*Chicago, Ill.*

### Caring for Leather Packing in Driver-Brake Cylinders.

*Editors*:

M. Watts says the best thing that he can find is water to soften driver-brake leathers, using very little oil. I have been using water for about six years, and it is the quickest thing to soften a leather that I can find. I will state that one of the road foremen of engineers recently wrote a letter to our master mechanic condemning the use of water, saying it was only a temporary expedient, and that it left the leather worse than it was before. I think a temporary expedient is better than none.

I recently had an engineer take me to his engine when he was starting out on a long trip with a freight train and show me his driver-brake. The air would not lift the piston at all. I said to him, "Put some water in." He replied that it would do no good. I said, we will cool it off, anyway. I put some water in the top of the cylinder and the brakes went on the first time they were applied, and they ran a week and held—if the water had not been put in he would have went over the road without brakes, perhaps killed some one or had an accident of some kind, so a temporary expedient was good in this case. I have done this many times when we have not had time to take down the cylinders and put new leathers in.

We use asbestos in the form of paste-board, in back of the cylinders, and I believe that is a great benefit towards keeping the leathers from burning up. We have it about ⅛ of an inch thick; we cut a piece the size of the back of the cylinder, put four holes in it and put it on the bolts that hold the cylinder on, this prevents the heat from the firebox from burning quite as bad as it would without anything on. Yet it does not keep the leather in good condition.

FRED B. ARMSTRONG.

*Camden, N. J.*

### From Full Release to Emergency.

*Editors*:

I see men are claiming to get increased pressure in brake-cylinder by placing brake-valve in full release quickly and then to the emergency position, when there has been a service application made. I cannot see how it can increase the pressure, for it will certainly throw the triple-valves to full relief position, allowing a per cent. of pressure then in brake-cylinder, and then to get the emergency action to take place the pressure has to be reduced below the auxiliary pressure again (train-pipe pressure I mean), and I think the loss from the pressure in the cylinder would be more than the train-pipe could add, as I believe, from observing the action of cars while trying the experiment, that more air has to be discharged from train-pipe to get the emergency-valves to act under these conditions than by making an emergency application only. And I notice that on a number of cars emergency does not take place, caused by the condition of the strainers, I think, they being so full of dirt and gum that it takes too long for air to pass through them. I am speaking of freight cars; have not experimented with passenger cars yet. Consequently, my advice to engineers is to go from service position to emergency, or from running position to emergency, as the case may be, and leave it there in case of danger. In ordinary stops, you can do a great deal better braking by not using the emergency at all. Judgment will make a better stop with less damage to cars and less time to the stop. If there are no leaks in the train-pipe, there is seldom any call for but a single application of the brakes.

*Covington, Ky.* J. H. BROWN.

### "What Ailed the Engineer's Valve?"

*Editors*:

In answer to W. F. Relyea's question, "What ailed the engineer's valve?" when air flowed freely through preliminary exhaust port, and yet would not set brakes in service application, would say that by some means air was prevented from escaping from train-pipe at service-stop exhaust through ports *M* and *N*, probably by stop-cock being closed; but one would think it must surely be discovered before taking valve apart. It may have been that the hole in the stop-cock plug was drilled transversely to the handle, and on this account might be overlooked in the shop. The difference in sound ought to make it discernible in service.

*Pittsburg, Pa.* JOHN BRUCE.

### Cold Facts About Theory and Practice.

*Editors*:

I would like to preach a short sermon, with Mr. Ernest Martin's letter on "Theory and Practice" as a text. If there was any one who seriously believed that theory was complete without practice, there might be some utility in the repetition of such statements as Mr. M.'s, but as the necessity of practice is universally admitted, even in the

technical schools, I don't quite see the utility The fact of the mechanical school graduate, who Mr. M quotes as going to work in the railroad shop, shows that he appreciates the necessity of practice.

I would like to ask Mr. Martin whether the persons who are examined are not invariably persons who, by a long and successful apprenticeship as firemen, have shown their mastery of the practical part of the work. If he knows of any road where men without a considerable experience as firemen are made engineers on the strength of a theoretical examination, there may be some ground for his complaint, but I do not know of any such.

So far as my observation goes, the oft-repeated platitudes about theory and practice come from men who are too dead intellectually to profit by the experience of others as given in books and periodicals. To support my view, I would refer to the very many splendid engineers who have been made during the last ten years, after making a good record as firemen and successfully passing an examination that the unsuccessful candidates call "theoretical."

AARON MCP. JENKINS.

*Argentine, Kan.*

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### Brown's Lame Engine.

*Editors*:

That lame engine of Mr. Brown's, in the September number, was probably caused by the failure of the artist who put up the job to get the rocker right arm up. In many of our American eight-wheel engines one arm of the rock-shaft is longer than the other, and if their positions are reversed it makes considerable difference in the cut-off when hooked up, while making very little in full gear; so that the engine may have shown everything correct in full gear, and have developed a very cross-legged exhaust when hooked up.

F. W. PETERSON.

*Boone, Ia.*

THE ANSWER.

*Editors*.

A left-hand rocker-arm was put on right side. The effect being, say ¼ inch, threw the valve out 1½ inches by having the set the wrong way.

*Waycross, Ga* A. A. BROWN.

---

### Answer to Driver-Brake Question.

*Editors*:

On examining the three-way cock I found a small crease cut in the plug, and when not left in its proper position it leaked around; but when left in its proper position it did not raise the driver-brake.

*Sherman, Tex.* R. HILL.

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### Cause of Brake Not Applying in Service Position.

*Editors*:

Mr. Relyea speaks of a brake-valve that would not apply brakes in service position. I am inclined to the opinion that the trouble was caused by a crack in the leather gasket in valve body, and that the crack was located between the direct application and supply passage and chamber *D*. With this defect in the valve an attempt to apply the brakes by a service application would draw pressure from above piston 17, but would not reduce it as the air in the train-pipe would flow through the crack in gasket and into chamber *D*, and assuming that the crack in the gasket was equal in area to the preliminary exhaust port the pressure above and below piston 17 would remain equal, and there would consequently be no movement of piston 17 and no release of pressure from train-pipe except from the preliminary exhaust port. This port being very small the discharge of air through it would not be sufficient in volume to reduce train-pipe pressure enough to cause triples to move the brake-piston over the leakage grooves in brake-cylinders.

Ordinarily these gaskets do not crack, and when they do it is generally caused by the valve being located very near the boiler-head, the heat from which dries and burns them up.

E. P. BISHOP.

*Birmingham, Ala.*

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### How to Set Valves in Eight Minutes.

*Editors*:

Some of your correspondents seem to think Mr. Campbell's plan of setting valves in ten minutes not possible. With my own eyes I have seen a "cub" set valves in eight minutes—to a sandbox. Of course, time for drilling holes and putting in pins was not counted.

A. A. BEAVERS.

*Waycross, Ga.*

---

### What Mr. Campbell Said About Quick Valve-Setting.

*Editors*:

At the time I wrote on valve-setting I did expect to hear some comments on it, but I did not expect to have them continue for such a length of time after the article was written.

Now, it seems to have done some little good after all, but, Oh Lord! "L. W." takes the cake, and I must confess it makes me feel proud to see how much he has accomplished through your valuable paper and my article.

I do feel a little sorry that my writing on valve motion was so misconstrued by others.

I did not say anything about a machinist's time of setting a valve.

I said my foreman—and I still say I would not have a foreman that could not tell a machinist what to do in ten minutes to square a valve. The idea of a man pinching an engine all over a roundhouse and keeping the laborers four or five hours pinching an engine! My idea is simply to tell a machinist what to do about lengthening or shortening eccentric-rods.

Now, Mr. W. H. Wesley, you see by this that you misunderstood me about the machinist. Neither I nor any other man living can tell how long it will take a machinist to do his part of the work, as he may have to cut out the holes in eccentric-blades and he may have to offset the keys in eccentrics if they are keyed on. Now, my foreman does not have to crawl under the narrow-gauge engines. He has other duties to attend to.

E. A. CAMPBELL.

*Houston, Tex.*

[This ten-minute valve setting controversy has been going on now for three years and if the readers are not tired of it the J. P is. We will sell the next contribution on the subject for waste paper.]

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### What Do You Want to Know About Coppersmithing?

*Editors*:

Let me say a word or two to the boys. I am interested in the boys, and the men, too, for that matter, and the foreman, and while I would like their attention and appreciation of my work, I am far more interested in the boys; because I know what *a boy* had to encounter fifty years ago, and what boys generally have to encounter now when in search of information to assist them in making themselves efficient and competent workmen. Now, I do not presume to know all there is known in the coppersmith's art, but having been a close student of it, and having had fifty years of practical experience in sheet-metal working at the bench, it is to be supposed that I can tell something about it, and if any of my boy readers will write to the Editor of LOCOMOTIVE ENGINEERING, asking an intelligent question concerning the work done in a railroad coppersmith's shop, I will, to my best, answer him or them in the most lucid manner in which I am able, or confess that I am unable to do so.

JOHN FULLER, SR.

*Seneca Kan.*

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### A New Unit of Measure.

BY JOHN H. COOPER.

Your remarks in September LOCOMOTIVE ENGINEERING reminds me that I once suggested and published the same in February, '88, a new division and organization of our rules and scales. The following will give the data and describe it in a general way:

A rule for measuring and the divisions and subdivisions of it should be suited to the human eye and hands.

The standard inch as we now have it, as a fixed unit, should be preserved and used.

The conclusion is already foregone that the decimal system of graduating rules and scales, the best of all, so far devised, should be employed and maintained.

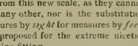
Whatever standard unit may be adopted, and however it may be divided, the subdivisions of it can be extended and the eye assisted by instrumental means to almost any refinement of reduction by verniers and microscopes, as already done.

The human eye will ever be what it is now, and any scale suited to its present needs will always be right.

The millimetre is too coarse for a smallest division on the scale, and its sub-division into tenths would be entirely too fine for the unassisted eye—much finer than the hundreth of an inch, which is practically invisible to most eyes To sub-divide the millimetre into halves and quarters would mix the fractional with the decimal systems and introduce confusion.

I propose taking for a unit of a new scale a space equal to *one-and-a-half* of the present standard inch, and then divide this new inch into ten equal parts, subdividing each of these parts again into tenths, whence we will find the hundredth part of this new inch a plainly visible and practically usable quantity without the use of instrumental helps to the eye.

A scale is here shown as divided, in order that its least division may be seen in comparison with the standard inch similarly divided.

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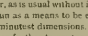


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It is neither believed, nor urged here, that all the exact dimensions of the fitting parts of machines can be measured by the eye from this new scale, as they cannot be from any other, nor is the substitution of measures by *sight* for measures by *feeling* here proposed for the extreme niceties of machine fitting.

The superiority of *feeling* over *sight* must ever, as is usual without instrumental aid, remain as a means to be employed for copying minutest dimensions.

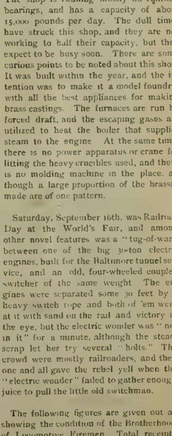
I propose further to use ten of these new inches to make the new foot, which will be equal in length to fifteen of the present standard inches, and the new *two-foot rule* for general use will, therefore, be thirty inches long, which will make a rod in every way equal to the present two-foot rule, and more convenient for eye and hand than the metre, and which can be readily employed for exact continued measuring; a feat not easily accomplished by the metre, by everybody, which any one may prove by taking a rod 3 feet 3 inches and three-eighths of an inch long, and try to see a fine mark at each end of it, while holding it immovable on the surface upon which the measuring is to be done.

But then, any radical change is attended with trouble and expense. The path of least resistance should always be taken.

There can be no reason whatever offered in favor of the metrical measure, other than its decimal division. This we have in the scale here offered, which also preserves the standard inch, a unit already made and preserved at immense cost.

Again, there is not a single tool, machine or device existing, which has been made by the standard inch, that the metre and its subdivisions will measure, while with the 1½-inch unit system a small fraction of the number only would not be measurable.

The system here proposed is based upon the three essentials of a measuring device its smallest division should be the least that is plainly visible to the unassisted eye, it should be graduated on the decimal system, and its two-foot rule should be as handy for general use as is our present two-foot rule.



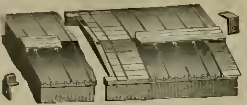
DRAW-HEAD AND REMOVABLE BUFFER FOR TENDERS. SOUTHERN PACIFIC RAILROAD.

One of the tidiest brass-molding shops to be found in the land is now in operation at Depew, N Y., by the Buffalo Brass Co. The shop is running mostly on railroad bearings, and has a capacity of about 15,000 pounds per day. The dull times have struck this shop, and they are not working to half their capacity, but they expect to be busy soon. There are some curious points to be noted about this shop. It was built within the year, and the intention was to make it a model foundry, with all the best appliances for making brass castings. The furnaces are run by forced draft, and the escaping gases are utilized to heat the boiler that supplies steam to the engine At the same time, there is no power apparatus or crane for lifting the heavy crucibles used, and there is no molding machine in the place, although a large proportion of the brasses made are of one pattern.

Saturday, September 16th, was Railroad Day at the World's Fair, and among other novel features was a "tug-of-war" between one of the big 30-ton electric engines, built for the Baltimore tunnel service, and an old, four-wheeled coupled switcher of the same weight The engines were separated some 30 feet by a heavy switch rope and both of 'em went at it with sand on the rail and victory in the eye, but the electric wonder was "not in it" for a minute, although the steam scrap let her try several "holts." The crowd were mostly railroaders, and they one and all gave the rebel yell when the "electric wonder" failed to gather enough juice to pull the little old switchman.

The following figures are given out as showing the condition of the Brotherhood of Locomotive Firemen Total receipts for the year ending July 31, 1893, $624,67? - 25; total disbursements, same period, $56?,-120 45; cash on hand, $56,557 80. This balance forms an excess fund. Protective funds on hand, $52,000. This fund is earning interest at 4 and 5 per cent. Increase of receipts over the present year, $115,000. increase of disbursements, $11,000. The order has now a membership of 29,000.

# THE MURPHY STEEL CAR ROOF.



HAS no surface nail or screw holes. It has no joints where cinders, rain or fine snow can get through. It allows for contraction and expansion, and has ample elasticity to provide for sagging, twisting, buckling and cornering of the car body. It is as solid as the car frame itself. It has no soldered joints. It can be repaired readily, and without taking off more of the roof than is damaged. It is much cheaper than any other metallic roof now in use, and is cheaper than the double board roof, made of good lumber. It is unlike any other metallic roof for the reason that **everything is furnished to make it complete**; so that the parties buying it have no expense other than to apply it.

**This ROOF can be applied on OLD LEAKY BOARD-ROOF CARS without making any changes in the board roof; thereby saving the expense of replacing the old boards with new, and thus utilizing material that must otherwise be thrown away.**

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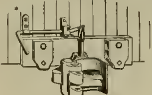

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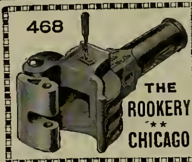


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Please compare these results and write us for prices and further information.

C. F. SPRINGER, MANAGER.

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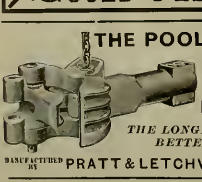

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Send stamp for our twenty page catalogue and price list.

STANNARD & WHITE, Appleton, Wis.

## The Polar Zone.

BY JOHN ALEXANDER.

Very few of my friends know me for a sailor, but I sailed the salt seas, man and boy, for five months and eighteen days, and I know just as much about sailing the hereinbefore mentioned salt seas as I ever want to.

Ever so long ago, when I was young and tender, I used to have fits of wanting to go into business for myself. Along about the front edge of the seventies, pay for "toting people and truck" over the eastern railroads of New England was not of sufficient plenitude to worry a man as to how he would invest his pay check—it was usually invested before he got it—but that's another story, as my friend Rud. Kipling would say.

One of my periodical fits of wanting to go into business for myself came on suddenly one day when I got home and found another baby in the house. I was right in the very worst spasms of it when my brother Enoch, whom I hadn't seen for seventeen years, walked in on me.

Enoch was fool enough to run away to sea when he was twelve years old—I suppose he was afraid he'd get a chance to do something beside whaling. We were born down New Bedford way, where another boy and myself were the only two fellows in the district for over forty years who didn't go hunting whales, icebergs, foul smells and scurvy, up in the Frost King's bailiwick, just south of the pole. Enoch was captain and part owner of a Pacific whaler; she had recently burned at Honolulu, and he was back home now to buy a new ship.

He had heard that his little brother John was the best engineer in the whole world and had come to see me; partly on account of relationship, but more to get my advice about buying a steam whaling ship. Enoch knew more about whales and ships and such things than you could put down in a book, but he had no more idea about *how* steam propelled a ship than I had what the "skivvie tricer" was.

Well, before the week was out Enoch showed me that he was pretty well fixed in a financial way, had no kin but me that he cared about, and offered me an interest in his new steam whaler if I would go as chief engineer with her to the North Pacific.

The terms were liberal and the chance a good one, so it seemed, and after a good many consultations my wife agreed to let me go for *one* cruise. She asked about the stops to be made in going around the Horn and figured a little after each place was named—I believe now she half expected I'd desert and walk home from one of these stops and was figuring on the time it would take me.

When the robins were building their nests the new steam whaler *Champion* left New Bedford for parts unknown (via the Horn) with the seasickest chief engineer that ever smelt fish oil.

The steam plant wasn't very much, two boilers and a plain 28 x 36 double engine and any amount of hoisting rigs, blubber boilers and other paraphernalia.

I'm not going to tell you much about this cruise of the *Champion*, it's not her story I'm telling, she only leads up to another strange, true story.

We refitted in San Francisco, and on a clear summer morning turned the white-painted figure-head of the *Champion* towards the North and stood out for Behring Sea.

I'm here to tell you that your uncle John didn't just relish the idea of three years up in the ice floes, out of reach of mail or wire, with a wife and three babies down in the Old Colony, and the nearer the *Champion* got to big fish the "lonesomer" your Uncle John kept getting.

We'll just pass over the fact that while we lay at the mouth of the Yukon River, up in Alaska, getting ready for a sally into the realm of water above the Straits, a whaler, bound for San Francisco and home, dropped anchor near us, and the homesickness struck in and there was a relapse, and—never mind the details now—your Uncle John came home without any whales, and was mighty glad to get on the extra list of the old road, and don't you forget it, neither.

The story I want to tell is another man's story, and it was while laying in the Yukon that I heard it. I was deeply impressed with it at the time and meant to give it to the world as soon as I got home, for I set it all down plain then, but I lost my diary, and now, after twenty years, my wife turned it up in the garret at this spring house-cleaning. Fred had it and an old Fourth of July cannon put away in an ancient valise, like a boy will treasure up useless things.

Under the head of October 12th I find this entry:

"At anchor in Yukon River, weather fair, recent heavy rains, set out packing and filed main-rod brasses of both engines. Settled with Enoch to go home on first vessel bound South. Demented white man brought on board by Indians, put in my cabin."

In the next day's record there appears the following:

"Watched beside sick man all night; in intervals of sanity he tells a strange story, which I will write down to-day."

The 14th has the following:

"Wrote out story of stranger, see back of this book."

In the back, on paper cut from the blank pages of an old log of the *Champion*, is the story, that now, twenty years after, I tell you here.

On the evening of the 12th I went on deck to smoke and think of home, after a hard day's work getting the engines in shape for a siege. The ship was very quiet, half the crew being ashore and some of the rest having gone in the boat with Captain Enoch to the *Enchantress*, homeward bound, and lying about half a mile below us. I am glad to say that Enoch's principal business aboard the *Enchantress* is to get me passage to San Francisco; I despise this kind of dreariness—rather be in State prison, near the folks.

I sat on the rail just abaft the stack watching some natives handle their big canoes, when a smaller one came alongside. I noticed one of the occupants lay at full length in the frail craft, but paid little attention until the canoe touched our side. Then the bundle of skins and Indian clothes bounded up, almost screamed "At last!" made a spring at the stays, missed them, and fell with a loud splash into the water.

The Indians rescued him at once, and in a few seconds he lay like one dead on our deck. I saw at a glance that the stranger in Indian clothes was a white man and an American.

A pretty stiff dram of liquor brought him to slightly—enough so he opened his eyes, looked up at the rigging, and, closing his eyes, he murmured "Thank God! —Frisco—Polaria!"

I had him undressed and put into my berth. He was shaking as with an ague, and when his clothes were off we plainly saw the reason—he was a skeleton, starving.

I went on deck at once to make some inquiry of the Indians about our strange visitor, but their boat was just disappearing in the twilight.

The man gained strength as we gave him nourishment in small, frequent doses, and talked in a disjointed way of everything under the sun. I sat with him all night.

Towards morning he seemed to sleep longer at a time, and in the afternoon of yesterday fell into a deep slumber, from which he did not waken for nearly twenty hours.

When he did waken he took nourishment in larger quantity, and then went off into another long sleep. The look of pain on his face lessened, a healthy glow appeared on his cheek, and he slept so soundly that I turned in—on the floor.

I was awake along in the small hours of the morning and heard my patient stirring, so I got up and drew the little curtain over the bull's-eye port—it was already daylight.

I gave him a drink and a biscuit, and told him I'd go to the cook's galley and get him some broth; but he begged me to wait until breakfast time, said he felt refreshed, and would just nibble a sea biscuit. Then he ate a dozen in as many minutes.

"Did you take care of my pack?" he said eagerly, throwing his legs out of the berth and looking wildly at me.

"Yes, it's all right; lay down and rest," said I, for I thought to cross him would set him off his head again.

"Do you know that dirty old pack contains more treasures than the mines of Africa?"

"It don't look it," I answered, and laughed to get him in a pleasant frame of mind—for I hadn't seen or heard of his pack.

"Not for the little gold and other valuable things, but the proofs of a discovery as great as Columbus made; the discovery of a new continent, a new people, a new language, a new civilization and riches beyond the dreams of a Solomon —— "

He shut his eyes for a minute, and then continued:

"But, beyond Purgatory, through Death and the other side of Hell ——"

Just here Enoch came in to inquire after his health, and sat down for a moment's chat. Enoch is first, last and all the time captain of a whaler; he knows about whales and whale hunters just as an engineer on the road knows every speck of the scenery along the line, every man and every engine. Enoch couldn't talk ten minutes about anything without being "reminded" about an incident in his whaling life; couldn't meet a whaleman without "yarning" about the whale business. He lit his pipe and asked

"Been whalin' or huntin' North Pole?"

"Well, both."

"What ship?

"The *Duncan McDonald*."

"The devil—the *McDonald!*—why, man, we counted her lost these five years; tell me about her, quick; old Chuck Burrows was a particular friend of mine—where is he?"

EXHIBITED AT WORLD'S FAIR BY H. K. PORTER & CO.

"Captain, Father Burrows and the *Duncan McDonald* have both gone over the unknown ocean to the port of missing ships."

"Sunk?"

"Aye, and crushed to atoms in the bell of ice."

Enoch looked out of the little window for a long time, forgot his pipe and at last wiped a tear out of his eye, saying, as much to himself as us:

"George Burrows made me first mate of the first ship he ever sailed. She was named for his mother, and we left her in the ice away up about the 73d parallel. He was made of the salt of the earth, a sailor and a nobleman. But he was a dare-devil, didn't know fear, always venturing where none of the rest of us would dare go. He bought the *McDonald*, remodeled and fitted her after he got back from the war—she was more than a whaler, and I had a feeling that she would carry Burrows and his crew away forever——"

Eight bells rung just here, and Enoch left us, first ordering breakfast for the stranger and saying he would come back to hear the rest after breakfast.

As I was going out, a sailor came to the door with a flat package, perhaps six inches thick and twelve or fourteen square, covered with a dirty piece of skin made from the intestines of the whale, and used by the natives of these climes because it is light and waterproof.

"We found this in a coil of rope, sir; it must belong to him. Lord, sir; it's mostly lead"

It was heavy, and I set it inside the

door, remarking that here was his precious pack.

"Precious' aye, aye, sir ; precious don't describe it. Sacred, that's the word. That package will cause more excitement in the world than the discovery of gold in California. This is the first time it's been out of my sight or feeling for months and months, put it in the bunk here, please."

I went away, leaving him with his arm around his sacred package.

After breakfast Enoch and I went to the little cabin to hear the stranger's story, and I, for one, confess to a great deal of curiosity. Our visitor was swallowing his last bowl of coffee as we went in.

"So you knew Captain Burrows and the *Duncan McDonald?*" said he.

"Let me see, what is your name?"

"Alexander, captain of the *Champion*, at your service, sir."

"Alexander ; you're not the first mate Enoch Alexander, that sat on a dead whale all night, holding on to a lance staff after losing your boat and crew?"

"The same."

"Why, I've heard Captain Burrows speak of you a thousand times."

"But you was going to tell us about the *McDonald* ; tell us the whole cruise from stem to stern."

"Let's see, where shall I commence?"

"At the very beginning," I put in.

"Well, perhaps you've noticed it, perhaps not, but I'm not a sailor by inclination or experience. I accidentally went out on the *Duncan McDonald*. How old would you take me for?"

"Fifty or fifty-five," said Enoch.

"Thanks, captain, I know I must look all of that; but lemme see, forty-five, fifty-five, sixty-five, seventy, seventy—— what year is this?"

"Seventy-three."

"Seventy-three. Well, I'm only twenty-eight now."

"Impossible' Why, man, you're as gray as I am, and I'm twice that."

"I was born in forty-five, just the same.

"My father was a sea captain in the old clipper ship days and a long time after. He was in the West India trade when the war broke out, and as he had been educated in the navy enlisted at once. It was on one of the gunboats before Vicksburg that he was killed.

"My mother came of a well-to-do family of merchants, the Clarks of Boston—and, to make a long story short—died in sixty-six, leaving me considerable money.

"An itching to travel, plenty of money, my majority, and no ties at home sent me away from college to roam, and so one spring morning in sixty-seven found me sitting lazily in the stern of a little pleasure boat off Fort Point in the Golden Gate, listlessly watching a steam whaler come in from the Pacific.

"My boatman called my attention to her, remarking that she was spick and span new, and the biggest one he ever saw, but I took very little notice of the ship until, in tacking across her wake, I noticed her name in gold letters across her stern, *Duncan McDonald*. Now, that is my own name and was my father's name, and try as I would I could not account for this name as a coincident, common as the name might be in the highlands of the home of my ancestors, and before the stanch little steamer had gotten a mile away I ordered the boat to follow her—I intended to go aboard and learn, if possible, something about where her name originated.

"As she swung at anchor off Goat Island I ran my little boat alongside of her and asked for a rope.

"'Rope?' inquired a Yankee sailor, sticking his nose and a clay pipe overboard, 'might you be wantin' to come aboard?'

"'Yes, I want to see the captain.'

"'Well, the cap'en's just gone ashore, his gig is yonder now, enemost to the landin'. You come out this evenin', the cap'en's particular about strangers, but he's allus to home of an evenin'.'

"'Who's this boat named after?'

"'The Lord knows, stranger, I don't ; but I reckon the cap'en kin tell, he built her.'

"I left word that I would call in the evening, and at eight o'clock was alongside again.

"This time I was assisted on board and shown to the door of the captain's cabin ; the sailor knocked and went away.

"It was a full minute I stood there before the knock was answered, and then from the inside, in a voice like the roar of a bull, came the announcement

"'Well, come in'

"I opened the door on a scene that will never be forgotten. A bright light swung from the beams above, and under it sat a giant of the sea, Captain Burrows. He had the index finger of his right hand resting near the North Pole of an immense globe ; there were many books about, rolls of charts, fire-arms, instruments, clothing and apparent disorder everywhere ; the cabin was large, well furnished and had something striking about it. I looked around in wonder without saying a word.

"Captain Burrows was the finest looking man I ever saw—six foot three, straight, muscular, with a pleasant face ; but the steadiest, keenest blue eye you ever saw. His hair was white, but his long, flowing beard had much of the original yellow. He must have been sixty, but for all the pleasant face and kindly eye you would notice through his beard the broad, square chin that proclaimed the decision and staying qualities of the man."

"That's George Burrows, stranger, to a queen's taste—just as good as a photograf," broke in Enoch.

"Well," continued the stranger, "he let me look for a minute or two, and then said.

"'Was it anything particular?'

"I found my tongue then, and answered:

"'I hope you'll excuse me, sir, but I must confess it is curiosity. I came on board out of curiosity to —'

"'Reporter, hey?' asked the captain.

"'No, sir ; the fact is your ship has an unusual name, one that interests me, and I wish to make so bold as to ask how she came to have it.'

"'Any patent on the name?'

"'Oh, no ; but I——'

"'Well, young man, this ship—by the way the finest whaler ever stuck together—is named for a friend of mine ; just such a man as she is a ship—the best of 'em all.'

"'Was he a sailor?'

"'Aye, aye, sir, and *such* a sailor ; fight' why, man, fighting was meat and drink to him——'

"'Was he a whaler?'

"'No, he wan't , but he was the best man I ever knew who wan't a whaler. He was a navy sailor, he was, and a whole ten-pounder battery by hisself. Why, you just ort to see him waltz his old tin-clad gunboat up agin one of them reb forts jest naturally skeered 'em half to death before he commenced shootin' at all.'

"'Wasn't he killed at the attack on Vicksburg?'

"'Yes, yes ; you knowed him, didn't you? He was a——'

"'He was my father.'

"'The devil, he was!' yelled Captain Burrows, jumping up and grasping both my hands. 'Of course he was ; darn my lubberly wit that I couldn't see that before!' Then he hugged me as if I was a ten-year-old girl, and danced around me like a maniac.

"'By all the gods at once, if this here don't seem like Providence—yes, sir, old man Providence himself! What are you adoin'? When did you come out here? Where be you goin', anyway?'

"I found my breath and told him briefly how I was situated.

"'Old man Providence has got his hand on the tiller of this raft or I'm a grampus' —*say*' do you know I was just wishin' and waitin' for you? Yes, sir ; by thunder' no more than yesterday, says I to myself. Chuck Burrows, sais I, you are a gittin' along too fur to the wind'ard o' sixty fur this here trip all to yourself. You ort to have young blood in this here enterprise ; and then I jist clubbed myself for being a lubber and not gettin' married young and havin' raised a son who I could trust. Yes, sir ; jist naturally cussed myself from stem to stern, and never onct thought as mabee my old messmate, Duncan McDonald, might have adone suthin' for his country afore that day at Vicks——*say*' I want to give you half this ship. Mabee I'll do the square thing and give you the whole of the tub yet. All I want is for you to go along with me on a voyage of discovery—be my helper, secretary, partner, friend—anything. What de you say? *Say!*' he yelled again before I could answer, 'tell you what I'll do—damme if I don't adopt ye , that's what I'll do. Call me *pop* from this out and I'll call you *son*' *Son!*' he shouted, bringing his fist down on the table with a bang. '*Son!* that's the stuff! By the bald-headed Abraham, who says Chuck Burrows ain't got no kin? The *Duncan McDonald*, Burrows & Son, owners, captain, chief cook and blubber cooker, by thunder' And who the hell says they ain't?'

"And the old captain glared around as if he defied anybody and everybody to question the validity of the claims so excitedly made out.

"Well gentlemen, of course there was lots else said and done, but that announcement stood, and was all the adoption proceedings made out, and to the day of his death I always called the captain Father Burrows and he called me son, always addressing me so when alone as well as when in the company of others.

"Gentlemen, to make a long story short, I went every day to the ship or accompanied Father Burrows on some trip into the city, while the boat was being refitted and prepared for a three years' cruise.

"Every day the captain let me more and more into his plans, told me interesting things of the North, and explained his theory of the way to reach the pole and what could be found there that fascinated me.

"Captain Burrows had spent years in the North, noted that particularly open seasons occurred in what appeared cycles of a given number of years, and proposed to go above the 80th parallel and wait for an open season. That, according to his figuring, would occur the following year.

"I was young, vigorous, and of a venturesome spirit and entered into every detail with a zest that captured the heart of the old sailor. My education helped him greatly and new books and instruments were added to our store for use on the trip. The crew knew only that we were going on a three years' cruise, that they had no share in the profits, but were paid extra big wages in gold and were expected to go to out-of-the-way places and further North than usual. Captain Burrows and myself only knew that there was a brand new twenty-foot silk flag rolled up in oil-skin in the cabin and that father Burrows had declared that, 'By the hoary-headed Nebblekenizer I'll put them stars and stripes on new land, and mighty close to the pole, or start a butt atryin'.'

"In due course of time we were all ready and the *Duncan McDonald* passed out of the Golden Gate into the broad Pacific, drew her fires and stopped her engines, reserving this force for a more urgent time, she spread her ample canvas and stood away towards Alaska and the unknown and undiscovered beyond.

"The days were not long to me, for they were full of study and of anticipation. Long chats with the eccentric but masterful man whose friendship and love for my father had brought us together were the entertainment and stimulant of my existence—a man who knew nothing of science except that he was the master of it in his own way, who knew all about navigation, and to whom the Northern seas were as familiar as the contour of Boston common was to me, who had more stories of whaling than you could find in print and better ones than can ever be printed

"I learned first to respect, then to admire and finally to love this old salt. How many times he told me of my father's death and how and when he had risked his life to save the life of Father Burrows or some of the rest of his men. As the days grew into weeks and the weeks into months Captain Burrows and myself became as one man.

"I shall never forget the first Sunday at sea, early in the morning I heard the captain order the boatswain to pipe all hands to prayers. I had noticed nothing of a religious nature in the man, and, full of curiosity, went on deck with the rest. Captain Burrows took off his hat at the foot of the mast and said

"'My men, this is the first Sunday we have all met together, and as some of you are not familiar with the religious service on board the *Duncan McDonald* I will state that, as you may have noticed, I asked no man about his belief when I employed him—I hired you to work this ship, not to worship God—but on Sundays it is our custom to meet here in friendship, man to man, Protestant and Catholic, Mohammedan, Buddhist, Fire Worshiper and Pagan, and look into our own hearts, worshiping God as we know him, each in his own way. If any man has committed an offence against his God let him make such reparation as he thinks will appease that God, but if any man has committed an offence against his fellow man let him settle with that man, now and here, and not worry God with the details. Religion is goodness and justice and honesty ; no man needs a sky-pilot to lay a course for him, for he alone knows where the channel and the rocks and the bar of his own heart is—look into your hearts.'

"Captain Burrows stood with his hat in his hand and bowed as if in prayer, and all the old tars bowed as reverently as if the most eloquent divine was exhorting an unseen power in their behalf , the new men followed the example of the rest. It was just three minutes by the wheel-house clock before the captain straightened up and said 'Amen,' and the men turned away about their tasks.

"'Beats mumblin' your words out of a book, like a Britisher,' said the captain to me , 'can't offend no man's religion and helps everyone on 'em.'

"Long months afterward I attended burial service conducted the same way—in silence.

"In due course of time we anchored in Norton Sound and spent the rest of the winter there, and in the spring of sixty-eight we worked our way north through the ice, we passed the 75th parallel of latitude on July 4th.

"During the summer we took a number of whales, storing away as much oil as the captain thought necessary, as he only wanted it for fuel and our needs, intending to take none home to sell unless we were unsuccessful in the line of discovery—in that event he intended to stay until he had a full cargo."

Here our entertainer gave out and had to rest and while resting went to sleep, so that he did not take up his story until the next day.

In the morning our guest expressed a desire to be taken on deck, and dressed in warm sailor clothes , he rested his hand on my shoulder and slowly crawled on deck and to a sheltered corner beside the captain's cabin. Here he was bundled up and again Enoch and I sat down to listen to the strange story of the wanderer.

"I hope it won't annoy you, gentlemen," said he, "but I can't settle down without my pack, I find myself thinking of its safety ; would you mind sending down for it?"

It was brought up and set down beside him ; he looked at it lovingly, slipped the rude strap loop over his arm, and seemed ready to take up his story where he left off, so he began

"I don't remember if I told you or no,

but one of the objects of Captain Burrows' trip was to settle something definite about the exact location of the magnetic pole, and other magnetic problems, and determine the cause of some of the well-known distortions of the magnetic needle. He had some odd, perhaps crude, instruments of his own design which he had caused to be constructed for this purpose, and we found them very efficient devices in the end.

"Late in July we found much open water, and steamed steadily in a northwesterly course. We would find a great field of icebergs and then miles of floe, and then again open water.

"The Aurora was seen every evening, but it seemed pale and white.

"Captain Burrows brought the *Duncan McDonald's* head around to the west in open water one fine day in early August and cruised slowly, taking a great many observations, and hunting, as he told me, for floating ice—he was hunting for a current.

"For several days we kept in the open water but close to the ice, until one morning the captain ordered the ship to stand due north across the open sea.

"He called me into his cabin, and with a large map of the polar regions on his table, to which he often referred, he said:

"'Son, I've been hunting for a current, there's plenty of 'em in the Arctic Ocean, but the one I want ain't loafing around here. You see, son, it's currents that carries these icebergs and floes south; I didn't tell you, but some days when we were in those floes we lost as much as we gained. We worked our way north through the floe, but not on the surface of the globe; the floe was taking us south with it. Maybe you won't believe it, but there are currents going north in this sea; once or twice in a lifetime a whaler or passage hunter returns with a story of being drifted *north*—now that's what I want, I am hunting for a northern current.'

"'We will go to the northern shore of this open water, be it one mile or one thousand, and there—well, hunt again.'

"Well, it was in September when we at last got what seemed the northern shore of this open sea, we had to proceed very slowly, as there were almost daily fogs and occasional snowstorms; but one morning the ship rounded to almost under the shadow of what seemed to me a giant iceberg. Captain Burrows came on deck, rubbing his hands in glee.

"'Son,' said he, 'that is no iceberg, that's ancient ice, perpetual ice, the great ice ring—palæocrystic ice, you scientific fellows call it. I saw it once before in '37 when a boy, that's it, and, son, beyond that there is something. Take notice that that is ice; clear, glairy ice. You know a so-called iceberg is really a snowberg; it's three-fourths under water. Now, it may be possible that that being ice, which will float more than half out of water, the northern currents may go under it—but I don't believe it—under or over, I am going to find one of 'em if it takes till doomsday.'

"We sailed west, around close to this great wall of ice for two weeks without seeing any evidence of a current of any kind, until there came on a storm from the northwest that drove a great deal of ice around the great ring, but it seemed to keep rather clear of the great wall of ice and to go off in a tangent toward the south.

"The lead showed no bottom at one hundred fathoms, even within a quarter of a mile of the ice.

"It was getting late in the season, the mercury often going down fifteen below zero, and every night the Aurora became brighter. We sailed slowly around the open water for more than a week, and finally found a place where the sheer precipice of ice disappeared, and the shore sloped down to something like a beach. Putting out a sea anchor, the *Duncan McDonald* kept within a half a mile of this icy shore. The captain had determined to land and survey the place, which far away back seemed to terminate in mountain peaks of ice

"That night the captain and I sat on the rail of our ship talking over the plans for to-morrow's expedition, when the ship slowly but steadily swung around her stem to the mountain of ice—the engines had been moving slowly to keep her head to the wind.

"Captain Burrows jumped to his feet in joy. 'A current!' he shouted; 'a current, and toward the north, too—old man Providence again, son, he allus takes keer of his own!'

"Some staves were thrown overboard, and, sure enough, they floated toward the ice; but there was no evidence of an opening in the mighty ring, and I remarked to Captain Burrows that the current evidently went under the ice.

"'It looks like it did, son; it looks like it did, but if it goes under we will go over.'

"After a few hours of sleep, the long boat landed our little party of five men and seven dogs. We had food and drink for a two weeks' trip, were well armed and carried some of our instruments.

"It appeared to be five or six miles to the top of the ice mountains, but it proved more than thirty. We were five days in getting there, and did so after a dozen adventures, that I will tell you at another time.

"We soon began to find stones and dirt in the ice, and before we had gone ten miles found the frozen carcass of an immense mastodon, its great tusks only showing above ground, but its huge, wooly body quite plainly visible in the ice.

"The ice was melting, and there were many streams running towards the open water. It was warmer as we proceeded. Dirt and rocks became the rule instead of the exception, and we were often obliged to go around a great boulder of granite. While we were resting on the third day for a bite to eat, one of the men took a dish, scooped up some sand from the bottom of the icy stream and 'panned' it out—there was gold in it, gold enough to pay to work the ground.

"About noon of the fifth day we reached the summit of the mountain, and from there looked down the other side upon a sight the like of which no white men had ever seen.

"From the very summits of this icy ring mountain the northern side was a sheer precipice of more than three thousand feet, and was composed of rocks, and rocks only—the foot of the mighty crags being washed by an open ocean, and this was lighted up by a peculiar crimson glow.

"Great white whales sported in the waters, huge sea birds swung in circles above the water, yet below us, and with our glasses we could see, on the rocks at the foot of the crags, seals and other animals that were strange to us.

"But follow the line of beetling crags and mountain peaks where you would, the northern side presented a solid blank wall of awful rocks, in many places the summit overhanging and the shore well under in the mighty shadow. Nothing that any of us had ever seen in nature was so impressive, so awful.

"We started on our return after a couple of hours of the awe-inspiring sight to the north, and for full two hours not a man spoke.

"'Father Burrows,' said I, 'what do you think that is back there?'

"'No man knows, my son, and it will devolve on you and I to name it; but we won't unless we get to it and can take back proofs.'

"'Do you think we could get down the other side?'

"'No, I don't think so, and we seem to have struck it in the lowest spot in sight. I'd give ten years of my life if the *Duncan McDonald* was over there in that duck poad.'

"'Captain,' said Eli Jefferies, the second mate, 'do you know what I've been thinkin'? I believe that air water we seen is an open passage from the Behring side of the frozen ocean over agin' some of them air Roosian straits. If we could git round to the end of it we'd soil right through the great northwest passage.'

"'You don't think there is land over there somewhere?'

"'Nope.'

"'Didn't take notice that the face of your "passage" was granite or quartz rocks, hey? Didn't notice all them animals and birds, hey?——'

"'Look out!' yelled the man ahead with the dog sledge.

"A strange whirring noise was heard in the foggy light that sounded over our heads. We all dropped to the ground, and the noise increased until a big flock of huge birds passed over us in rapid flight north. There must have been thousands of them.

"Captain Burrows brought his shot-gun to his shoulder and fired. There were some wild screams in the air, and a bird came down on the snow with a loud thud. It looked very large a hundred feet away, but sight is deceiving in this white country in the semi-darkness. We found it a species of duck, rather large and with gorgeous plumage.

"'Goin' north to Eli's "passage" to lay her eggs on the ice,' said the captain, half sarcastically.

"We reached the ship in safety, and the captain and I spent long hours in trying to form some plan for getting beyond the great ice ring.

"'If it's warm up there, and everything we have seen says it is, all this cold water that's going north gets warm and goes out some place; and rest you, son, wherever it goes out there is a hole in the ice. The rocks may head us off, but there is a notch in the ice.'

"Here we were interrupted by the mate, who said there were queer things going on overhead, and some of the sailors were ready to mutiny unless the return trip was commenced at once.

"Captain Burrows went on deck at once, and you may be sure I followed at his heels.

"'What's wrong here?' demanded the captain in his roaring tone, stepping into the midst of the crew.

"'A judgment against this pryin' into God's secrets, sir,' said an English sailor, in an awe-struck voice. 'Look at the signs, sir,' pointing overhead.

"Captain Burrows and I both looked over our heads, and there saw an impressive sight indeed. A vast colored map of an unknown world hung in the clouds over us—a mirage from the Aurora. It looked very near, and was so distinct that we could distinguish polar bears on the ice crags. One man insisted that the main mast almost touched a snowy peak, and most of them actually believed that it was an inverted part of some world slowly coming down to crush us.

"Captain Burrows looked for several minutes before he spoke. Then he said

"'My men, this is the grandest proof of all that Providence is helping us. This thing you see is only a picture, it's a mirage, the reflection of a portion of the earth on the sky. Just look and you will see that it's in the shape of a crescent and we are almost in the center of it, and, by the gods, it's a picture of the country just in front of us. See this peak? See that low place where we went up? There is the great wall we saw, the open sea beyond it, and, damme, if it don't look like something green over in the middle of that ocean! See, here is the *Duncan McDonald* as plain as A B C, right overhead. Now, there's nothin' to be afraid of in that; if it's a warning, it's a good one—and by the knock-kneed Israel, if anyone wants to go home to his mother and's old enough, *he can walk!*'

"The Captain looked around, but the sailors were as cool as he was—they were reassured by his honest explanation.

"Captain Burrows took me by the arm and, pointing to the painting in the sky, said:

"'Old Man Providence, again, son, sure as you are born; do you see that lane through the great ring? There's an open, fairly straight passage to the inner ocean, except that it's closed by about three miles of ice on our side; see it there, on the port side?'

"Yes, I could see it, but I asked Captain Burrows how he could account for the open passage beyond and the wall of ice in front; it was cold water going in

"'It's strange,' he answered, shading his eye with his hand and looking long at the clear passage, like a great canal between the beetling cliffs. All at once he grasped my arm and said in excitement, pointing towards the outer end of the passage

"'Look!'

"As I gazed the great mass of ice in front commenced to slowly turn over, outwardly.

"'It's an iceberg, sir, only a damned iceberg,' said the captain, excitedly, 'and she is just holding that passage because the current keeps her up against the hole; now, she will wear out some day and then—in goes the *Duncan McDonald!*'

"'But there are others to take its place,' and I pointed to three other bergs apparently some twenty miles away, plainly shown in the sky, 'they are the reinforcements to hold the passage.'

"'Looks that way, son, but, by the great American buzzard' we'll get in there somehow if we have to blow that berg up.'

"As we looked the picture commenced to disappear, not fade, but to go off to one side just as a picture leaves the screen of a magic lantern; over the inner ocean there appeared dark clouds, but this part was visible last, and the clouds seemed to break at the last moment, and a white city set in green fields and forests was visible for an instant, a great golden dome in the center remaining in view after the rest of the city was invisible.

"'A rainbow of promise, son,' said the captain.

"I looked around, but the others were gone, they were tired of the scene and Captain Burrows and myself were the only ones that saw the city.

"We got under way for an hour and then stood by near that berg until eight bells the next morning, but you must remember it was half dark all the time up there then.

"While Captain Burrows and myself were at breakfast he cudgeled his brains over ways and means for moving that ice or preventing other bergs from taking its place. When we went on deck our berg was some distance from the mouth of the passage and steadily floating away. Captain Burrows steamed the ship up cautiously toward the passage, there was a steady current coming out.

"'I reckon,' said Eli Jefferies, 'that they must have a six months' ebb and flow up in that ocean.'

"'If that's the case,' said Captain Burrows, 'the sooner we git in the better,' and he ordered the *Duncan McDonald* into the breach in the world of ice.

"Gentlemen, suffice it to say that we found that passage perfectly clear and wider as we proceeded, this we did slowly, keeping the lead going constantly.

"The first mate reported the needle of the compass working curiously, dipping down hard and sparking—something he had never seen.

"Captain Burrows only said 'Let her spark.'

"As we approached the inner ocean, as we called it, the passage was narrow, it became very dark, and the waters roared ahead. I feared a fall or rapid, but the *Duncan McDonald* could not turn back. The noise was only the surf on the great crags within.

"As the ship passed out into the open sea beyond, the needle of the compass turned clear around and pointed back.

"'Do you know, son,' said Captain Burrows, 'that I believe the so-called magnetic

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MAKER AND PATENTEE OF

IMPROVED

**HYDRAULIC JACKS**

**Punches, Roller Tube Expanders, and Direct Acting Steam Hammers.**

☞ Jacks for Pressing on Crank Pins or Car Wheels made to order. Communications by letter will receive prompt attention.

## THE CHAPMAN JACK.

**PATENTED.**

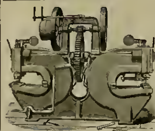
THE screw being lubricated and protected, the Jack is always ready for instant service. Railroad men appreciate the importance of having Jacks always in good working condition. Serious delays frequently occur in getting common Jacks so that they can be worked when suddenly required in train service.

Common Jacks are frequently destroyed in efforts to make them work quickly after the screws are set with rust and dirt. This consideration alone makes the **Chapman Jack** the most economical one to purchase.

THE CHAPMAN JACK CO., CLEVELAND, OHIO.

## The Long & Allstatter Co.

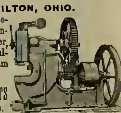
HAMILTON, OHIO.



Double, Single, Angle-Bar, Gang, Horizontal, Twin, Boiler, Spacing, Gate, Multiple, Belt, and Steam Driven

**Punches & Shears**

OVER 300 SIZES.

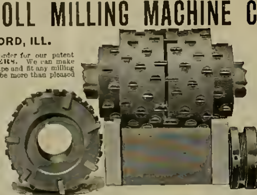


## INGERSOLL MILLING MACHINE CO.,

ROCKFORD, ILL.

Give us a trial order for our patent **MILLING CUTTERS.** We can make them to mill any shape and fit any milling machine. You will be more than pleased with them.

SEND FOR PHOTOGRAPHS AND DESCRIPTION OF OUR HEAVY
SLAB MILLING MACHINES AND
Horizontal Boring Machine.



PATENT ADJUSTABLE MILLING CUTTER.
ONCE USED, ALWAYS USED.

## FALLS HOLLOW STAYBOLT Co.

CUYAHOGA FALLS, O.

ROLLED HOLLOW STAY BOLTS ARE STRONGER AND SAFER THAN DRILLED ONES.

Mandrel rolled from the finest charcoal iron. All sizes, from ⅝ to 1½ inch, with any sized hole required from ⅛ to $\frac{5}{16}$ inch. Let us send you a sample and quote prices. A set for one fire-box will convince you of their merits, safety and economy.

## BOSS SCREW PITCH GAUGE.

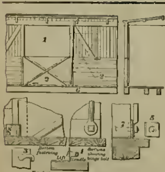
Price $1.25, by Mail.

A FULL LINE OF

## Machinists' Fine Tools.

SEND POSTAL CARD FOR OUR NEW 1893 CATALOGUE.

STANDARD TOOL CO.,
Box O, ATHOL, MASS.



## Steel Grain Door Come to Stay.

**COMPARISON.**

Loss of Doors in Two Years:

| | |
|---|---|
| 500 cars equipped with steel doors lost two doors. | 500 cars equipped with wooden doors lost 80 per cent. in the same time. |

MICHIGAN RAILWAY SUPPLY CO.,
DETROIT, MICH.

ESTABLISHED 1875.] [SAMUEL OTLEY, Patentee and Gen. Mgr.

## OTLEY MANUFACTURING COMPANY,

Sole Manufacturers of Otley's Eureka Steam Packing Cement.

For use in making Joints, Stopping Leaks, Calking Seams, etc., on Steam Pipes, Boilers, Heaters, Air Pumps, LOCOMOTIVE EXTENSION FRONT ENDS, DOORS, STACKS, SADDLES, ETC.

Four times lighter than Red or White Lead, and four times more efficient. This cement does away with the need of ground joints.

Being absolutely fire-proof, joints made with this Cement last longer than any other packing known.

702 Real Estate Board Building,
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## THE "WELLS LIGHT." Adapted for Tire Expanding.

With this arrangement tires may be removed or put on while the wheels are under the engine. Any tire ready for removal or putting on with from 10–15 min. HEATING.

The TIRE COVERS may be used or arranged so that they are adapted for ALL SIZES OF TIRES.

The advantages of this system are its ECONOMY, PORTABILITY, POSITIVE and QUICK EFFICIENCY, and EQUAL HEATING of the whole tire from its outside diameter.

250 Railroads Now Use the WELLS LIGHT

FOR

WRECKING CARS, NIGHT CONSTRUCTION AND HEAVY METAL HEATING,

FOR WHICH PURPOSES ITS

PORTABILITY, POWER AND AUTOMATIC ACTION MAKE IT INVALUABLE.

—MANUFACTURED BY—

WILLIAM HALPIN, Successor to KEEGAN & HALPIN, 43 Washington Street, NEW YORK.

pole is a great ring around the true pole, and that we just passed it there. The whole inside of this mountain looks to me like rusted iron instead of stone, anyhow.'"

Here our story-teller rested and dozed for a few minutes, then rousing up, he said:

"I'll tell you the rest to-morrow; yes, to-morrow, I'm tired now. To-morrow I'll tell you about a wonderful country, wonderful cities, wonderful people! I'll show you solar pictures such as you never saw, of scenes, places and people you never dreamed of. I'll show you implements that will prove that there is a country where gold is as common as tin at home—where they make knives and forks and stew pans of it. I'll show you writings more ancient and more interesting than the most treasured relics in our Sanscrit libraries. I'll tell you of the two years I spent in another world. I'll tell you of the precious cargo that went to the bottom of the frozen ocean with the stanch little ship *Duncan McDonald*, the bravest, noblest commander, and the sweetest angel of a woman that ever breathed and lived and loved. I'll tell you of my escape and the hell I've been through. To-morrow——"

He dozed off for a few moments again.

"But I've got enough in this pack to turn the world inside out with wonder - ah! what a sensation it will be, what an educational feature. But it will send out a hundred harum-scarum expeditions to find Polaria—but there are few commanders like Captain Burrows; he could do it, the rest of 'em will die in the ice——"

"But when I get to San Fran——. Say, captain, how long will it take to get there, and how long before you start?"

Enoch and I exchanged glances, and he answered

"We wan't goin' to Frisco."

"Around the Horn, then?" said the stranger, sitting up; "but you will land me in Frisco, won't you? I can't wait, I must——"

"We're goin' *in*," said Enoch; "goin' north, for a three years' cruise."

"North!" shouted the stranger, wildly. "Three years in that hell of ice. Three years! My God! North! North!"

He was dancing around the deck like a maniac, trying to put his pack loop over his head. Enoch went toward him to tell him how he could go on the *Enchantress*, but he looked wildly at him and sprang out on the bowsprit, and from there to the jib. Enoch saw he was out of his mind, and ordered two sailors to bring him in. As they sprang onto the bow, he stood up and screamed:

"No! No!! No!!! Three years! Three lives! Three hells! I never——"

One of the men reached for him here, but he kicked at the sailor viciously, and turning sidewise sprang into the water below.

A boat, already in the water, was manned instantly, but the worn-out body of another North Pole explorer had gone to the sands of the bottom where so many others have gone before; evidently his heavy pack had held him down, there to guard the story it could tell in death as he had in life.

### Work of the Traveling Engineer.

In the address of President Conger at the Traveling Engineers' Convention, the following passages are found

"Railroads are operated nowadays on so small a margin of profit that the distance between a dividend and going into the hands of a receiver is measured by the small economies and savings in all departments. In our line, we know that by close economy in coal and oil, by looking after the machinery when in service on the road, and seeing that it is taken care of, so running repairs can be kept down, by assisting in enforcing good discipline, to avoid many of the petty accidents which waste money, we can do our part in saving money which can be easily wasted and not so easily accounted for. There is necessarily so much wasted on a railroad in keeping trains moving safely that it begets a habit of asking more than is needed, so as to *be sure to have enough*. *Gallons* of oil are used where *pints* would do the work. Tons of coal are burned, where a close watch of grades and stopping places would result in saving lots of it. Wheels are changed before they are worn out because we dare not risk having a broken one, and in a dozen ways familiar to us all unnecessary expenses run up. To draw the line between necessity and extravagance in the use of material out on the road is a hard task, but that is just what is expected of us, and we should be thoroughly posted on what is actually needed to get the engines over the road with economy and certainty.

"The traveling engineer has a great many duties to look after, some of them are pleasant, others are very disagreeable—all are responsible. The good men in charge of engines must be encouraged, the inexperienced instructed, and the indolent, careless ones notified, as quietly and certainly as possible, that if they do not attend to their work somewhere near as well as the best that they can expect to be disciplined. Mercy is sometimes thrown away on a lazy man, just the same as running repairs are thrown away on an old back number engine ready to be cut up and sold for scrap.

"The traveling engineer, no matter by what title he is known, has come to stay. A few years ago they were looked upon as one of the luxuries of railroad management, and there were very few of them in service; now there are over 500 of them, all more or less appreciated according to their usefulness. If we desire permanent employment or promotion, we must show the managers we can more than pay our way in the increased efficiency of the engines, in economy of fuel, and in looking after the small every-day leaks that can be stopped."

### Ignominy and Glory of Texas.

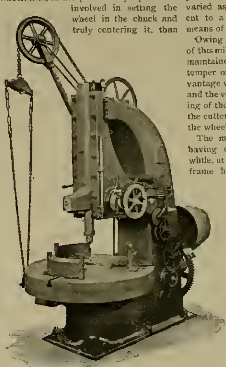
For several years past the principal labors performed by the individuals elected by the people of Texas to legislate for the interests of the State have been devoted to working out legal ways of robbing the owners of railroads. The railroads in Texas have been built almost exclusively with foreign capital. On this account it seems easy to incite legislators to act as if this species of property had no rights which people were required to respect. The policy adopted has been shortsighted, even when viewed from a Texas standpoint, for men with capital to invest in railroads are keeping severely away from the State, and railroad building will make no headway for years to come. This is to be regretted, for it leaves a splendid field of industry undeveloped, deprives thousands of people from obtaining lucrative employment and comfortable homes, and maintains fruitless vast regions capable of yielding rich harvests.

Few people realize the great extent and vast natural resources of Texas. Mr. Charles Hamilton, vice-president of the Texas Central, in a letter to the *Railroad Gazette* incidentally mentions that the State is "as large as New York, New Jersey, Delaware, Maryland, Pennsylvania, Ohio and part of Indiana, yet its size is only one of its characteristics. It has more coal area than Pennsylvania, more iron than Alabama, more granite than New Hampshire, more pine than Wisconsin, more oak than West Virginia, more prairie than Kansas, more corn land than Illinois, more wheat land than the two Dakotas, more cotton land than Mississippi, more sugar land than Louisiana and more rice land than South Carolina. It contains more mines than any other five States, has 500 miles of sea coast and 8,000 miles of railroads, with room for 8,000 more."

### A Novel Car-Wheel Boring-Mill.

William Sellers & Co., incorporated, Philadelphia, Pa., have recently put on the market a new wheel boring-mill, which we illustrate herewith. The following description from the makers will make its design capabilities perfectly plain:

Every master mechanic of a railway shop knows that more time is often consumed in "getting ready" to bore a car-wheel, *i. e.*, in the preliminary operations involved in setting the wheel in the chuck and truly centering it, than in the actual work performed by the machine.



SELLERS' NEW WHEEL BORING-MILL.

All the modern mills are so constructed that the time of rough boring, finishing, and facing the hub of the wheel is reduced to a minimum; but in this novel machine we have designed to save the time heretofore lost in setting, centering, and removing the wheel from the mill, by making these operations practically automatic, and we have thereby succeeded in not only increasing the capacity of the machine, but in reducing the labor and responsibility of the attendant, and removing altogether the liability to error on his part in truly centering the wheel. These results are secured by means of a self-closing universal chuck on the table, so arranged that the act of starting the machine causes the chuck to close upon the work and hold it securely in the true position for boring. *Per contra*, the stopping of the table automatically opens the jaws and releases the work.

The time heretofore lost in the gradual stopping of the rotation of the table is also saved, as in this apparatus the table may be stopped instantly, without shock, by the simple movement of a hand-lever.

An unusually stiff boring-bar, with double cutters having four cutting edges, insures quick and accurate boring of wheels which are hard in the hub, a common source of trouble in less powerful machines. The value of the double cutter, with its four cutting faces, has been demonstrated by years of use, and the simplicity of the locking device on this mill, permitting, as it does, change of cutters without loss of time, will commend itself to every practical mechanic.

The special crane designed for and attached to this mill is a convenient auxiliary, and contributes to the increased speed of the machine and decreased labor of the attendant.

The mechanism of the crane is such that when the wheel is raised to the proper height for swinging on the table, the hoist automatically stops, and when the attendant has swung the wheel into position it gently drops into its seat. The table is then started, the jaws of the chuck at the same moment close towards the center and hold the wheel in true position; the boring-bar with the double cutters descends through the hub, and the hole is rough bored; the boring-bar quickly rises clear of the wheel; the finishing cutters are immediately substituted for the roughing cutters, and the true hole is completed in a few seconds. The feed is varied as required, from a fine roughing cut to a five eighths finishing feed, by means of an adjustable friction device.

Owing to the great stiffness and power of this mill, quick speeds may be uniformly maintained, irrespective of the varying temper of the iron in the wheels, an advantage which lighter mills do not possess; and the very common annoyance of springing of the boring-bar and displacement of the cutter by "hard spots" in the hub of the wheel is obviated.

The mill presents the appearance of having enormous stiffness and power, while, at the same time, the contour of the frame harmonizes with the increased dimensions of the slide, table and gears; the machine is graceful to the eye, instead of appearing a clumsy affair.

This powerful mill, with its novel additions, is, of course, more expensive to build than those of the ordinary type; but it is believed that the additional first cost will be admitted to be but trifling when compared with the increased capacity, the superior accuracy of the work, the reduced manual labor and responsibility of the attendant, and other collateral advantages.

In a descriptive article published in the *Railroad and Engineering Journal*, June, 1892, the editor says: "The machine may be considered the latest development of its class, with all the improvements which experience has shown to be desirable."

### An Old-Timer.

Mr. E. N. Underwood, master mechanic of the Colusa & Lake Railway, at Colusa, Cal., has been making a visit East, after a California residence of twenty-four years.

Mr. Underwood was foreman of the Albany shops of the New York Central, or rather the Hudson River road, in the early fifties, and while in that position put the first cast-iron valve on a locomotive in this country. This was on the Breeze, Kneeland & Co. engine "Baltic," and done against the advice of the master mechanic and at the expense of the builders.

Mr. Underwood was a machinist runner, and as such attended the Engineers' Convention at Baltimore, November 6, 1855, where the Locomotive Engineers' Association of the United States was formed. This dragged along for a year or two; then the Brotherhood of the Footboard took its place, only to fail, and at last, in 1863, W. D. Robinson formed the present Brotherhood of Locomotive Engineers.

Mr. Underwood took out engines for the Breeze & Kneeland Co. for awhile, and while South in this capacity was offered and accepted the position of master mechanic of the East Tennessee & Virginia road, which he held until the war made it so hot he got out.

Mr. Underwood held several positions as master mechanic of Southern roads after the war, and finally went to California, where for seventeen years he was in the employ of the Southern Pacific.

Many of our well-known superintendents of motive power were shop-mates of Mr. Underwood, but most of them have gone over to the majority.

Mr. Underwood kindly loaned us a list of the engineers present at the Baltimore meeting, which is printed elsewhere in this issue. Many of these men are still alive, and some of them are running locomotives yet.

# Car Shops and Car Builders.

## Waitt's Brake-Gear for Six-Wheel Trucks.

The remarkably simple form of brake-rigging shown in the annexed engraving was designed by Mr. A. M. Waitt, general master car builder of the Lake Shore & Michigan Southern Railway. In connection with this gear Mr. Waitt writes us

"We have adopted during the past year a new arrangement of levers in connection with the application of the triple brake to six-wheel passenger trucks. This has been in use on some cars for nearly a year, long enough to fully prove its advantages and simplicity as compared with former arrangements.

"I send you a drawing showing the former generally adopted plan for applying triple brakes to six-wheel passenger trucks. You will notice in the old method that a peculiar-shaped forging, having a double reversed curve, has to be used in making the connection underneath the middle axle. You will also notice that in the old arrangement the top connection from the truck lever has to go over the top of the bolster and above the truck transom.

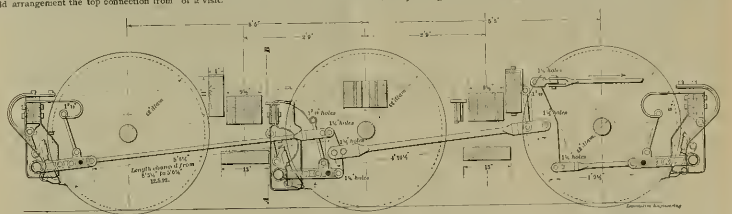
"Any one who has made an examination of cars equipped with modern six-wheel trucks with 38-inch or 42-inch wheels, well knows that there is very little room between the rigging attached to the body of the car and the top of the truck transom and bolster. In fact, on many cars the top connection chafes very hard on the transoms, or on some of the iron work or piping of the underside of the car body.

"With our improved arrangement, you will notice that we use for bottom connections nothing but straight forging, with the ordinary sizes of clevises, and the top connection is brought down low, it being on the outside of the truck, beyond both the bolster and transom, and, therefore, is in a position where there is plenty of room and no liability of the rods becoming cramped from coming in contact with any part of car body, or attachments to same.

"The arrangement in the drawing shows the device as applied to our standard six-wheel passenger truck, so made that it will take steel wheel 42 inches in diameter and will admit of the use of modern steel brake-beam and the M. C. B. standard type of brakehead, and the M. C. B. standard Christie shoe.

"As there has been quite a desire to do away with the crooked forged connection under the middle wheel, in the old style of application of triple brake, I present here an arrangement which is a simple device overcoming all of the difficulties of the old arrangement and providing several decided advantages, both as regards reduction in number of parts, simplicity of attachment, and ease of adjustment.

"You will also notice that we have provided for a release spring for the middle brake-beam; an arrangement which has not been much used, owing to the difficulty in application on most of the cars in the country equipped with the old style or triple brake."



## The Butler Draw-Bar Exhibit.

In the freight-car exhibit at the World's Fair the visitor is attracted to one car by the sheen of electric light inside. On climbing up the steps, which are hospitably easy, we find inside a fine display of Butler drawbars, Chapman jacks and a varied assortment of malleable iron castings made by the National Malleable Iron Co. All forms of the Butler draw-bar in use are shown as applied to the draft timbers. Having the method of fastening plainly exhibited on a bench where it can be carefully examined is found to be very convincing to visitors. This exhibit is said to have enjoyed the peculiar good fortune of making converts, who manifested their faith in the most welcome way by giving orders on the spot.

The Chapman jack exhibit comprises all the sizes made, from one monster jack three feet long to a tiny fellow that could be used for jacking up the equalizer of a locomotive. The car is very well worthy of a visit.

## Work For Master Car Builders.

The Executive Committee of the Master Car Builders' Association have laid out a generous programme of work for the next convention. Committees have been appointed to investigate the following subjects:

1. Tests of M. C. B. Couplers.—J. M. Wallis, J. S. Lentz, R. D. Wade, J. H. M. Connell, S. A. Crone and T. G. Duncan, committee.
2. Air-Brake Tests—G. W. Rhodes, S. P. Bush, George Gibbs, A. S. Vogt, E. A. Williams, committee.
3. Steel-Tired Wheels—R. E. Marshall, J. O. Pattee, C. H. Cory, A. E. Mitchell, H. Bartlett and T. A. Bissell, committee.
4. Road Tests of Brake Shoes—R. H. Soule, W. S. Morris, S. A. Crone, G. W. Rhodes, A. E. Mitchell, W. H. Lewis, J. W. Warden, A. M. Waitt, Jos. Townsend, Samuel Porcher, J. C. Barber and W. L. Hoffecker, committee.
5. Laboratory Tests of Metal for Brake Shoes—S. P. Bush, D. L. Barnes, J. W. Cloud.
6. Brake Beams—E. D. Nelson, J. H. Rankin, John Bean.
7. Safety Chains for Freight Cars—H. Coulter, W. H. Day, J. E. Simons, E. E. Carver, J. J. Casey.
8. Heating Passenger Equipment—W. L. Hoffecker, James Macbeth, George F. Wilson, A. J. Cromwell, John Hodge.
9. Ventilation of Passenger Equipment—R. P. C. Sanderson, William Forsyth, A. C. Robson, G. W. West, J. M. Holt.
10. Lighting Passenger Equipment—C. A. Schroyer, W. H. Fry, L. B. Paxson, William Apps, L. Packard.
11. Wheel and Flange Gauges—J. N. Barr, Thomas Anderson, T. Sutherland, Joseph Townsend, Thomas Fildes.
12. Lubrication of Cars—A. M. Waitt, W. H. Thomas, I. E. Wood, F. A. Stinard, W. K. Carr.
13. Air-Brake and Hand-Brake Apparatus on Cars—E. D. Bronner, Pulaski Leeds, James McGee, William McWood, W. P. Siddons.
14. Compressed-Air Appliances and Hydraulic Machinery—J. C. Barber, William Garstang, William McCormack, H. L. Preston, J. R. Skinner.
15. Freight Car Trucks—J. J. Hennessey, Samuel Irvin, William Voss, John H. Davis, F. H. Stark.

## Who Built the First Sleeping Car?

Since the sleeping car business was made a success many different claimants have arisen for the honor of having designed the first sleeping car that carried passengers. We were lately assured that the Bradley Car Works built the first sleeping car after plans furnished by Mr. John Kirby, long master car builder of the Lake Shore, and we wrote trying to obtain copies of the drawing. Osgood Bradley & Sons answered very courteously, expressing regret that they could not furnish the drawings because they had been destroyed years ago by a fire that took place in the works. They assured us, however, that the sleepers they built from Mr. Kirby's designs were not the first introduced, as they had previously built a sleeping car on designs prepared by Ira Hopgood, a conductor on the Boston & Albany. The inventor of this car died shortly after it was built, and the drawings were burned in the fire referred to, so no particulars about the cars could be given. If any of our New England readers can give us any information about these cars we feel certain that our readers would appreciate it.

## The Smilie Coupler Exhibit.

A great many people exhibiting car couplers have invented appliances for making the trucks carrying the couplers move so that the coupling and uncoupling could be clearly displayed. But all attempts in this line have been comparatively crude compared to the mechanism arranged by Mr. Taylor for exhibiting the Smilie coupler at the World's Fair. He arranged couplers on stationary draft timbers at the two limits of his space. Between these he wanted to run a car with couplers on each end which would move to and fro between the stationary couplers and couple and uncouple when contact took place.

It was desirable to provide means that would keep the car constantly moving when visitors were there. Many schemes were tried. Mechanical engineers and electrical engineers were consulted, but none of their plans promised success. Finally Mr. Taylor set to the task himself and arranged an electric motor, which makes the car perfectly automatic in its movement. As the coupler on the car strikes the stationary coupler a reversing stop is touched, which reverses the motor, and the car starts away back, unless the coupler is set to couple. It is generally set open, and all day long the car moves too and fro, coupling and uncoupling. The exhibit attracts crowds of railroad men all the time.

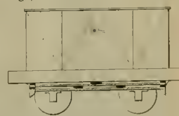
## Wooden Springs.

Mr. E. J. Rauch, of the Manhattan Elevated, formerly a Philadelphia & Reading machinist, foreman and master mechanic, writes us Your correspondent, De Sanno, asks for some information about the wooden car spring in use on the P. & R. R. R., and on some others also, until within the past few years.

About 1850, a workman in the wooden coal-car shops of the P. & R. R. R. Company conceived and patented the idea of using an ash or other kind of wooden spring on coal cars. Failing in introducing it into use, he sold his right to Jas. Millholland, then master mechanic of the P. & R., who put it on the four-wheel wooden coal cars and on the trucks of eight-wheelers, when they came into use, and realized a handsome sum from the royalty. A few years later, Mr. Millholland traded his interest in the spring to the firm of Heywood & Snyder, of Pottsville, Pa., in exchange for the engine and blowing cylinders for the furnace of the Leesport Iron Co., of which he was a member.

The spring was very cheap, and for cars hauling coal, ore or other coarse freight was about as good as steel.

I send you a sketch of the spring as it appears on a four-wheel coal car It consisted of two pieces of ash about 9 feet long, 7 in. wide and 2 in. thick, secured to



the sill of car by pockets. On the top piece in the center was a rubber block bearing against the sill of the car, and between the pieces were two rubber blocks as shown. The ends in pockets were kept apart and from sill by wooden blocks.

## Steel Growing Popular in New England.

The introduction of steel axles and forgings generally throughout New England is quite marked. This is more noticeable during the last year. While the Middle States and Western roads have adopted steel quite generally, the New England roads have adhered to iron, for two reasons, we think: First, on account of the better quality furnished by the New England forges, for which they were willing to pay; and second, because of a desire to encourage those domestic manufacturers who were conscientious in their efforts to supply a reliable article. Of course, there was more or less prejudice to steel based upon experiences dating back some six years, and which was put in competition in price with the first quality of iron axles.

It was found to wear rapidly and heat badly. These defects seem to have been entirely eliminated in the manufacture of the best qualities of steel of to-day. Among

the New England roads recently using steel heavily are the Boston & Albany, Fitchburg, New York & New England, etc. Steel scrap finding its way in wrought scrap and this inferior quality of wrought scrap thrown in the market during the past years of "dear cheapness" practiced heretofore so generally, has reversed the condition of things in New England, as it has elsewhere throughout the country, and wrought axles are found to wear unequally, and are becoming dangerously troublesome. The head of the car department of one road tells us of his experience, which certainly demands serious consideration.

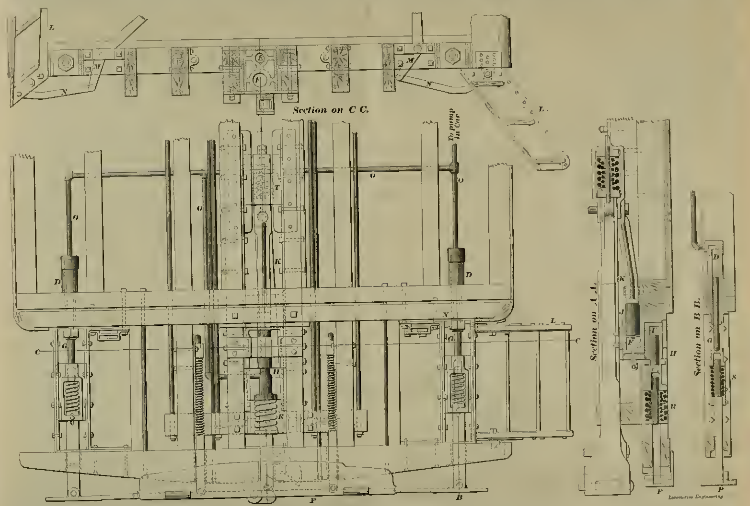
### Leonard's Hydrostatic Buffer.

The object of this buffer is to provide means of holding adjacent cars firmly together, thus increasing the friction between the buffers and lessening the length. The cylinders $F$, $E$, $D$, $D$ are all connected to the same system of piping, and the pressure per square inch will be the same in each. This pipe $O$ is connected to a pump and reservoir inside the car. The pipes, cylinder and reservoir are filled with water or other fluid.

In the ordinary systems of coupling cars used in this country with couplers of the Janney and Miller type, the couplers and buffers are usually so arranged that when the cars are coupled the springs that force the buffers out are compressed to a certain extent, thus forcing the buffer together and tending to hold the cars steady. The amount of this compression and the subsequent pressure upon the buffers is, however, limited, since in order to effect a coupling the cars must be driven together with sufficient force to compress the buffer springs and allow the couplers to engage. If the springs are too stiff this impact is too great, and will not only dam- pressure in the adjacent ends of two cars is pumped up to about the same amount (sufficient to put the springs under a heavy compression) as shown by the gauges.

If one buffer has more pressure in the cylinders than the other, the buffer will move toward the car on which there is the smaller pressure. The leakage is very small and may be supplied by a few strokes of the pump when required. The long buffer plates shown increase the area of friction surface between the buffers, and this combined with the greater pressure between them has a marked effect in reducing the oscillation of the cars. It also tends to hold the end of the car up on uneven track. In case of a low joint or depression in the track the truck will drop and with the ordinary buffer the body of the car will follow the truck, and as the truck rises again the body of the car meets it and produces a shock. With the hydrostatic buffer, however, the friction between car and the platform end timber. By increasing the width of the platform it becomes necessary to use hinged steps which can be turned up out of the way when the train is running. The step $L$ is pivoted as shown and is raised and lowered by the lever $M$ and link $N$. When in a station the step is lowered for passengers. When running it is raised in the position shown on the left hand side of the cross-section, and held in that position by a spring latch.

An improvement in refrigerator cars has been patented by Mr. John Player, superintendent of motive power of the Atchison, Topeka & Santa Fé, at Topeka, Kan. The principal claims made are a refrigerator car with the combination of an elevated ice-box communicating with the car, a duct beneath the floor communicating with the space beneath the ice-box and that inside the car. A series of troughs are placed beneath the bottom of the ice-




amount of oscillation due to curves and uneven tracks.

In the different views on the drawing the same letter refers to the same part. Two center cylinders, $E$ and $F$, cast in one piece, are firmly secured between the center sills of the car. The cylinder $E$ is fitted with a ram $H$, which forces outward against a cross-head pressing against the spring $R$, which transmits the pressure to the buffer $P$. The cylinder $F$ is fitted with a ram $J$, which is forced against the pressure-bar $K$. This pressure-bar is secured to the back end of the drawhead. When pressure is admitted to cylinder $F$ by the pipe $O$, the ram $J$ is driven back and the drawhead is drawn in. At the same time the pressure passes through the port to the cylinder $E$, and forces the buffer $P$ outward; thus the cars are drawn firmly together. Two side cylinders, $D$, $D$, are secured in the end sill of the car. Each of these is fitted with a ram, $G$, which bears against a crosshead and transmits the pressure through a spring, $S$, to the buffer $P$. The buffers $P$ are thus pressed together at three points on their age the cars, but will cause a disagreeable shock to the passengers. In some systems the coupler and buffer are so connected by levers or pressure-bars, that as the coupler is pulled forward the motion is transmitted to the buffer, and the opposing buffers are thus pressed together with greater force. In this case, however, the amount of pressure that can be put on the buffers is limited, since the springs must be compressed and the cars coupled by impact. In the English system of coupling, the cars are drawn together and pressure put on the buffers after the cars are coupled by a screw operated by hand. This method, however, is slow and crude, and involves the necessity of a man going between the cars. It is, moreover, inapplicable to automatic couplers.

In the hydrostatic system the pressure is let out from the cylinders when the cars are to be coupled and a coupling may be thus effected with a slight impact. After the coupling is effected the pressure is pumped into the cylinders by an attendant in the car, and any desired amount of pressure may be put on the buffers. The the plates is sufficient to hold the end of the car up for the moment as the trucks fall, and a much steadier motion is the result.

In rounding curves, as the cylinders on the end of one car are all connected, one end of the buffer is free to move in while the other moves out, the fluid passing from one side cylinder through the pipe into the other as the rams move, and thus serving the purpose of an equalizing bar to maintain a uniform pressure on each end of the buffer.

In case of a collision the hydrostatic buffer would afford much more protection to the cars and passengers than the ordinary system both on account of the greater area of buffer and also because the shock will be better absorbed by the hydrostatic buffer, since the force necessary to compress it is much greater.

In connection with this buffer the platform is extended out nearly to the width of the car body; this gives a wider space for the vestibule if one is used and increases the strength of the platform by affording an opportunity to put in additional timbers between the end sill of the box and the floor of the car to maintain a body of cold water at this point, whereby the air passing into the duct is brought into contact with the troughs and cooled.

The Boston & Albany Railroad management deserve sympathy rather than blame for the terrible accident which happened to a passenger train on that road on the last day of last month. A weak bridge was undergoing repairs for the purpose of strengthening it. The men had cut out the rivets from the old plates as a preliminary to putting strengthening plates on. They left the girder in this weakened condition and went to dinner. Before they returned the Chicago limited came thundering along and went through the bridge, killing thirteen persons and injuring many others. The man in charge of the repairs was clearly to blame for not requiring the speed of trains to be reduced while crossing the bridge in its weakened condition. There have been few fatal accidents on the Boston & Albany, and the immunity has been due to the use of first-class equipment of all sorts and careful operating

# ? A. What You Want to Know. ? A.

**Don't ask questions that simply require a little figuring to determine; make each question separate. No notice taken of anonymous questions.**

(93) M. J. B., Poughkeepsie, N. Y., asks

Do you think power brakes on the drivers of an engine are bad for them? Do you think they do them harm? *A.*—No.

(94) C. A. J., Meridian, Miss., asks

I do not understand the storage battery process of electricity; can you give me any light in your next issue? *A.*—Storage batteries are so constructed that electricity can be, so to speak, pumped into them, much as you would pump air into a tank, this can be drawn off for use as wanted.

(95) L. A. P., Los Angeles, Cal., writes

What is the matter with the following method of finding the dead center on the road? Place end of chisel on frame of cross-head, so that in moving the engine pushes the chisel, which leaves a mark on the guide. The end of the mark indicates the extreme point of travel, and, therefore, the dead center, or at least close enough for setting an eccentric on the road. *A.*—That gets the dead center near enough to do the temporary work required on the road. Under some circumstances the crank-pin may, however, be a considerable distance away from the center when the cross-head reaches the extreme point of travel.

(96) W. N., McAdams Junction, N. B., writes.

Why does an engine slip more with small nozzles than with large ones? Am running a 10-wheel connected engine. Nozzles got gummed up, and the engine slipped so that I could not do anything with her. Got nozzles cleaned out and trouble from slipping ceased. *A.*—The only thing we can think of as a reasonable explanation of this phenomenon is, that the weight of the gum on the nozzles may have been sufficient to overbalance the weight on the driving wheels. If this is not satisfactory we give up the question, and leave it to those who imagine that a locomotive gets out of humor at times.

(97) H. R. R., New York, writes

"A" contends that an engine with 54-inch driving wheels will *start* a train quicker than an engine with 84-inch wheels, crank-pins same distance from hub, weight of engine and train the same in both instances. "B" contends that size of wheels have nothing to do with the case, but that the weight of engine accounts for quicker starting. Please say which is right and why. *A.*—"A" is right, the engine with small wheels has the advantage of leverage, the piston works on the short end of a lever, the long end is longer as the wheel is larger; to overcome the inertia of weight of train, the small wheel has an advantage on the start, were there no weight to move one wheel would start as soon as the other.

(98) Fireman, Buffalo, writes

We have some of Brooks' ten-wheelers with rocker set in front of forward drivers, short valve-stem and long eccentric rods, valve-stem has flexible joint about midway between rocker and packing-box, and is fitted with metallic packing with a soft metal-lined guard extending out from packing-box about 10 inches. In an argument with an old runner, he claimed the joint was put in valve-stem on account of the guard being there. I said the guard was used on account of joint, and joint was used on account of valve-stem being so short. Being only a fireman, I did not feel like opposing his ideas very strong, but determined to write to LOCOMOTIVE ENGINEERING and find out. *A.*—Your views are correct.

(99) J. Hartley, Philadelphia, Pa., writes

The *Engineering News* says that Fig. 144, in Grimshaw's "Locomotive Catechism," there given as an express passenger engine with two pony trucks, is not that but a double ended suburban engine. Which is right? *A.*—The engine alluded to is given on page 15 of Baldwin Locomotive Works' "Catalogue of Locomotive Details" as for "express passenger service," being styled by them "Class 8¼ C;" C indicating with those builders that four wheels are connected as drivers, the "8" that there are eight wheels altogether, and the "¼" that there is a truck at each end. The Baldwin Works, probably, know an express passenger engine when they see one. Mr. Grimshaw suggested this type of engine some years ago for his proposed run from New York to Chicago in eighteen hours; illustrating it in the *Journal of Railway Appliances*. From New York to Chicago is hardly suburban traffic.

(100) J. B. R., Indianapolis, Ind., writes

I am an apprentice in a railroad machine shop and I am trying to learn everything about the business which a foreman must know. Some of the men tell me that all I have to do is to learn now to do the work of the shop well. It seems to me that there are other things one ought to know which are not learned by a machinist in the shop. Some one advised me to write you about it. *A.*—A youth anxious to rise in a mechanical business ought to learn a great many things which he is not likely to find out in the shop. The best way is to attend a night engineering school. The ordinary machinist does not learn everything about the speed of tools and how to calculate the size of pulley to produce a certain speed. He finds out little about the strength of material. In these days a foreman must be familiar with hydraulics and electricity. He must be familiar with the principles of boiler design, the action of steam and a thousand other things. A studious youth may learn a great deal about these things from books, but the right place to get instruction is an engineering school.

(101) G. E. B., Bedford, Ia., asks

1. Suppose an engine should come in at an out-of-the-way roundhouse with all four eccentric blades bent, twisted and broken, so that it would be impossible to get the length accurately enough from them to send to headquarters, and you had no blue-print and no other engine of exactly same build was at hand, how would you get the length, close enough to allow for adjustment, to send to repair shop? (It is not probable that such an accident ever happened, unless in a bad wreck, but I use it simply as an illustration.) *A.*—Put engine on forward center, take up steam-chest cover, or use tram to set valve with proper lead opening, then measure from center of hole in top of link for eccentric-rod pin to shoulder on eccentric strop, drill holes after the blade arises, do same for back motion, and the two blades will be practically the same length. 2. How is the drop of the link-lifter arms of the lifting shaft determined? That is, when shaft is leveled on surface plate and center of reach-rod and pin-hole is perpendicular to surface, how is the distance (if any) calculated of the centers of pin-holes of lifting arms below centers of shaft bearings? *A.*—The throw of the tumbling shaft arm must be enough to move the link up and down the length between the eccentric blade connections; the bending down of arms is often done to avoid the boiler when the arms are at their highest point; the length of arm, of hanger and of the location of the tumbling shaft have a great deal to do with the distribution of steam. 3. What are the "Mansell" retaining rings and how are driving-wheel tires secured by them? *A.*—The Mansell retaining ring is two rings bolted to the outside of the wheel center, and having a lip on their insides that are let into grooves turned in the sides of the tire. 4. In laying off driving-spring hangers what is a good rule to observe in regard to the amount of draw to give a spring in relation to number of leaves and weight to be supported? *A.*—There is no set rule that can be followed in this case. 5. How is the tension of the driver-springs applied to the boxes of the "999"—by a downward pull connection at bottom of box, or pressure on top through system of levers? If at bottom how connected? *A.*—The springs are underhung, a heavy spring hanger being bolted across from one jaw of the driving-box to the other, the boxes are of Ajax metal and the connection made close to the bottom.

## A Great Thing, of Wind.

A man who signs himself Rev. W. R. Covert, has an article in the *American Journal of Politics* entitled "The Raub Gravity or Three-Cylinder Engine The Locomotive of the Future." We advise all railroad men to read the article—it's killingly comical. His reverend (?) giblets has evidently lent himself to the land-selling scheme at Elwood, Ind. The man of the cloth publishes a report on the test made by the Erie officials, and signed James H. Barrett, Gen'l Sup't, that goes a long way to prove that there are a whole lot of things about locomotives that Mr. Barrett don't know—just as a sample, he says "She carries no dead weight, since all the component parts of her are equally distributed around and about her center of gravity, and hence *saves all expenses of its carriage and maintenance*." He also suggests that the engine will make one hundred miles per hour with a train of seven Pullmans, *as a result of her doubled-tractive force and momentous centrifugal power*.

The reverend M. E. speaks of an engine whose "grates exceeded the limits of its *combustive center*," and also says that the new engine "enables the increase of the revolutions of the drivers without increasing the velocity of the *cylinder position*," also, in referring to an ordinary engine, says "When one piston of a *two-cylinder engine driver!*"—— If you have any money to invest and want to put it in a safe place—where you will never see it again—buy some shares in the Raub-Center-Power-Gravity-Locomotive and Farm-Land-Improvement-Co. (limited).

## National Railroad Master Blacksmiths' Association.

In response to the call of a committee of foreman blacksmiths, published in our last issue, about forty railroad foremen blacksmiths met in the Rookery, Chicago, on September 5th, and organized the National Railroad Blacksmiths' Association. The following officers were elected President, J. J. Thornton, Northern Pacific; First Vice-President, Stephen Uren, Southern Pacific; Second Vice-President, W. W. McLelland, Denver & Rio Grande; Secretary and Treasurer, Geo. F. Hinkins, St. Paul & Duluth. Mr. Hinkins is well known to our readers through his blacksmithing articles.

The president nominated the following members for the Executive Committee C. H. Williams, Cincinnati Southern, J. Buckley, Illinois Central; J. E. Mick, B. & O. S. W.; H. Jeffries, Baldwin Locomotive Works; William Young, Wabash Road.

Mr. W. W. McLelland of the Denver & Rio Grande then presented a very interesting paper on iron, treating the subject historically. It was admirably written, and displayed the results of a most careful study of the subject. The paper was warmly received and was followed by a paper from Mr. George F. Hinkins of the St. Paul & Duluth, in which the duties and aims of the blacksmith foremen were talked about in a most entertaining and suggestive manner.

Several topics were offered for consideration at the first regular meeting, which will be held in Pittsburg, in September, 1894. Among them were: "Work on axles and frames," "Best methods of handling scrap," "Furnace design," "Fuel gas and oil for furnaces," "Welding in locomotive and car work," "Electric welding," and "Piece work."

## Case-Hardening and Furnaces for the Work.

BY W. G. LOTTES.

My letter in September number on case-hardening seems to have drawn considerable attention, according to the personal letters I have received. The question asked in the letters is the time it takes to harden a certain size piece in a certain depth, which is a thing that depends a great deal on the furnace you have and the man that is tending the furnace. If you allow your heat to go up and down you will not get as good results as you would with a good even heat from the time you put it in until you take it out.

Next is the length of time you leave it in. If your case-hardening is packed right, the longer you leave it in, the deeper it will harden, providing you have your box packed so that your charcoal or charred bones or good ground bones will not burn to ashes, and have enough of them for the size piece you are going to case-harden. For instance, a crank-pin for a locomotive ought to have at least a layer of two inches all around it, and a good, tight box. If Jones & Loughlin machine steel, or a good close grain iron is used, you can harden it in as much as $1\frac{1}{16}$-inch by keeping it hot twenty-four hours.

I have been asked what kind of a furnace could be built for doing this work without much expense. This reminds me of the first case-hardening I had to do. We had an old firebox that had been taken out a sheet at a time and thrown in the scrap. It was taken and bolted together, and some big pieces of iron put in, to set the box on. After having the box in, the door sheet was hooked on, then we had a furnace that would burn both wood and soft coal, in fact all the old rubbish in the yard, and surely the old man could not kick on the expense of building.

Another cheap furnace is to lay a brick wall on the outside of your forge, 3 feet 6 inches to 4 feet high, and leave a hole on the top between stack and brick big enough to throw wood in. When you want to take your box out, pull right through the wall, or pull the wall down first, but you want to do it quick, so you will not lose any heat. This makes a cheap furnace, and the old man cannot kick on expense of building. He might kick if you break too many bricks, but you can work in a good many pieces. I have used them as many as twenty-five times.

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A terrible rear end collision happened with a double section of Big Four's passenger trains near Kankakee, Ill., on the evening of September 18. The story is as old as railroad operating, and has been repeated hundreds of times. The first section was stopped unexpectedly and the flagman failed to go back. The engineer of the second section rushed along ignorant of danger and saw the rear end only in time to apply the brakes and jump. The engine plowed through a car loaded with passengers and killed eight, wounding many others. The use of time fusees would have prevented this disaster.

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A patent has been granted to Mr. Harry C. Buhoup, the well-known railroad supply man, of Chicago, for his buffer and vestibule connection for passenger cars. There are eleven claims made for the invention. It is a combination of an independent lateral vertical buffer provided with rearwardly extending plates, which constitute vestibule face plates. There is a casing and door posts between which the plates slide. One set of buffers have a curved face and the others are flat-faced. The principal attachments necessary to form the vestibule are covered by the patent

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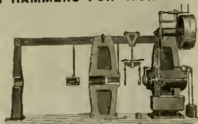

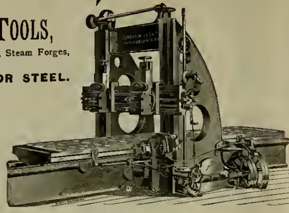

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# LOCOMOTIVE ENGINEERING

## A PRACTICAL JOURNAL of RAILWAY MOTIVE POWER AND ROLLING STOCK.




VOL. VI, No. 11. NEW YORK, NOVEMBER, 1893. 20 Cts. Monthly \$2.00 Per Year.

### New Fast Express Locomotive, Central Railroad of New Jersey.

Our engraving shows one of the latest fast express engines built by the Baldwin Locomotive Works for the "Royal Blue" trains on the Central of New Jersey, designed by Superintendent of Motive Power and Equipment Chas. A. Thompson.

Owing to the limit for height Mr. Thompson was obliged to take the whistle and safety-valves off the top of the dome, but instead of putting the pops in a smaller dome, or on the boiler, as is done by the P. R. R. and several other roads, he places them on the back side of the dome proper.

Material of firebox, steel.

Thickness of plates of firebox, side, back and crown sheets, 5/16 and 5/16 and 3/8 in.

Material of firebox tube-sheets, steel, 1/2 in. thick.

Crown-sheet staying, 1 1/8 in. radial stay.

Diameter and height of dome, 31 1/2 x 20 1/2 in.

Working steam pressure per square inch, 170 lbs.

Kind of grates, water grate and pull-out bars.

Number of tubes, 260.

Diameter of tubes, 2 in.

Width of opening between tubes, 3/4 in.

Grate surface, 38.6 sq. ft.

Size of tender axle-journals, 5 x 8 in.

Wheel-base of tender, 16 ft. 2 in.

Spread of truck-wheel centers, 5 ft. 6 in.

Capacity of tank in gallons, United States, 3,500 gallons.

Fuel capacity of tender, 6.8 tons.

Total wheel-base of engine and tender, 49 ft. 3 in.

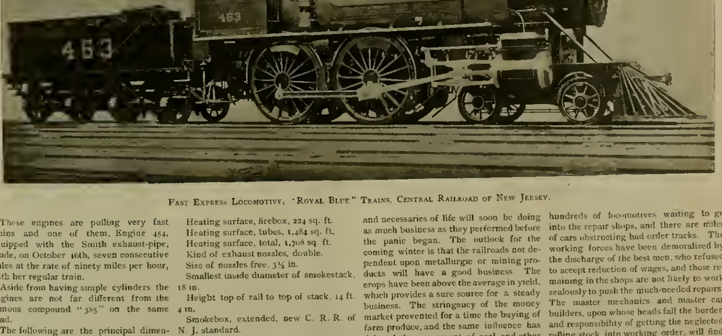
Total length of engine and tender over all, 59 ft 9 in.

### Entering the Winter with Rolling Stock Run Down.

The indications are that the railroads which derive their principal revenue from the transportation of farm produce, coal and necessaries of life will soon be doing as much business as they performed before the panic began. The outlook for the coming winter is that the railroads not dependent upon metallurgic or mining products will have a good business. The crops have been above the average in yield, which provides a sure source for a steady business. The stringency of the money market prevented for a time the buying of farm produce, and the same influence has delayed the movement of coal and other supplies that must be provided for the winter. There are now indications of unusual activity to make up for lost time, and the railroad companies will be the first to enjoy the benefits.

Very few railroads have their rolling stock in a condition to handle a rush of business during the winter months. A blind policy of cutting down shop forces has been pursued, and all work not absolutely essential for present needs has been shut down. Not a few of the managers acted as if there was no future. Most of them are now wakening up a little, and increase of force and lengthening of working hours is the rule of the day.

When the nights are long and dark, there will be full working hours in many shops and much overtime going on. This will compel the companies to pay a large premium for the small savings they effected by reduction of force and of working hours at the time when the work could be done to advantage. The volume of business has not increased very greatly yet, but some of the roads have every locomotive fit to haul cars in service. Should the winter prove severe, the roads that pursued the waiting policy are certain to be in a frightful condition. There are hundreds of locomotives waiting to go into the repair shops, and there are miles of cars obstructing bad order tracks. The working forces have been demoralized by the discharge of the best men, who refused to accept reduction of wages, and those remaining in the shops are not likely to work zealously to push the much-needed repairs. The master mechanics and master car builders, upon whose heads fall the burden and responsibility of getting the neglected rolling stock into working order, will find themselves in a most unenviable position. They were generally opposed to the policy of senseless reduction, their advice was generally in favor of putting the machinery in order at the season when men could work to the best advantage. After their advice went unheeded and chaos has come, they are called upon to put things to rights, and they will be blamed if they fail to do it at small expense. The coming winter is certain to witness roads blockaded with cars because there are not locomotives enough to move them, and freight delayed because there are not cars to haul it.




Fast Express Locomotive, "Royal Blue" Trains, Central Railroad of New Jersey.

These engines are pulling very fast trains and one of them, Engine 454, equipped with the Smith exhaust-pipe, made, on October 16th, seven consecutive miles at the rate of ninety miles per hour, with her regular train.

Aside from having simple cylinders the engines are not far different from the famous compound "385" on the same road.

The following are the principal dimensions:

Cylinder diameter and stroke, 20 x 24 in.

Size of steam ports, 1 1/2 x 20 in.

Size of exhaust port, 3 1/2 x 20 in.

Slide-valve traveling full stroke, 6 1/2 in.

Slide-valve lap, outside, 1 in.

Slide-valve lap, inside, 0.

Slide-valve lead, full stroke, 1/16 in.

Diameter of driving-wheels, with tires, 78 in.

Diameter of truck wheels, 36 in.

Size of driving axle journals, diameter and length, 8 x 12 in.

Material of outside shell of firebox, steel, 5/8 in. thick.

Heating surface, firebox, 224 sq. ft.

Heating surface, tubes, 1,484 sq. ft.

Heating surface, total, 1,708 sq. ft.

Kind of exhaust nozzles, double.

Size of nozzles free, 3 1/2 in.

Smallest inside diameter of smokestack, 18 in.

Height top of rail to top of stack, 14 ft. 4 in.

Smokebox, extended, new C. R. R. of N. J. standard.

Total weight of locomotive, working order, 123,800 lbs.

Total weight on driving-wheels, 88,400 lbs.

Total wheel-base of locomotive, 22 ft. 3 1/2 in.

Distance between driving-wheel centers, 7 ft 6 in.

Distance between front driving-wheel centers and cylinder centers, 11 ft. 4 1/2 in.

Length of main driving-rod, center to center, 7 ft. 2 1/2 in.

Weight of tender, empty, 32,500 lbs.

Weight of tender, with fuel and water, 82,000 lbs.

Number of wheels under tender, eight.

### Erie Train Service and Cars.

The advantage secured in the moving of trains safely by having a good signaling system has been very well illustrated this season on the Erie. This road has been carrying a very heavy excursion business of people going to the World's Fair, trains often running in five or six sections. This is the most difficult kind of business to handle safely, but, thanks to the excellent block system, the trains have been run without accident.

In connection with the large passenger business done by the Erie this season, their latest pattern of passenger cars is worthy of more than a passing notice. Within the last year the company have received nearly one hundred new passenger cars, that are unusually substantial and comfortable. They embody all the latest improvements and conveniences for the comfort of passengers. The interior finish is in mahogany of a rich, neat design, with quarter oak head-lines tastefully decorated. The trimmings are bronze, and Forney seats are used, upholstered in crimson and old-gold plush. The cars have Pintsch gas, Westinghouse quick-action brakes, air-signals and platforms of the improved Janney-Buhoup pattern. A very desirable feature about these cars is that the space between the bed timbers is filled with mineral wool, which is said to have a decided effect in deadening noise.

### Use Fusee Signals.

There is a growing sentiment in favor of railroad companies being compelled to employ block signals for the safe movement of trains. Every rear end collision resulting in loss of life makes new converts in favor of a system that will keep trains apart. If railroad companies wish to delay legislation in favor of block signals they had better use every means to make the flagging system more effective. As a radical improvement on or addition to the methods of the rear brakeman we commend the following plan recommended by Col. Haines.

"More extended recognition should be given to the use of the time fusee. Its use at night should be obligatory, not only by the flagman but also by the engineer. Whenever he is about to stop or slow down his train at an unusual place, he should drop a lighted ten minute fusee on the right hand side of the track on which the train is running, one mile before the stop is made, and an interval of ten minutes ahead of the following train is at once secured by a sentinel that will not desert its post, by a signal whose unmistakable light will illume its surroundings, let the wind blow and the rain fall as they may. Such a use of the fusee will not do away with the protection afforded by the flagman, but rather increase it, for as he crosses a bridge on his way to the rear he will feel personally safe so long as he sees that purple blazing between him and the approaching train. Even in the day time, the smoke from a lighted fusee would attract the attention of a following train."

The damage caused by one wreck would probably cause more loss than the expense of providing time fusees for a whole year. Why this excellent system of signaling has been so long neglected is something we cannot understand. No road that is without block signals can afford to neglect the fusee method of protection to trains.

### A Brazen Affair.

"Did you ever hear how the expression, 'The cheek of a government mule' originated?" asked the Old Member at the last meeting of the club.

No one was aware how that classic phrase arose, so the Old Member proceeded to enlighten them thusly.

"Away back in the year—well, no matter what year—the Coal Combine road was supplied with brass by the Brazen Body Company, whose headquarters are in Jersey. The manager of the company, Mr. Scheme, was noted for his aggressive business methods. He did not sell all the brass in his possession, but kept a good stock on his face to do business with.

"They had been furnishing brass to the Coal Combine Company for years, and were making a good thing out of it. It came to pass that a new master mechanic came to the road, and as the times were a little hard—just as they are now—Mr. Charles, as the master mechanic was called, got looking into how he could reduce expenses, and he discovered that the company were paying more than the market price for their brass. This was a good opportunity to retrench, so he sent out a request for bids for the supply of brass, and the circular went to the Brazen Body Company as well as to others.

"Next morning Mr. Scheme was bright and early waiting on Mr. Charles.

"'What does this paper mean?' he inquired with some heat. 'Is our brass not good enough for you?'

"'Yes,' replied Mr. Charles, 'it is good enough, but it is too dear. You charge more than the market price.'

"'Now, you may just as well stop right here,' retorted the man of brass. 'We are going to continue supplying your company with brass at the price we are getting, and don't you forget it. There is a power behind the throne that will quickly pull you down if you don't look out.'

"'That is all right,' returned Mr. Charles, who has a quiet, easy way of talking, 'just bring out your power as soon as you like, but bring down your price by the first of next month or I shall order a supply of brass from some one else.'

"Mr. Scheme walked out in a rage and proceeded to pull all the ropes within his reach, but none of them were strong enough to dislodge Mr. Charles from his position. He tried all sorts of actions to prevent the price from being reduced without success, and finally got a friend who was corporation counsel to give notice that a suit would be brought against the railroad company for causing a smoke nuisance with their locomotives. After this notice was given he went to condole with Mr. Charles.

"'Now, Mr. Charles,' he said, 'I am very sorry to hear about this suit, for it will be a serious reflection on you. But I may be able to help you out. The mayor is my friend, and I will try to get the suit withdrawn if you will continue the brass contract at the old figure.'

"'Mr. Scheme, you got this suit begun, and now you want to dicker with me to stop it. You have the cheek of a government mule, but your kick has missed. Our president has seen the mayor and the suit is already withdrawn.'

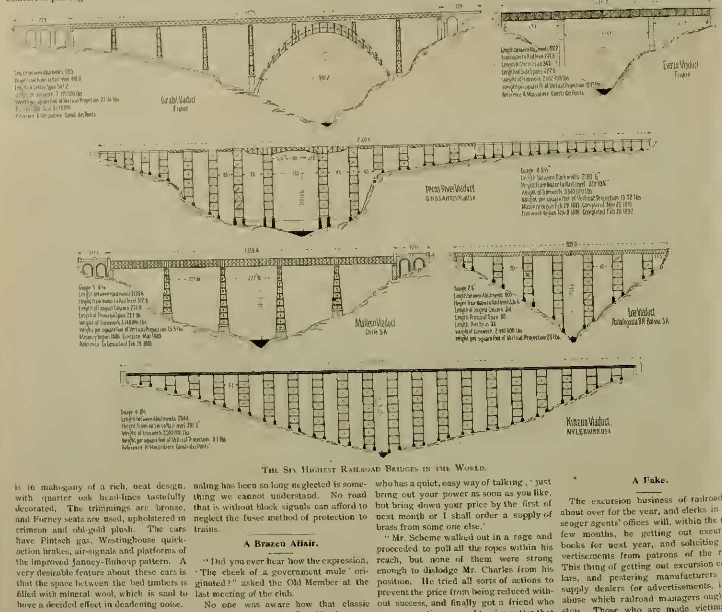
"The answer so much amused railroad men, that 'the cheek of a government mule' has become a proverb."

### The Highest Railway Bridge.

The expression, "highest in the world," has to be modified every now and then—some other "highest" has gone up a few feet.

Kinzua Viaduct, on the Erie, long had the reputation of being the highest railroad bridge in the world, but, as can be seen by the drawings of other bridges on this page, there are several bridges higher—just at present the Garabit Viaduct, in France, is holding the medal.

We are under obligations to General Manager J. Kruttschnitt, of the Southern Pacific, for the drawing here reproduced. All the details for each bridge is given on the engraving, so that a detailed description in type is unnecessary.




THE SIX HIGHEST RAILROAD BRIDGES IN THE WORLD.

### A Fake.

The excursion business of railroads is about over for the year, and clerks in passenger agents' offices will, within the next few months, be getting out excursion books for next year, and soliciting advertisements from patrons of the road. This thing of getting out excursion circulars, and pestering manufacturers and supply dealers for advertisements, is an abuse which railroad managers ought to stop. Those who are made victims of this business invariably say that they have been subjects of blackmail. We are certain that very few railroad managers would countenance the practice of soliciting advertisements for folders and other pamphlets, if they only were aware of the abuses connected with the practice.

The actual number of LOCOMOTIVE ENGINEERING printed during the year ending September 30th was 243,624—an average circulation of 20,302 for each month. We keep no back numbers. We will give a prize of a yellow poodle pup to any one who will name any other railroad paper that can prove they issued one quarter that number during the same time. Come early and avoid the rush.

### Rogers Compound for Jamaica.

The Rogers Locomotive Co. have recently sent to Jamaica a heavy ten-wheeled compound, a picture of which is shown herewith.

They have some heavy grades there, and coal is expensive.

This engine has cylinders 20 inches and 30 inches in diameter by 26-inch stroke, driving wheels, 50 inches in diameter, with 12 feet 3 inch rigid wheel base and 22 feet 9 inches total wheel base. She is standard gauge and weighs in working order 137,500 pounds, 97,000 of it being on the drivers.


Rogers Compound Freight Engine for Jamaica.

The starting gear of the Rogers compound is quite simple, the intercepting and reducing-valve being controlled by a connection to the reverse lever, as shown just ahead of the air-pump. When the reverse lever is in the extreme forward or backward notch of the quadrant the curved slot of the bell-crank is brought into a position to hold the reducing-valve open and work the engine simple; when the lever is taken out of the corner the engine commences to work compound.

### Compound for Cleaning Paint.

The tanks on the South Carolina road all look as if they had been recently polished, and we knew there must be a reason for it—there is.

First Elevated in New York, 1873.

The superintendent of motive power, E. M. Roberts, has a complexion preserver for tanks and other paint work that does the business. He makes up face wash for paint as follows: Four gallons of water, one pound of borax, one quart of lard oil; and the directions read as follows.

"First, wipe off all dust with dry waste, then use compound, rubbing over paint for a space of about three or four feet, and then wiping off clean. It is not advisable to let it dry, and if a greater space than this is covered at one time it is likely to be difficult to wipe off properly. This cleans paint work beautifully, and preserves the luster of the varnish for a very long time."

They only use the compound on tenders, but we can't see why it is not good for any painted and varnished surface.

### Boston & Albany Shops.

The general air of neatness and order which prevails in and around the shops of the Boston & Albany road makes and leaves a most pleasing impression upon the visitor, and is just as sure to result in economies to the railway company. The Springfield machine shops were not entitled to this word of praise up to a very recent date, but under the charge of the new master mechanic, Mr. C. H. Barnes, order and neatness already prevails, and many changes are taking place which bespeak efficient management. At East Albany, under Mr. Purvis, a visit alone can convey a correct idea of his able management—even the scrap heap is made a feature of order and attractiveness.

What is said in praise of the locomotive department holds with equal force in regard to the car shops. Mr. Adams' department has long been a model for order and efficiency throughout the country, his equipment both in freight and passenger departments standing at the head of the list. The attractive and modern features of his passenger cars has had much to do with the building up of the strictly first-class suburban traffic held by this road, and we believe has drawn this trade from other lines to no inconsiderable degree.

### An Old-Time Royal Carriage.

A period of fifty years represents in the history of railways a rate of progress and development almost incredible to those who only look at what lies in plain sight, and take for granted the things of to-day, without a thought of the experiments and failures which have led up to them.

The old-fashioned rolling stock and railway relics in general which are to be seen at the Chicago World's Fair must emphasize the above statement very strongly to the crowd of sight-seers, and ought, it would be supposed, make modern travelers appreciate somewhat more highly than they appear to do the advantages of sleeping and dining cars, such as are now available to almost any one.

As an additional pendant and contrast to the ordinary Wagner or Pullman cars that run on all the main lines to-day, we illustrate an old-time "Royal Saloon," which would now be deemed by a third-rate drummer as quite unfit even to carry his samples, let alone his own valuable person.

This "Saloon" was built fifty years ago, in 1842-3, for the old London & Birmingham line, which used it principally, if not entirely, for Queen Adelaide, the relict of King William IV. It was, therefore, known as the "Queen Dowager's Carriage," and has been preserved as a curiosity in the railway company's works at Wolverton ever since finally passing out of service. The London & Northwestern Railway, into which the London & Birmingham was merged, now own a very different "Royal" train of cars for Queen Victoria's use.

The under frame of this relic was constructed in the company's carriage works, then situated at Euston, and the body at a coachmaker's shop in Birmingham, under the superintendence of the late Mr. Joseph Wright. Originally this saloon had three compartments, with the rear one so arranged that when used for sleeping the feet of the occupants extended under the arrangement projecting outward like the "boot" of an old-fashioned coach.

The body of this carriage was only 5 ft. 1½ in. wide inside, 6 ft. high from sills to apex of roof outside, and 11 ft. from rail to top of lamp. The body was 16 ft. 6 in. long over all, and the total length over bumpers 21 ft. 9 in. The wheel base was 10 ft.


A Queen's Coach, 1842.

### An Old Experiment with Balanced Valves.

In the development of railway machinery a great many inventions which promised to effect radical improvements have been tried, and rejected as impracticable. After they were thrown aside for years others took them up and by a few minor changes succeeded in making them a success. The balanced valve for locomotives is one of the best instances of this kind. Balanced valves have been tried more or less ever since locomotives were brought into use, but it is only within the last ten or twelve years that they have been made a decided success. With the high-pressure and large slide valves now employed a locomotive works under severe disadvantages when the valve is not balanced. The well-known engineer and inventor, Mr. Jerome Wheelock, of Worcester, Mass., read a paper twenty years ago at the Master Mechanics' Convention on balanced valves, which makes interesting reading to-day. The following are extracts from the paper:

"Experiments with so-called 'balanced valves' have been legion, and the results, if we may believe the statement of those interested, have been truly wonderful. I have listened to statements where one of these inventions has effected a saving of 33 per cent., besides a great saving in wear and tear of the valve-gear; but up to this time I do not believe it possible to show by actual test any case where, after having given the ordinary slide its proper proportions and adjustment, a fair comparative trial has resulted in any saving of fuel or material in favor of the balanced valves. On the contrary I am fully persuaded that the opposite is the result. I know I am on ticklish ground, and some of my associates will question these views, but I have had the disease. I have been through with a series of experiments to demonstrate the value of balanced valves for locomotives, and I assure you the dose has entirely cured me.

"My early acquaintance with the locomotive led me into the common error that a very great amount of power of the engine was being absorbed to move the valves; in fact, it appeared to be self-evident. As figures would not lie, it was easy enough to make out a case. Taking the area of the surface of the valve, multiplied by the steam pressure per square inch, made the sum total of the load to be moved perfectly enormous. To stand by and see the valve-gear shake as an engine was leaving a station was, it appeared, sufficient to satisfy anyone.

"I was made aware that the subject was not new, as upon my becoming an inventor in this direction, my attention was called to between thirty and forty different devices gotten up to relieve the pressure on the valves. Many had been tried and some had not; and I will here say that some of these devices are marvels of genius; complicated though they may be, they yet have occupied some of the best brain power of this nation."

A description of the valve was then given. It consisted of a cylindrical casing with a conical plug, through which the steam was admitted. Several railroads in New England were willing to give the valve a trial, and it was applied to an engine. Experience with the engine and views of balanced valves generally are then given as follows:

"The engine came out, and as she moved up and down the yard everything seemed to work as it should, and she was attached to a freight train and the trial began. Using steam quite freely for the work performed, it was suggested that the engine was just out of the shop and was stiff. It was evident that the valves did not go hard, as the reverse lever could be handled with perfect ease. If the latch was raised out of the notches, the lever would stand at any point without holding —a result I considered very satisfactory. Arriving at the first descending grade steam was shut off as usual, when it was expected speed would increase by the inertia of the train. This, to my surprise, was not the case. The engine was indeed 'stiff.' Steam rapidly accumulating, the furnace door was opened, when a very strong exhaust was discovered, drawing hard on the fire, and the firebox was soon emptied of the fuel, the engine blowing off violently. I will here remark that my valves were allowed an end play, or movement of about one-half inch, working away from their seats when steam was shut off. This I had expected would be sufficient to relieve the engine when running down grade. I was greatly surprised at the result, as were my companions. Where all this exhaust came from was a mystery; but as it had made the engine steam well I tried to persuade myself and others that it would result to an advantage.

"This round trip having been made, and several promiscuous trials on different trains gone through with, the engine was at length put upon her accustomed passenger train. Here the comparative trial began, and after about a year's use the trial ended.

"The engine 'blowed,' and the valves must come out to be looked at. When taken out they had the polish of a mirror. Anti-compression and relief-valves were put in, and changed this way and that way. One day one thing and the next day something else would suggest itself as being necessary to make the engine better. I will here remark that I was in the hands of friends. Never were men more anxious for success than were the officers of that road that these valves should succeed. Every facility was furnished and every assistance rendered that could be. The engine was taken off her train while I applied a second pair of valves with some of the details changed. And thus I worked, and tugged, and studied, until I nearly wore myself out during that year all to no purpose, trying to make that engine do as well as she had done with her old valves.

"I am fully persuaded that the trial was as exhaustive as has ever been made in this direction, and I verily believe the results were as favorable to balanced valves as any that were ever tried; but still the verdict must be that the engine did not do as well as with her old style of valve.

"There are several reasons why balanced valves are not practical for the locomotive. High-pressure steam is a terrible searcher, and will find the minutest outlet. It affects metals variously at various pressures. Expansion and contraction of metals are among the evils to contend with. Thus, while a pair of valves might be practically tight at 60 pounds, they would be found to leak badly at 120 pounds pressure. The walls and cover of the steam-chest subjected to great strain are warped, more or less, and do not remain absolutely as when fitted. Then comes the wear. But, perhaps, it will be argued there is no wear with the valves balanced. Ah! gentlemen, this is preposterous, as you could not wipe a woolen cloth over the surfaces the number of times the valve is moved without perceptible wear. But enough of this."

## Two Swiss Locomotives.

The two fine engravings shown herewith were made from photographs secured by a lady on a recent trip through the Alps, as was also the mountain climber, shown on another page.

We have been unable to gather much data about them, in fact none so far as sizes go.

The six-wheeled engine is one of a class in use for the past five or six years for mixed traffic—a practice of running trains that exists to the great discomfort of the passengers.

V. S. B. means "Vereinigte Schweizerbahnen" (United Swiss Railroads). This road has many curves and heavy grades, especially on the line from Winterthur to St. Gallen, and from there down to the lake of Constance.

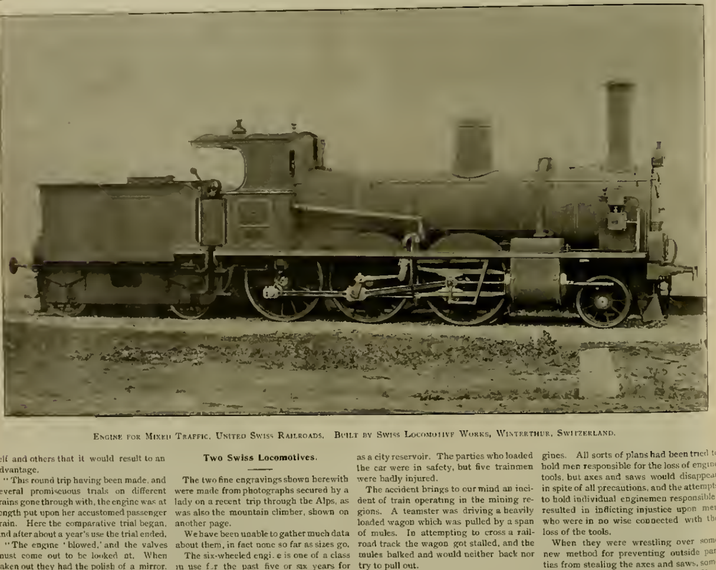
The drivers are about four feet six, but the size of the cylinders we do not know. Like most engines built in Switzerland, they have the Walschaert valve motion and outside steam pipes.

The curved lever on the tank is the tender brake-lever.

The four-wheeled coupled engine belongs to the "Schweizerische Nord-Ost-Bahn" (Swiss Northeastern R. R.), one of the most important lines in the little republic, and is used also for mixed traffic.

These lines have until recently used a continuous system of steam-brakes, but have discarded them for the Westinghouse air-brake.

Both engines were built by Swiss Locomotive Works, at Winterthur.



Engine for Mixed Traffic, United Swiss Railroads. Built by Swiss Locomotive Works, Winterthur, Switzerland.

## Carelessness with Dangerous Loads.

There was a bad wreck out in Ohio the other day that shows how reckless some men grow when they are accustomed to handling dangerous material. A car was loaded with 234 kegs of powder, and an old car was used with doors so loose that sparks could pass through them as readily as through a smoke-stack netting. To make the thing worse there was straw and shavings left littering the bottom of the cars. What might have been expected happened. A spark started a fire in the car. It soon reached the contents of one of the kegs and the whole load went off in a blast that made a hole in the track as big as a city reservoir. The parties who loaded the car were in safety, but five trainmen were badly injured.

The accident brings to our mind an incident of train operating in the mining regions. A teamster was driving a heavily loaded wagon which was pulled by a span of mules. In attempting to cross a railroad track the wagon got stalled, and the mules balked and would neither back nor try to pull out.

Presently a heavy train made its appearance rounding a curve near the crossing. The driver of the wagon jumped off, and began running through the meadow like a scared deer. The engineer of the train opened his whistle when he saw the wagon, and the mules made a plunge and pulled the load clear just as the pilot was about to throw it in the air. The train stopped, and the crew began guying the teamster for running away.

"What was the matter?" asked the engineer, "did you think we would chase you through the prairie?"

"No," drawled the teamster, "leastwise I did not think you would come after me in a body. I was afraid of your parts."

"What do you mean by being afraid of our parts?"

"Well, that a're wagon is loaded with dynamite, and I did not want any of you fellows' legs or heads to be fired my way."

## Removing Tools off Locomotives.

At the first impression, the proposal to take the axe, saw and screw-jacks away from the locomotives, seems to be absurd, yet the question was discussed at a recent meeting of the New York Railroad Club, when a large attendance of master mechanics was present and the prevailing opinion favored the proposal. Few of those present had previously given the subject a thought, but when they listened to the arguments in favor of the plan, most of them were convinced that the change was a good one. The question came up, owing to a change which has lately been carried out on the Pennsylvania and Erie railroads. The mechanical officers of these companies found that the maintaining of axes, saws and jacks on locomotives that were not assigned to regular crews, was a source of expense that was not in keeping with the benefits derived from having these tools on the engines. All sorts of plans had been tried to hold men responsible for the loss of engine tools, but axes and saws would disappear in spite of all precautions, and the attempts to hold individual enginemen responsible, resulted in inflicting injustice upon men who were in no wise connected with the loss of the tools.

When they were wrestling over some new method for preventing outside parties from stealing the axes and saws, some one raised the practical inquiry: How much use or service is an axe or saw on a locomotive? This led to investigation, and it was found that there is really no use for an axe except in case of a wreck, and that a saw is used only to saw blocking for the cross-head, in case of break downs. The man who waits until breakage occurs before he gets the cross-head blocking ready, is not taking time by the forelock. If he depends on any piece of wood that can be picked up after an accident happens, he is likely to use blocking that will not be strong enough to hold the piston. Hundreds of cylinder-heads have been knocked out and more serious damage done by employing inferior blocking for cross-head. It seems sound business policy to require an engineer to provide himself with good blocking before an accident happens. All careful engineers do this without compulsion, and careless ones ought to have the screws applied, for compulsion that promotes safety is a kindness.

When all these things were considered, there appeared to be a good case made out for taking the axe and saw off the engine. The engine crew is, however, not deprived of the use of the articles referred to, for they are carried in every way car and are at the service of the engineman when required.

Screw-jacks are not things that get stolen frequently, but it was found that the jacks on the engines were so hard to keep in working order that they were also removed to the way car, where they could be kept locked up in a clean, dry locker. There was some disposition to censure enginemen because the jacks to be found in tender boxes are generally rusted and out of order. We do not think the enginemen are to blame for this. Tool-boxes for locomotives are seldom made watertight. Iron or steel articles cannot be kept clean and in working order without constant attention when they are exposed to soaking every time it rains and every time water is spilt in filling the tank. When men are not regularly assigned to an engine it is not fair to expect that they will devote much attention to keeping up the condition of tools they may never be called upon to use.

The introduction of the standard signal code into New England has begun, and will, no doubt, now make rapid progress. Most of the New England roads, being members of the Railway Association, should have taken the lead in the adoption of the standard code, instead of being the last to adopt it. The Fitchburg and the New York, New Haven & Hartford are now using it, and others are likely to follow suit soon. The Old Colony system, being now under the New Haven management, will likely be the first to fall in line. Under the vigorous and enlightened management of the new president, Mr. Tuttle, the Boston & Maine is likely to abandon many of its ancient ways, and no doubt the adoption of the standard signal code will come soon.

Only one passenger for every 1,491,910 carried were killed on our roads last year.

ENGINE FOR MIXED TRAFFIC, SWISS NORTHEASTERN R. R. BUILT BY SWISS LOCOMOTIVE WORKS, WINTERTHUR

## Heating Surface of Firebox and of Tubes.

By Angus Sinclair.

EVAPORATIVE EFFICIENCY OF FIREBOX AND DIFFERENT PARTS OF BOILER.

It has been proved beyond doubt that the walls and crown sheet of a firebox and the sheets of a furnace form the most valuable portion of the heating surface. These parts are exposed to the direct radiation of the fire, and are impinged on by the hot flames, so that a great portion of the heat generated by combustion is absorbed before the gases pass into the tubes. The annexed illustration gives a graphic illustration of the comparative evaporation of the different parts of a locomotive boiler as found by experiments made in England. It will be seen that the evaporation in the firebox is about equal to that of all the tube surface, and is ten times as great as that of the last section of the tubes. The first section of the tubes evaporates about four times the water turned into steam by the last section.

VERY LARGE FIREBOXES MAY WASTE FUEL.

These are interesting facts, and they are well known to nearly all locomotive designers, but there is good reason to believe that the admiration for the evaporating qualities of the firebox has frequently led to the building of locomotives that had excessively large fireboxes, and were deficient in tube surface. This has always turned out badly. When extremely large fireboxes are used, a large proportion of the water is evaporated by them, but the tendency is to keep the firebox temperature so low that part of the gases fall below the igniting temperature and cause waste of fuel. The size of grate necessary to burn the fuel required to evaporate the quantity of water used, ought to regulate the size of the firebox. Years ago, D. K. Clark, the famous engineer, made the statement that the grate area of a locomotive cannot be made too small, provided the rate of combustion does not exceed the limits imposed by physical conditions. This means that if the grate area is large enough to admit the required air to burn the coal with fair economy, the smaller it is the better. Locomotive designers have frequently ignored Clark's dictum, but no experiments have been made which proved his views to be wrong. Many locomotives are worked so hard at times that more fuel is consumed than can be burned economically, but they are run at other times so light that the grates are too large for the fuel consumed and waste of coal results.

RATIO OF GRATE TO FUEL CONSUMPTION.

With the fixed draft appliances used by a locomotive there is some ratio of fuel consumption to grate area which is the most economical. It may be the burning of 50 pounds or of 100 pounds to the square foot of grate area, or it may be more or less. The closer the average working of the engine can be made to conform to the most economical ratio, the better will be the results obtained. We are constantly seeing efforts made to have the grates large enough to produce a high ratio of economy, when the engine is working at its maximum steam-using capacity. As the engine may work in this way only a small proportion of the time, the grate area is too liberal in its supply of air for lighter working, and lighter working may be the service done by the engine the greater part of the time.

It is difficult to determine with accuracy the most economical ratio of grate area to rate of fuel consumption for a locomotive, and stationary boiler practice, where tests can be conclusively made, has guided designers to a great extent in establishing locomotive proportions. In stationary-engine tests it has been found that the loss of fuel is very great when the rate of combustion is raised from 10 to 100 pounds per square foot per hour. An ordinary locomotive, on the contrary, will use fuel more economically when burning 100 pounds of coal per square foot of grate, than it will do when the consumption is reduced to 10 pounds of combustible per hour to the square foot of grate. It has also been proved that the waste of fuel will be ten times as great when 100 pounds per square foot of grate is burned in the furnace of a cylindrical tubular boiler, as it will be when the same quantity is burned on the grates of a good locomotive. The abstract reasoning, then, that the grate area of a locomotive must be sufficiently liberal to approach stationary boiler practice, is based on an erroneous foundation.

RATE OF FIREBOX COMBUSTION.

Coal can be burned in the firebox of a locomotive with economy at the rate of 100 pounds to the square foot. As much as 200 pounds per square foot is sometimes burned without excessive waste, and 150 pounds per square foot of grate per hour is a common rate of fuel consumption. If a locomotive is designed with grate surface suitable for burning 150 pounds of coal per hour when the engine is working at nearly the maximum rate of steam consumption, the engine is likely to be well adapted for pushing to a higher rate of work or for being dropped to light steaming. It may be forced to 200 pounds consumption or dropped below 100 with fair economy. The important point is to calculate on proportions to suit a high average working.

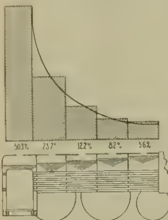
RATIO OF GRATE TO STEAM CONSUMPTION.

Let us take the case of some well-known locomotives pulling fast trains. The cylinders are $19 \times 24$ inches and the driving wheels are 78 inches diameter. One of these cylinders has a cubical content of 3.93 feet. The greatest drain of steam from the boiler per unit of time is when the engine is running at its highest velocity. Suppose the engine is running at 70 miles an hour and cutting-off at 6 inches or quarter stroke. As this portion of the stroke has to be filled with steam twice at each revolution there will be 3.93 cubic feet of steam taken at each turn of the driving wheels to supply the two cylinders. This does not take the clearance spaces into consideration, but they can safely be ignored since the compression brings the pressure up close to the admission line.

A wheel 78 inches diameter turns 258.73 times per mile. At 70 miles an hour we have $258.73 \times 70 = 18,111$ revolutions per hour. This number of revolutions multiplied by 3.95, the quantity of steam used per stroke, gives 71,177 cubic feet of steam to be supplied per hour. The steam is about 175 pounds boiler pressure or 190 absolute. At this pressure, the relative weight of steam to water is 149 to 1. We then have the problem $71,177 \div 149 = 447.65$ cubic feet of water to be evaporated per hour. A cubic foot of ordinary feed water weighs about 63 pounds, so we have $447.65 \times 63 = 28.202$ pounds of water to be evaporated per hour. It is found that a pound of good coal evaporates in these engines about 7 pounds of water even when the rate of combustion is about 150 pounds per square foot. Then $28202 \div 7 = 4029$ pounds the quantity of coal that must be burned per hour at the rate of steam consumption discussed. When this is divided by 150 it gives nearly 27, which is the square feet of grate required. As a matter of fact, the engines have 27.3 square feet of grate.

CIRCUMSTANCES INFLUENCE GRATE AREA.

When locomotives are intended for slower service the grates can safely be made smaller, but designers ought to cal-




culate the weight of coal that must be burned per square foot of grate when the engine is working under the condition when most of the work will be done. A large grate area is necessary for slow burning fuel, such as anthracite.

The grate area is not settled by any well established rule. The designer is to a great extent guided by circumstances. When the firebox is placed above the frames and there are no physical restrictions to ample grate surface it is generally made large, sometimes too large. By examination of a great many modern locomotives, we find that the total cylinder content in cubic feet multiplied by 3½ agrees fairly well for engines burning good soft coal In some cases, where the firebox is between the frames, the grate area does not exceed 2½ times the cylinder content in feet. With anthracite coal burning engines, on the other hand, the grate area is sometimes more than five times the total piston displacement in cubic feet. When the poorer grades of soft coal and lignite are burned in locomotive fireboxes, the grate area has to be increased to nearly the same proportions as those employed for anthracite.

TUBE SURFACE SUPERIOR TO COMBUSTION CHAMBER SURFACE.

The efficiency of the firebox surface for evaporating water has led many designers to increase the space open to direct radiation of the heat by adding combustion-chambers to fireboxes using bituminous coal. In a great many instances we have seen the combustion-chamber abandoned and the space filled with tubes, and in every case the steaming of the engine was improved. The combustion-chamber appears to act well with Wootten fireboxes, and it might be of some service with very shallow fireboxes of any kind, but with deep fireboxes the space is better utilized by tubes.

EFFICIENCY OF TUBE SURFACE.

The deliberate planning to make the tubes secondary to the firebox as a water evaporating medium is not good engineering. The multitude of tubes are what first made the locomotive boiler a success, and every attempt to make the tubes secondary to the firebox detracts from the efficiency of the boiler. If there is not sufficient tube opening for the gases of combustion to pass through freely, it exerts the same detriment to the efficiency of the furnace as a restricted smokestack does to a natural draft boiler. Although the last section of the tubes toward the smokebox may evaporate little more than 5 per cent. of the total water turned into steam, that 5 per cent. exerts its own influence on the consumption of fuel, and the heat is saved from passing into the atmosphere. A very long tube is not economical in a locomotive boiler because there is difficulty in keeping it from leaking, but within practical limits long tubes and economical combustion of fuel go together. The most successful locomotives in America have about 200 square feet of flue area to each foot of cubical content of both cylinders. If inferior or refractory coal is used a greater ratio of heating surface is necessary.

LONG AND SHORT TUBES.

There were some interesting tests made on a French railway that demonstrated the exact value of long and short boiler tubes. With an equal amount of total work performed, it was found that the quantity of water vaporized per pound of coal was always decreased when the length of the tubes decreased, but that the diminution inefficiency was small when the length was decreased from 23 ft. to 19½ ft., and even to 16½ ft. the decrease in economy was very slight. From 16½ ft. to 14¾ ft. the reduction in economy is much greater, and from 14¾ ft. to 13 ft. it is considerable. After this point is reached, a further reduction below 13 ft. in length reduces the economy regularly, that is, almost in proportion to the deduction of total heating surface.

It was further found that if it was desirable to consider, instead of the amount of water vaporized per pound of coal, the total amount vaporized in a boiler in a given time, the change in tube lengths produced a different result. When the length of tube was decreased below 23 ft., the total quantity vaporized in a given time was considerably increased, and kept increasing until it was at a maximum between 14¾ feet and 13 feet; but after that a further reduction decreased the amount evaporated. When the tubes experimented with were about 9.8 ft. in length, the total evaporation in a given time was reduced to be equal to that when they were 16½ ft. in length.

The result of these experiments was that tubes about 14 ft. long were adopted as standard. This is too long for American engines, because iron tubes of that length are too heavy, and vibrate themselves loose in the flue-sheets, but saving of heat calls for the tubes to be as long as they can be used without leakage.

## Lining Up and Marking Off Wedges.

BY W. L. BOYLE.

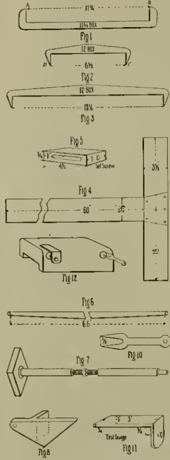
In keeping up rolling stock, one of the things to be avoided is the measuring by planer hands and other mechanics, and all the errors and "slight differences" due to this measuring.

I ignore the cylinders and the center casting in my measurements, and try to get my axles square in the frames.

To this end, I fit up several little inexpensive gauges, that save time on the planer, insure uniformity in all repair work on driving-boxes, wedges and shoes, and leave behind something to test the work by. These gauges, tools, templates, jigs, or whatever you choose to call them, cost little more than the lining up of one or two engines in the old way, and insure correct and uniform work with less labor and less skill.

In the first place, I make a set of gauges like Fig. 1 for each sized box in use, say, one for a 12-inch box, the next 11⅞ inches, another 11¾ inches, making one for each size less by an eighth of an inch for as long as the web of the box will stand planing off, using a smaller gauge as the box is cut away. Now, when you are re-brassing or refitting your driving-boxes, have the planer hand use one of these gauges, instead of "just skimming them up," regardless of the size they finish to. This will save you considerable trouble and delay.

Make some small trams, like Fig. 2, one for each size of box. Have the distance, $C D$, between the points just one-half the distance of $A B$, Fig. 1, plus ⅝ in. in each case. The reason for adding this ⅝ in. is explained further on.




Now, make another set of trams, Fig. 3, just like Fig. 2, except that they are just twice as long. I am putting the sizes I use on the sketches. These trams will be 1¼ in. (twice ⅝ in.) longer than the size of the box. All the above gauges and trams can be made of old spring leaves.

Make a long tram for spread of wheels, one for each class of engine, or difference in centers. This tram, Fig. 6, should have its points bent sideways, instead of down; this prevents sagging when handled.

Make four (for eight-wheeler) studs like Fig. 7 to screw between wedge and shoe, keeping them in position. Then make four angle brackets like Fig. 8. These are slipped on to the round part of stud, Fig. 7, and when the inside flange is against the side of the shoe the top is level and is used to support a long straight-edge.

A long straight-edge and a T-square, Fig. 4, is all you require now to line up wedges on any engine.

The T-square requires four sliding jaws such as shown in Fig. 5, with a set-screw to hold them in place.

Suppose you were going to line up the wedges on an eight-wheeled engine, with drivers spread 8 feet 6 inches, and having driving-boxes 12 inches wide between wedge surfaces, you would put up your pedestol braces, shoes and wedges, placing a ¼-inch block between the live wedge and pedestal brace. Put your studs, Fig. 7, between the shoe and wedge, with the brackets Fig. 8, on them; get the flange of this bracket flat up against the side of wedge and tighten up the right and left hand-screw. Lay your straight-edge on these brackets and see that it is up firmly against all shoes and wedges 1, 2, 3, 4, then lay your T-square or straight-edge with blade across frame, and between the shoe and wedge.

Take the short tram, marked "12-inch box" and with one point in $A$ mark point $B$, then with a 2-foot square draw line down dead wedge or shoe to $D$.

Point $A$ is almost invariably marked on the frame by the builders, and is, or should be, the center point between the face of the front and back jaws.

Now move your T-square up against shoes on both sides of engine, and adjust the four sliding jaws on the inside and outside of each shoe, and set-up screws now move square so that outside sliding-jaw comes to line on shoe, then scribe a line on the inside of the shoe, and also on the inside and outside of the shoe on opposite side.

Then with the 12-inch tram from a point at $C$, mark $D$ on the shoe and $E$ on the wedge, and with the same tram from $I$ mark $F$, and see that the tram fits from $D$ to $F$.

Now take your long tram, 8 ft. 6 in., and from the points $C$ $D$ $E$ and $F$ lay out the points $G$ $H$ $I$ and $J$ on the other box. Do the same on the other side of the engine Now your wedges are ready for the machine shop.

Furnish your planer hand with a small, solid gauge, Fig. 10, made of ¼-in. round steel, with the points ⅝-in. apart.

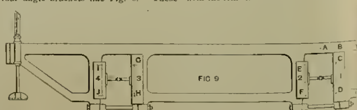
The planer hand uses this gauge to scribe a circle from each of the four points already marked on the shoes and wedges and the *edge* of this circle is the point to plane to.

Supply your gang foreman with a test gauge like Fig. 11, with a point just ⅝ in from inside of flat surface, and by laying this on the planed face of shoe or wedge it can be seen in an instant if the work has been done correctly.

Now the reason for lengthening all trams except wheel center tram, ⅝ of an inch is seen; it is to locate this measuring point far enough back on the flange of wedge that it will not be removed in rounding the corners and is where the work can always be tested.

When I find the boxes out of parallel with the frame I divide the difference.

By this plan of lining up wedges and boxes you keep your driving boxes the same size all the time; you line by the frame, and any unevenness of wear is taken off the face of shoes and wedges, keeping the box true in the jaws and the axle square with the frame.




The word "gas," which is now so familiar to people in every walk of life, was invented by Von Helmont, a Belgian chemist, about 1644, and applied to all volatile essences. It is supposed to have been taken from the German word "geist," ghost or spirit.

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There were 2,554 railroad men killed in the United States, last year, and 28,267 crippled. Don't men taking these chances deserve better pay than men in less hazardous trades? And do they get it?

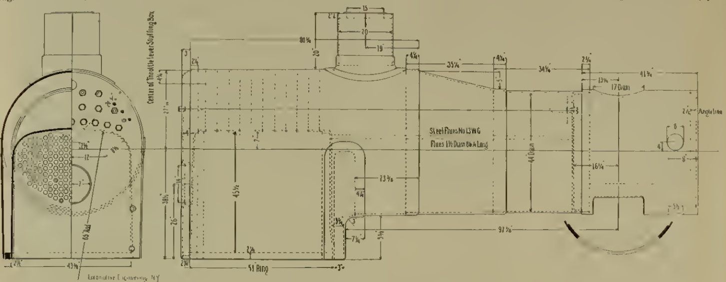
### Hedley's Locomotive Boiler.

The outline drawing reproduced on this page shows some innovations in locomotive boiler construction that seem to be in the line of improvement.

This boiler was designed by Mr. Edward Hedley, master mechanic of the Brooklyn Elevated road.

Mr. Hedley desired to use a wagon top boiler, radial stays, and to get the dome back close to the firebox.

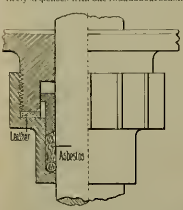
To accomplish this he had the back course of the shell sheets made 80¾ inches long, cut slots the length of the outside of




Hedley's Boiler, Brooklyn Elevated Railroad.

firebox, on each side, and then rolled up the sheet, the flat sides of the furnace were then straightened out, and the front end riveted up to form back part of boiler shell. This got rid of the riveted joint close up to firebox and gave room to put the dome on the back course and close to the firebox.

The throat-sheet was then formed and put up on the outside of the shell and water-leg. This makes a very neat job, is easier than the old form to repair, and entirely dispenses with one roundabout seam.




### A New Piston-Rod Packing for Driver-Brakes.

Men in charge of air-brake repairs have had more trouble than a little with piston-rod packing on pull-up driver-brakes. The leaking of packing at this point has caused accidents, prevented effective braking and introduced the push-down brake.

Packing becomes dry and hard under the pressure and heat, and the constant movement of the rod wears it out until it is useless for the purpose for which it is intended.

On the Vandalia road they have some seventy-five engines equipped with a packing designed by one of their foremen, Mr. Kelley, at the Terre Haute shop.

Mr. Kelley uses a loose gland inside the box, the top end of which is enlarged, and the outer gland, or box, screws up on to a shoulder, making an air-tight joint on a leather seat.

In this outer gland there are a couple of rings of fibrous packing, usually asbestos, but there is no pressure on this packing except when there is air in the cylinder; then the pressure on the enlarged end of the loose gland forces it down, setting out the loose packing and making a tight job; when the pressure is relieved the packing is loose, has no chance to harden or wear by movement of the rod.

The "Van" have had some of these packings in use now for over a year without being repacked and they are tight. They estimate the cost of the old style cup-leather packing for renewal was ten dollars per engine per year.

We would advise a test of this packing before the pull-up brake is condemned entirely, a little thing makes all the difference in the world sometimes.

### The Otis Elevating Railway, Catskill Mountains, N. Y.

The Otis elevating road is one of the latest things in use to take passengers to the hotel on top of a mountain.

It is a single track cable road, running cars up and down at the same time. This is accomplished by use of an automatic turnout half way up the mountain.

One of our pictures shows the entire road excepting a very short distance on the lower level. The road is 7,240 feet long, raising 1,800 feet in that distance. The Catskill Mountain House, shown to the left at top of this picture, is 2,250 feet above sea level.

Another view shows one of the passenger and freight and baggage cars approaching the summit. These cars are propelled by a double line of steel wire cable which passes around a drum in the power-house and reaches from one car to the other, one

car always being at the top when the other is at the foot of the mountain.

The power is supplied by two horizontal Corliss engines with reversible link motion. Each car is equipped with an arrangement attached to the bottom of the body, which, in case the cable breaks, is released and acts as a brake and stops the car by clutching the wooden guard rail shown in the roadway. In approaching the terminal points, should the engineer fail to stop the cars in the usual way, there is provided in the roadway between the rails a tongue or lever which is tripped by the car approaching the summit; this shuts the steam off from the engines and applies a Westinghouse automatic air-brake, located in the engine-room, and having the brake-shoes on the drum around which the cable turns, thus automatically stopping the cars at their proper places.

The track is composed of three rails except at the "turnout" or passing point, where there is a double track.

The "turnout" is formed by curving the right hand and middle rails to the right, and the left hand and an extra rail to the left. By this method the rails always remain in the same position and no switching apparatus is required. The total


length of the "turnout" is 400 feet, and it is, of course, situated at a point half way between the terminal points of the road.

Many accidents have been caused by the long push-bar used to span the pilot of a locomotive breaking when engines were pushing, and many leading railroads are projecting a bull-nose through the pilot far enough to couple with a car draw-bar. The Pennsylvania Railroad have followed this practice for a long time, and consider it much safer than the long push-bar. But it has one serious defect. If any animal is struck by the pilot with a bull-nose on it, the animal is likely to be pushed into the middle of the track, where it is in danger of throwing the train off the rails. This defect has been very neatly overcome by Mr. Pulaski Leeds, of the Louisville & Nashville, who hinges the bull-nose so that it can be turned up when the coupler is not in use. This invention is attracting much attention among railroad men at present, and is likely to be largely adopted. The Cincinnati Southern people are trying it, and intend putting a lip upon the under part of the bull-nose, which will act as a guard to catch a car or anything that is accidentally pushed up on the pilot.

At the Cincinnati, New Orleans & Texas shops, at Ludlow, Ky., they are changing a simple locomotive into a tandem compound. The engine will have many peculiar features, especially in the valve gear. A sort of double link is employed, with the curve reverse to the common type. In place of the slide-valve a gridiron-valve is used, giving very large port opening and having unusually short travel. We are afraid that the engine will suffer from the defect that interfered with a former well-known locomotive that had gridiron-valves. When the latter was under construction a locomotive engineer of large experience predicted to the designer that the valves would break every time the engine was reversed while in motion. "But they must not reverse the engine while in motion" exclaimed the patentee, and he gave orders that care should be taken to see that the engine was stopped before the reverse lever was pulled over. It is needless to say that the injunction was not very strictly obeyed, and that broken valves was a common breakdown.

The Lake Shore & Michigan Southern people have contracted for about one hundred furniture cars to be delivered next summer. It is the practice of this company to contract for the building of cars long enough in advance to have the lumber piled for six months before work on the cars begins. They consider from past

experience that the practice pays, for there is very little shrinkage to the wood after the cars go into service. We lately examined some cars belonging to this company that had been in use for nearly three years, and no appearance of shrinkage was to be found in the parts that generally give most annoyance from this cause

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## Utility and Beauty of the American Locomotives at the Fair.

A conspicuous feature about the American locomotives exhibited at the World's Fair was the severe plainness of mechanism and the entire absence of attempts to form attractions by means of useless ornamentation. Plain iron and steel well-fitted and finished up in a workmanshiplike manner were the lines on which exhibitors endeavored to claim commendation. In this respect the American exhibits were in strong contrast to many of those that came from foreign countries. In these useless ornaments and elaborate finish of parts that were none the better of being polished indicated extra cost not justified by utility. In another respect the foreign locomotives did not compare favorably with those produced in our workshops. There was frequently displayed a tendency to use indirect methods of complex mechanism to perform a desired operation. American locomotive machinery, on the contrary, was noted for directness and simplicity. This was particularly noticeable in valve-motion mechanism. It is almost a principle with American locomotive designers to have as few joints or pins as possible between the actuating point of the motion and the valve, the foreign designers act as if increase of wearing parts were no detriment to a machine.

In another respect the foreign locomotives were far behind those of American manufacture. This was in the arranging of the appliances for operating the engine so that they are convenient to the engineman. This has originated to a great extent from the development of the American locomotive having been worked out or controlled by men who have themselves passed years on the footboard. This experience convinced them of the necessity for having everything handled by the engineer and fireman within easy reach and convenient to operate. It is only knowledge born of experience that gives a man a proper estimate of the importance there is in arranging the equipment of the cab so that the engineer can do his work without withdrawing his attention from the track in front. Experience on the locomotive is also necessary to convince designers that an engineer comfortably housed is likely to give his business closer and more individual attention than one exposed to discomforts of the weather or to the wearing action of a rough-riding engine. The men in foreign countries who exercised the greatest influence in establishing the existing form and attachments of locomotives were either civil engineers, shop mechanics or office draughtsmen. Many of them were accomplished steam engineers, and aimed to make a locomotive that would perform the greatest possible amount of work per unit of fuel consumed; others were well informed regarding strength and fatigue of material, and devoted their attention to the combining of strength and lightness in the machinery. But none of them had the training that gave a good estimate of the danger likely to result from having an injector difficult to start, an air-brake valve-handle in an awkward position, or a feed water-cock out of reach. Nor was it generally realized among these people that an engineman shivering with cold or exposed to saturating rain is likely to devote attention at times to escaping personal discomfort instead of watching for signals. The foreign locomotives exhibited all bore traces of the opinion that the convenience or comfort of enginemen was not worthy of consideration. The American engines manifested a spirit of rivalry to make everything as convenient as possible for the engineman, and to promote his comfort in every way consistent with the form of the locomotive.

Ten years ago, when the Exposition of Railway Appliances was held in Chicago, foreign critics had a good deal to say about the inartistic forms of domes, sand-boxes and other prominent parts of the American locomotives. This criticism was perfectly fair, for a fashion had become prevalent of using exceedingly unharmonious proportions of moldings and bases. In the ten years that have elapsed since that exhibition was held, great improvement has taken place in outward designs, and the American locomotives exhibited at the World's Fair had very little in outward forms that was unpleasing to the most fastidious taste. In this respect they were superior to all rivals except the Webb locomotive. It was curious to compare the outward appearance of the American and of the French locomotives. The French people are credited with being the most artistic of the nations that exhibited locomotives at the World's Fair, and it might be presumed that the national training would be manifested in machine designs. Americans, on the other hand, are supposed to be little influenced by anything that comes of art training. Yet the French locomotives are noted for their ugliness, in this respect excelling everything that runs on wheels. Ingenuity appears to be exhausted by French engineers to make the outward attachments of harsh looking forms and to convey extraneous pipes and rods in a shape to break up all the harmony of their surroundings.

From all points of view, American locomotive builders have good reason to be gratified with the display they made at the Fair. For simplicity of form, for adaptability to the work to be done, and for beauty of proportions, they were not surpassed by anything displayed against them.

## Angle-Cocks are Often Turned Without the Tramp.

Of late there has been considerable talk in this paper and among road and air-brake men about the turning of angle-cocks in the train-pipe by tramps or other irresponsible persons. That these cocks are turned once in a while, and disastrous wrecks caused thereby, we have no doubt, but that the turning is always done by the tramps, with malice aforethought, we don't believe. On the older passenger equipment the straight-way cock is employed, and this cock has a long handle. In much of the equipment this handle was pointed *down* and at right angles to the train-pipe when open—this is the most dangerous kind of train-pipe cock. A stone or piece of coal falling from a fast moving train, or a piece of ballast struck by any part of the running gear is liable to strike and close this cock—it has been done.

The angle-cock with the curved handle, lying on top of the cock is much better, but there is great danger of its being closed "automatically" when there is not a tramp within a thousand miles. They are closed by careless car building—almost criminal carelessness.

Unless the end of the train-pipe is securely fastened to the car, the jerking of hose pulling apart, and the regular jar and movement of the service will soon have the pipe carrying the hose in a condition to "rattle," and being springy, it moves all it can. Just as soon as it gets movement enough to strike the bottom of the car, it does so, and the top of the angle-cock, being the highest part, acts as the hammer head. This movement may be only a quarter of an inch or an eighth of an inch, but it is enough to do the business. When the top of the plug or the handle is struck, the taper plug is forced down a little, loosened in its seat, and the coil spring under it acts as a sort of a screw, to turn it ever so slightly at a time until the valve is at last closed.

Then it becomes necessary to stop; the engineer applies his brake, it don't work, a bad wreck takes place and the division superintendent sits on the case as judge, jury, executioner and coroner. If the engineer was killed, it was his fault—asleep at his post, perhaps. If he lives, and has witnesses that he was doing his duty, his whole duty and nothing but his duty, why, it was a case where the "air-brake failed to work." The real cause of the wreck was the saving of 15 cents per car by using a bad pipe fastener rather than a good one.

Some cases of cock closing were recently hunted up on the U. P., and the cause found as here stated.

We recently saw some new cars—part of an order for some hundreds—well designed, heavy cars with air-brakes and automatic couplers, but the train-pipe was held up under the end sills by a strip of $1\frac{1}{4} \times \frac{1}{8}$-inch iron with a hook on one end and a hole through the other, through this hole a $\frac{1}{2}$-inch lag screw went up into the wood—you could bend this clip and move the pipe with your hands, and the angle-cock was just in the right place to get tapped on the head when the pipe got a little "flop" to it. This is the usual fastening for train-pipe in the average contract shop, and it is entirely inadequate, and should be looked after by inspectors. The end fastenings of train-line pipe should be a clip that will prevent the pipe from moving, and grip it so tight that it cannot be pulled lengthwise of the car—this is what breaks off branch pipes.

On these little details depends the sure and safe action of the air-brake, a device that has doubled our train speeds, increased traffic, and saved more property and more lives than all the other railroad inventions besides. Look after these details.

Don't think because you have bought the best brake in the world that you have done all—the finest watch is useless if one turn of the hair-spring crosses another.

## The Appalling Death-Roll.

The Interstate Commerce Commission have just issued a volume of railroad statistics for the year ending June 30, 1892, from which we take the following statement about accidents to trainmen and passengers. The latter, it seems, are comparatively safe, but the list of dead and maimed in the ranks is something awful. If cholera had reached our shores this year with no more deaths than this, it would have paralyzed the nation and called for the expenditure by the Government of stupendous sums of money, and the employment of all the skill and force of the entire people to stop its course. What has been done, that could easily be done, to save the lives and limbs of these men who earn their bread in the train service of our roads? There are 821,415 employés of railroads in this country, one to every 79 inhabitants, and that 378 of these men should have been killed and 10,319 maimed, in coupling cars alone, in a single year, is nothing if not a national disgrace. Yet, when anyone wants the law requiring the adoption of automatic couplers rigidly enforced, the cry is set up that no road could stand the expense. Ten times the cost of this equipment would not pay for the lives and limbs of these yearly victims of the national plague.

"The number of railway employés killed during the year covered by the report was 2,554, being less than the number killed during the previous year. The number of employés injured, however, was in excess of the number injured during the previous year, being 28,267. The number of passengers killed was largely in excess of the number killed during the previous year, being 376 in 1892 as against 293 in 1891; while the number of passengers injured was 3,227 in 1892, as against 2,972 in 1891. An assignment of casualties to the opportunity offered for accidents shows 1 employé to have been killed for every 322 employés, and 1 employé to have been injured for each 29 men in the employ of the railways. A similar comparison shows 1 passenger killed for each 1,491,910 passengers carried or for each 35,542,282 passenger miles, and 1 passenger injured for each 173,833 passengers carried, or each 4,140,966 passenger miles. The largest number of casualties to employés resulted from coupling and uncoupling cars, 378 employés having been killed and 10,319 injured while rendering this service. Of the total number killed in coupling and uncoupling cars 253, and of the total number injured 7,766 were trainmen. The accidents classed as 'falling from cars' were, in this year as in previous years, responsible for the largest number of deaths among employés, the number killed in this manner being 611. Of this number 485 were trainmen. Collisions and derailments were responsible for the death of 431 employés. Of this number 336 were trainmen. This class of accidents is responsible also for the largest number of casualties to passengers. Thus 177 passengers were killed and 1,539 were injured by collisions and derailments during the year. Collisions alone were responsible for the death of 286 employés and 136 passengers."

## Screw-Jacks for Locomotives.

While traveling in one of the Middle States lately our train stopped between stations. Finding that no move was made after waiting twenty minutes, the writer went out to reconnoiter. He found four trains on the main line obstructed by something in front. On walking forward we found the cause of the obstruction to be a heavy mogul engine that had run over the end of a switch and sunk down in the mud at the end of the ties, in a position where she could not help herself without being jacked up. After waiting nearly three hours a wrecking train came along, and the derailed mogul was quickly put back on the steel with no apparent damage. They jacked up one side, put blocking beneath the wheels and the engine backed on herself. It was a simple operation, and the question naturally arose, why did the engineer in charge of the mogul not do that without waiting for the wrecking outfit? The answer is simple and conclusive, he did not have screw-jacks powerful enough to lift the engine. The jacks supplied to the engine were of the kind designed for lifting the class of locomotives in use twenty years ago—the kind that are still to be found on the most powerful engines of the present day. A screw-jack is a perfectly useless tool if it is not equal to the requirements, and there is good reason for believing that the greater part of this article to be found rusting in the boxes of locomotives are worthless for lifting the heavy weights they have now to deal with.

The efficiency of screw-jacks or of the other tool equipment of locomotives may seem a small matter, but the results that come from their inefficiency are sometimes very serious and expensive. In the case referred to, the whole train service of a railroad was obstructed for hours because a few dollars were saved on what would have been required for efficient jacks. The weight to be raised ought to be considered when screw-jacks are purchased for locomotives, just the same as other parts are proportioned to the work to be done. It would pay most railroad companies to equip their engines or trains with hydraulic jacks or the improved forms of screw-jacks now in use. A protracted delay due to the want of an efficient jack is likely to cost enough to equip a railroad with improved forms, and it is not good management to persist in clinging to obsolete articles of this important character.

### Automatic Signals Demanded for Train Protection.

There have been more serious accidents to railroad passenger trains during the last four months than there has ever been before in the same length of time. The accidents have been due largely to the congested condition of the passenger business carrying people to and from the World's Fair; but the number of trains on some of the roads where disastrous accidents happened has not been greater than it would have been in fairly prosperous times, when a full volume of freight was being moved. The prostration of the freight business for the last four months has put the railroads in unusually good condition to transport passengers safely, yet a heart-rending degree of death and suffering has overtaken travelers who trusted the railroads to convey them safely to Chicago and back. Most of the accidents have resulted from the want of proper and necessary appliances that have been invented to secure the safe movement of trains. The appliances most neglected on our lines are those that form a good system of signals.

The railroad system on this continent has developed slowly. The roads that are now most prosperous have grown up from the small beginnings which found trains running hours apart. While a road remained in this condition it was safe enough to depend on the care and vigilance of trainmen to prevent collisions, and the reliance upon these men was well founded, for no class of men have ever displayed equal success in avoiding accidents under difficult conditions. As traffic increased and rolling stock augmented in weight, the crude appliances for controlling trains had to be improved, and twenty-five years ago the air-brake forced its way with magic rapidity into use on passenger trains. This wonderful invention jumped into popularity because a point in train operating had been reached where the old appliances were unequal to the requirements. The necessity of the case brought the invention that met the needs. In the quarter of a century that has elapsed since the air-brake began to receive general application, conditions have been changing, and a point is again reached where another long-spanning step in the interest of safety must be taken. Fixed automatic signals that will keep trains a safe distance apart must be adopted by all railroads moving a certain volume of business.

Railroad companies in America have been extremely slow in recognizing the necessity for fixed signals to protect trains. The fact of their having exceptionally intelligent trainmen has delayed the conversion of railroad managers to the belief in signals. While they could reasonably hold men responsible for the safety of their trains without any mechanical aids, they have been ready to declare their reliance on good intelligent men in preference to mechanism that might break. This, in fact, has been a line of argument used as an excuse for failing to adopt all needed improvements.

Railroad history does not tell when the first fixed signal was first applied on this continent. It was doubtless used to warn trains not to attempt to pass over a draw-bridge when the bridge was swung. This was the first purpose for which fixed signals were considered a real necessity among American railroad managers, and we have no doubt that many of the same managers were convinced of this necessity very much against their will. At all events, the mechanical ability employed to design the signals introduced was of an extremely low order, for nothing could exceed the crudity of the devices brought into use. The frequent accidents that happened at grade crossings led to the protecting of these crossings by fixed signals in some districts, even before the State Legislatures began passing laws making it compulsory that trains stop before going over a grade crossing. The crude signals first brought into use as a protection at crossings led to numerous accidents, and they did much to break the confidence of railroad men and legislators in signals as a means of preventing accidents at such places. Had a good system of interlocking signals been first adopted for the protection of grade crossings and drawbridges, it is very unlikely that legislation calling for what are called know-nothing stops at crossings would have come into existence. Instead of this, legislation would have been directed to compelling the use of interlocking signals.

The next chapter in the introduction of signals was where trains began following each other so closely that there sometimes was not time for the flagman to go back and warn the other train in case of unexpected delay. The remedy adopted for this dangerous condition of affairs was to put up at each station a board intimating the time that each train passed. The engineer of the next train could by this means find out how many minutes ahead of him the other train was. This system was some help, but it gave no indication if something happened round the next curve which caused the train to stop. While he was pushing along under the assurance that the train was miles ahead of him, he was suddenly confronted with a red signal just as the back end of the train came in view and a smash-up was the consequence. This happened in hundreds of cases, and is going on daily where no provisions are made to keep trains a given distance instead of a given time apart.

The flagman who fails to go back in time has come in for his full measure of abuse, but the careless flagman is not so much to blame as the dangerous and unreliable system which makes him responsible for duties that are frequently hard to perform. We have known cases where it was certain death for any human being to stand out in the open track for hours without shelter, and yet there was a probability of a train coming along pulled by a locomotive that had strong snow brushes in front of the leading wheels. It was useless to put torpedoes on the rail. The brushes would sweep them off as they would sweep the snow they were used for, and a lamp set on a snowbank was likely to give no warning to an engineer looking through snow-covered glass.

The time signal has been tried under a great variety of forms, but it is thoroughly unreliable for a heavy traffic. Its utility is doubtful under any circumstances, for it tends to give confidence without indicating danger. There has been nothing said for time signals that was considered worthy of consideration except that they were cheap at first cost. Like nearly all other devices advocated on the score of cheapness they were in the end the dearest that could be used.

When time signals were demonstrated in many a bloody wreck to be unreliable, the absolute block system of signals came into use on the most progressive roads. An absolute block system of signals is operated by dividing a railroad into sections, protecting these by signals and arranging that the signals shall not be cleared to admit a train upon a section until the preceding train has passed off. There are several systems of block signaling, and some of them have been wonderfully developed. The Hall automatic block signal system, which so many railroad men have had the opportunity of watching in Chicago this season, performs the work automatically without attention from any person. All the trains on the lines of the Illinois Central Railroad in the neighborhood of Chicago, have been operated by this system, and the safe handling of the immense traffic gives the highest testimony as to its efficiency.

Space will not permit us to enter into the details of the system, but readers of Locomotive Engineering will be able to read a description of this and of the other leading signal systems in the near future written by an expert signal engineer. The New York Central, the Pennsylvania and other leading roads have their main lines operated under various forms of block signals, and their use reduces the possibilities of accident to the lowest limit. While human nature is fallible and while the strongest metals will break unexpectedly there will be railroad accidents; but the adoption of the most approved appliances is the duty of railroad managers, in order that the possibilities of securing safety may be exhausted. The air-brake is almost perfection, and little more can be expected from appliances to stop the train quickly. The next move waiting urgently for general adoption is the providing of signals that will intimate the necessity for stopping.

In replying to criticism of your communication, don't sneer, don't lament the intellectual density of the man who can't or don't grasp your idea—it only takes the editor's time and wastes ink scratching it out. Stick to the subject, talk mechanics, be fair, and don't be personal. Then the editor will put a postscript in your behalf to his daily petitions.

### BOOK REVIEW.

Compound Locomotives. By Arthur T. Woods, M. M. E. Revised and Enlarged by David L. Barnes. Published by *The Railway Age and Northwestern Railroader*, Chicago. Price, $3.00.

This is the latest and best book on compound locomotives, and we wish to say right here that no one can afford to buy copies of the first edition now, as they are already out of date and very incomplete.

When Professor Woods died, he had a revision of his book well under way and his widow undertook to finish it. The editing of the notes and memoranda was undertaken by Mr. Barnes, who was a close friend of the author. The work has been all rewritten, many new engravings introduced, and all the devices used on compound locomotives anywhere are illustrated and described. There is also a chapter on the selection of a type of engine for a given service, and one on reasons for economy that are entirely new. It is the only complete work on the compound locomotive up to date.

*Aeronautics* is the name of a new monthly journal published at 47 Cedar street, New York, by Mr. M. N. Forney. The paper has been started for the purpose of publishing the papers read at the International Conference on Aerial Navigation, held at Chicago last summer. The interest in aeronautics has grown so much lately that it was considered likely that a sufficient number of readers could be found to make a journal devoted to the subject a success, and Mr. Forney is trying the experiment. The papers on aerial navigation will run through twelve monthly numbers. If it is then found that the journal is receiving satisfactory support, it will be continued, if not, it will be stopped. The paper is got out in very good shape, and contains interesting matter of its kind. Every person interested in aeronautics should send for the paper. The price is $1.50 a year.

### PERSONAL.

Mr. H. A. Kennedy has been promoted from assistant superintendent to be General superintendent of the Cleveland, Canton & Southern.

Mr. W. H. Whalen has been made general foreman of the Wisconsin division of the C. & N. W., at Chicago, *vice* P. R. Jones, promoted.

Mr. H. Weston has been appointed general foreman of the car department of the Buffalo, Rochester & Pittsburg, with headquarters at Rochester, N. Y.

Mr. O. O. Winter has been appointed superintendent of the Breckenridge division of the Great Northern, with headquarters at Minneapolis, Minn.

Mr. F. L. Tompkins has been promoted from master of transportation to be superintendent of the Jacksonville Southeastern, with headquarters at Jacksonville, Ill.

Mr. Edward Eldon, master mechanic of the Toledo division of the Lake Shore, has been appointed master mechanic of the Buffalo division, with headquarters at Buffalo.

Mr. P. Ryan has been appointed superintendent of the Kalispell division of the Great Northern, with headquarters at Kalispell, Mont., in place of Mr. P. J. Welles, resigned.

Mr. T. B. Irwin, general foreman of the Central of Georgia, at Chattanooga, Tenn., has been appointed master mechanic of that road at Savannah, Ga., in place of Mr. J. J. Anderson.

Mr. John H. Bell has been appointed superintendent of the Reynoldsville & Falls Creek, with headquarters at Reynoldsville, Pa., in place of Mr. George Mellinger, resigned.

Mr. W. L. Blair has been promoted from chief clerk of the general superintendent's office to be superintendent of the Eastern division of the Nickel Plate, with headquarters at Cleveland, O.

Master Mechanic T. P. Jacob, of the Mexican National, at Acambaro, has been putting in a month at the Fair, leaving the grief and pass-book in the hands of Traveling Engineer I. M. Hutchinson.

Mr. E. W. Baker has been appointed purchasing agent of the Mexican Central, with headquarters in the Mason building, Boston, in place of Mr. Theodore Nickerson, general purchasing agent, resigned.

Mr. A. W. Johnston has been appointed general superintendent of the Nickel Plate, with headquarters at Cleveland, O. He has been for the last four years superintendent of the Eastern division of the same road.

Mr. Harry Flanders, late superintendent of the Central division of the St. Louis, Iron Mountain & Southern, has accepted the position of division superintendent of the Mexican Central, with headquarters in the City of Mexico.

In his speech on Railroad Day, at the World's Fair, Mr. M. E. Ingalls, president of the Big Four and the C. & O. roads, stated his belief that a system of profit-sharing was the true solution of the labor troubles on railroads.

Mr. C. M. Lawler has been appointed general superintendent of the Philadelphia, Reading & New England, with headquarters at Hartford, Conn. He was formerly superintendent of the Atlantic division of the Philadelphia & Reading.

Mr. Fred. Wells, foreman of the West Shore shops at Frankfort, N. Y., resigned last month to accept a more responsible position with the Fitchburg. Mr. Wells is one of the progressive shop men of the times and thoroughly understands repair shop management.

Mr. Gustav Jacobson has been appointed master mechanic of the Montpelier & Wells River road, with headquarters at Montpelier, Vt.

Spon & Chamberlain, of this city, have issued a little 50-cent book entitled "Cromwell's Easy Lettering," a very handy little guide for draughtsmen and others who wish to neatly letter drawings.

Geo. W. O'Brien, master mechanic of the C. R. R. of Georgia, at Augusta, Ga., died in that city on October 9th. He was formerly with the R. & D., and was well known among railroad men in the South.

Mr. P. R. Jones, general foreman of the Wisconsin division of the C. & N. W. Railway, at West Fortieth street, Chicago, has been promoted to the general foremanship of the Iowa division, with headquarters at Boone, Ia., in place of Mr. S. Mantashed, resigned.

Mr. Wm. Gibson, division superintendent of the Cincinnati division of the Big Four, has had his jurisdiction extended over the Sandusky division. Mr. Gibson has been exceedingly fortunate in his management of the Cincinnati division, and on this account had his territory extended.

Mr. C. E. Walker has been appointed master mechanic of the Toledo, St. Louis & Kansas City. Mr. Walker has been for several years division master mechanic of the Cincinnati, Hamilton & Dayton. Before that he was on the Cincinnati Southern, having risen through the grades of roundhouse foreman and general foreman.

Mr. R. W. Bryan, superintendent of the Breckenridge division of the Great Northern, has been appointed assistant superintendent of the entire Eastern division of the Great Northern system, with headquarters at Minneapolis, Minn. He will have charge of the maintenance of roadway and structures, stations and transportation.

Mr. James Bradeen has been appointed master mechanic of the Toledo division of the Lake Shore & Michigan Southern, with headquarters at Norwalk, O., in place of Mr. Edward Elden, transferred. He was formerly foreman at the Air Line junction and Toledo engine-house, in which position he is succeeded by Mr. James H. Calkins.

Mr. A. Bardsley has been appointed master mechanic of the Buffalo & Pittsburg divisions of the Buffalo, Rochester & Pittsburg, with headquarters at Bradford, Pa. He was for several years division master mechanic of the Northern Pacific, and was noted for the ingenious contrivances that he invented to facilitate shop work.

Mr. Alex. Gordon, president of the Niles Tool Works, at Hamilton, O., has returned home from a long sojourn in Europe. Mr. Gordon was for years a martyr to a peculiarly painful form of dyspepsia, and he went to Europe to try the effects of German mineral waters. His numerous railroad friends will be pleased to learn that Mr. Gordon is entirely cured, and that he looks stout and healthy.

Mr. F. P. Boatman has been appointed master mechanic of the Omaha & St. Louis, with headquarters at Stanberry, Mo. Mr. Boatman was long master mechanic of the Ohio & Mississippi, and left there to take charge of the machinery of the Cleveland, Cincinnati, Chicago & St. Louis. Dr. Barnard, who was formerly general manager of the Ohio & Mississippi, is now receiver of the Omaha & St. Louis; so Mr. Boatman goes among old friends.

Mr. John Robinson, master mechanic of the Lake Shore & Michigan Southern, at Buffalo, N. Y., is dead. Mr. Robinson was well known to railroad men of Western New York, having been a regular attendant at mechanical meetings. He was born in England, and was for some time in the employ of the London & Southwestern. He has been with the Michigan Southern since 1868, and was considered a very able mechanic. He was a member of the Master Mechanics' Association.

Mr. Willard Kells, son of the late Ross Kells, has been appointed general foreman of the Erie shops at Meadville, Pa. Mr. Kells has received an excellent mechanical training, which includes shop drawing, office, and technical school experience. From the active, energetic, and systematic way that he starts out, there is every prospect that he will make a decided success. He is one of the young men with influential friends who relies upon his own ability and industry to push him up the ladder of life.

Mr. W. D. Holland, master mechanic of the Guatemala Northern Railroad, has just recovered from an attack of yellow fever. Mr. Holland has charge of the locomotive and car departments. He likes looking after the repairing of locomotives and cars very well, but there is one line of work which the car department has to perform which he dislikes. Carpenters are not very numerous in the country, and when the necessity arises the car department is called upon to make coffins for the whole community. This line of work is distasteful to railroad men.

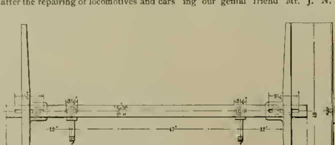


*Fig. 2*

Mr. J. B. Barnes, the well-known superintendent of motive power of the Wabash, has not been able to visit the World's Fair, because he was confined to his bed, nursing a broken leg at the time he had settled upon for his visit to the Jackson Park display. Mr. Barnes sometimes jeopardizes his life by riding behind live horses, and this led to the injury which prevented his seeing the Fair. We all sympathize with Mr. Barnes, but at the same time we cannot lose the opportunity this accident gives to impress upon our readers that it is the course of wisdom for railroad men to confine their admiration to the docile iron steed, which seldom runs away.

Mr. J. E. Phelan, well known to our readers as the author of "Air-Brake Practice," and who went, some three years ago, from the mechanical department of the Northern Pacific into the transportation, becoming superintendent of the Missouri division of that road, is going back to his first love, and on November 1 will become master mechanic of the Dakota division, with headquarters at Fargo, N. D., succeeding Mr. S. L. Bean, who has been promoted. We said at the time that we regretted to see "Jim" leave the mechanical department. He has spent his life as fireman, engineer, traveling engineer and master mechanic, and in this field he can be most useful to the railroads and to himself.

Mr. W. D. Ewing, who has been for the last two years assistant general superintendent of the Fitchburg Railroad, has been made general superintendent, in place of Mr. John Adams resigned. Mr. Ewing is a remarkably good executive railroad officer, and has made his mark on the Fitchburg during the short time he has been with the road. He rose from the lowest step of the railroad ladder, and has had experience in banking and newspaper work. While strict in seeing that duties are punctually and faithfully performed, he is kind to subordinates, and takes a keen interest in their welfare. He is a man capable of filling with credit a much higher position than he has yet reached, and we are mistaken if Mr. Ewing does not some day rank as one of the first railroad men in the country.

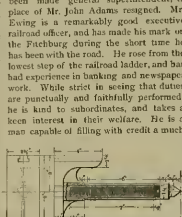


*Fig. 1*

We were recently alarmed on meeting our genial friend Mr. J. N. Barr, superintendent of motive power of the Chicago, Milwaukee & St. Paul, to find a striking change in his personal appearance. Those who witnessed Mr. Barr disporting in the sea at Cape May, will remember that he carried a heavy wad of adipose tissue on his front end. In fact, he was building up an extension front of the most pronounced type. What caused our alarm and astonishment on meeting Mr. Barr the other day was that the extension had disappeared. From neck to knee he was straight as a plumb line. The change has been induced by a peculiar form of exercise, which Mr. Barr is willing to recommend to all men who are suffering from the accumulation of superfluous fat. He is greatly improved in health since the change was effected.

Among the men whom one meets annually at the railroad mechanical conventions, none is more popular or better known than Mr. C. P. Krauth, treasurer of the Mc-Conway & Torley Co., of Pittsburg. Mr. Krauth is decidedly stout, and carries a coating of fat thick enough to keep his heart warm. Fat men are not generally noiseless sleepers, and the likelihood is that Mr. Krauth is no exception in this respect. At least he got an accusation of disturbing the silence of the night brought against him lately in a curious fashion. His home had been crowded with visitors, and his little daughter aged five years was sleeping with her papa. Towards morning Brother Krauth was awakened by two little hands persistently pulling at his ears. When he got fully awake he asked, "What is it, my little daughter?" The child answered, "Oh, papa, I want oo to stop making 'at noise wi oor nose."

## Double T-Square and Straight Edge for Squaring Locomotive Frames.

At the Waukesha shops of the Wisconsin Central road they use a special tool for squaring up shoes, wedges and frames, which we illustrate herewith.

The tool is a combined double T-square and straight edge but is designed and constructed especially for the purpose of squaring locomotive frames. Provided with means of adjustment to meet the requirements of all sizes of ordinary locomotives, with firm and reliable supports while applied to the work, T-heads perfectly parallel with each other and square with the straight edge body, its use insures an accuracy not solely dependent upon the judgment of the workman, and which cannot be obtained under the ordinary practice of using separate squares applied to a straight edge, generally supported upon wooden blocks wedged between the shoe and wedge faces of engine frames.

The general dimensions of the tool are given in the illustrations, and in detail its construction is as follows:

In Fig. 1, $A$ is a cast-iron bracket provided with a T-slot in its upper face to receive the head of a hand-bolt, by which the straight-edge is secured to the bracket. Into a boss projecting from the inner side of $A$ is pressed a tubular steel piece provided with an internal thread for about two inches at its outer end, and counterbored to full size of thread for the remainder of its length. Into this is screwed the center $B$, the thread of the latter being protected by a sleeve $C$, affixed to $B$ and passing over the nut-piece projecting from $A$. The sleeve is knurled its entire length and furnishes a hand grip by which $B$ can be unscrewed and extended sufficiently to secure $A$ between the shoe and wedge faces of the engine frame.

The straight-edge or body of square $B$, Fig. 2, and also the blades $cc$ of the T-heads are steel. $B$ is secured to brackets $AA$ by the hand-bolts $DD$, which pass through holes slotted lengthwise in $B$, to provide for a lateral adjustment of the same. The blades $cc$ are riveted to the center-pieces $GG$, which are secured at any location upon the outer ends of $B$ by means of the hand-screws $HH$, which pass through longitudinal slots in $B$, and engage in nuts affixed to $GG$. Both edges of $B$ are beveled for a distance of 16 inches from each end, the head-pieces $GG$ having corresponding recessed bevel, all constructed in such a manner that when heads $GG$ are secured by $HH$ they will draw up on the beveled edges of $B$, and preserve and maintain the accuracy of the T-head in any position of lateral adjustment.

The operation of applying the square to engine frames is as follows:

Having set and trued the cylinder lines, the brackets $AA$ are secured firmly against the shoe faces by screwing out centers $BB$ against the wedge faces. (The brackets and centers are so proportioned that they can be used either with or without the shoes or wedges in position.) The straight-edge is then placed upon the brackets and secured by the hand-bolts, after which the T-heads are placed on their respective ends of the straight-edge and set to the cylinder lines. The T-slots in tops of brackets admit of a side movement of straight-edge in order to bring either T-head parallel with one cylinder line, when, if the cylinder lines are parallel, the opposite head will coincide with the line on that side, or if any error exists it will be at once observed. Working lines on the frames are laid out from the straight-edge.

The tool is simple and inexpensive, and is an indispensable adjunct to any well-equipped locomotive shop. Its use detects and eliminates errors which cannot fail to exist when the common method is followed in the class of work to which the tool is applied.

"Sthand at head, Moike!" yelled the new fireman, from the top of the teoder, "She's aigen away from the watherin' spout."

## A Strange Boiler Explosion.

On the 27th of July last the boiler of Engine No. 4, on the C. C. division of the Seaboard Air Line, exploded, and the effects of that explosion seem to us to have been rather peculiar and very interesting.

This engine was a Baldwin eight-wheeler, but six years old, and the explosion was doubtless caused by seaming and pitting of one of the barrel sheets.

The engineer of the train, Mr. J. S. Bundy, the fireman, and a car-tracer, named Lewis, were on the engine at the time.

Speaking of the accident, the engineer said

"I had the '4' on Train 5 on the 27th of July, between Lawrenceburg and Charlotte, N. C. On nearing Nelson branch trestle, about four miles from Monroe, I shut off the throttle and we were rolling along about ten miles per hour, being dead on time, which was slow. When nearly across the trestle, I linked up the lever, and had or was just commencing to open the throttle when the boiler exploded.

"The barrel-sheet just ahead of the wagon-top blew entirely off, carrying away the sandbox and stripping a great deal of her machinery, derailing engine, tender and two box-cars, and also breaking two stringers in the bridge.

"The boiler was full of water, and the steam pressure was about 127 pounds when she let go. None of us were seriously hurt, although I was considerably shocked and bruised.

"None of us heard the report!

"The first hint I had that anything was wrong was the ringing of the bell, caused by engine riding the ties.

"I found myself turned around, with my head lying in the front window, and protected from the scolding water and flying pieces of wreck by the jacket, that had folded back over the cab.

"By the time I came to my senses I missed the fireman and Mr. Lewis, but they came to my rescue at once. I suppose the whole thing happened in less than a minute."

A Strange Boiler Explosion.—After Wreck Was Picked Up.

A Strange Boiler Explosion.—Ready to be Towed Home.

On looking at the engraving made from a photograph, taken at Monroe the next day, it will be seen that one entire sheet is gone from the boiler, and that there is evidence of a tremendous force exerted in all directions from the center of the cylindrical part of the boiler. The flues are bent out in every way from the center, the dry pipe is bent up and the heavy frames bent down, as were also the guides, pistons, etc.

It is believed that had this explosion taken place on *terra firma* instead of on an open trestle, that the engine would have turned over, and in all probability killed her crew; the theory being that the force of the escoping steam had a chance to get away and had no chance to lift the engine, as there was, so to speak, no place for it to lift from.

The force of the explosion must have been enormous to bend all the heavy parts it did.

As far as could be seen there was a deep seam along the horizontal seam in the sheet that gave out, and it is supposed that it was here the rupture started. The metal was not torn at the roundabout seams, either on the ruptured sheet or those to which it was attached, but the rivets tore out or the heads pulled off.

The strangest thing about the wreck is the statement of all three men that they heard no explosion, and none of them could have any incentive to tell anything else than the truth. We would like to have some scientific man come to the front and explain this phenomenon. Certainly the explosion made a report—why did not these men hear it?

## A Burning Question.

BY L. R. ANDREWS.

Less attention has probably been paid to the improvement of grates than to any other department of locomotive practice.

The result is that the various patterns and styles of grate-bars in use are almost without exception faulty in principle, construction and operation, and that they are in many cases extremely wasteful of fuel is evident to every observant superintendent of motive power, master mechanic and engineman.

The usual method of cleaning a fire with slice-bars, pokers, and clinker-hooks, necessitates keeping the furnace doors open a long time at each cleaning, reducing the steam pressure during this interval, with a corresponding lowering of boiler temperature, and consequent strain on plates, in addition to which is the injury to tube-sheets and grate-bars by the severe pounding of the tools necessary to dislodge the dirt.

In addition to the bad effects of the cold air rushing between the bare grates, and through the open furnace door during this process, on the tubes and tube-sheets, they are subjected to further severe strain by the harsh use of the blower necessary to restore the pressure quickly, which in turn clogs the tubes, spoils the fire, and causes the direct loss of a large amount of water and steam, besides being wasteful of fuel.

Where rocking-grates are used, of either the finger or perforated plate pattern, much good fire is lost when grates are shaken, as the tendency is naturally for the fire to drop through with the ashes and dirt, and as there is nothing to prevent this taking place, the result is a large loss of fuel only partially burned; especially is this so, if, as is often the case, a clinker or other substance lodges between the grates when same are tilted at an angle, thus preventing their returning to their normal position and causing them to be burnt out.

Water bar-grates fitted with drop-bars, or bars which are drawn out when fire is to be cleaned, are open to the same objection, a large and entirely unnecessary loss of good fire.

The levers attached to the arms of the various rocking grates extend through into the ashpan, interfering with proper cleaning of same, and in case of leaky tubes, the ashes which accumulate behind the levers, freeze in cold weather, thereby rendering the shaking apparatus useless.

When removing or replacing such bars it is usually necessary to take down the ashpan, which is a considerable item of expense.

The prime object to be attained in cleaning a fire is to remove the ashes, dirt and other products of combustion which accumulate at the bottom thereof, without disturbing the body of the fire more than is necessary to loosen it up and admit the proper amount of air to and through it, as nearly the entire amount of air needed for perfect combustion should be passed through the fire from beneath in order to get the best results from the fuel.

A fire should be disturbed or broken up on top as little as possible, and will seldom need to be touched by the tools if a grate is used that will do all the cleaning from the bottom.

I propose a geared rotary grate-bar, designed for use in locomotive, marine or stationary boilers, or in furnaces generally, where the fuel admits of cast-iron grates being used, and I claim for them cheapness in construction, simplicity of operation, economy in fuel and better combustion.

The principle on which they are designed, constructed and operated will keep the entire bed of fire constantly clean and bright with the minimum waste of fuel, time and labor.

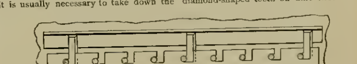
Combustion is improved by reason of the fact that the round shape of bars with their blunt, diamond-pointed teeth or projections, arranged spirally in rows from end to end, offer the least possible resistance to the passage of air around and between them, thus preventing the fire from coking, as is apt to be the case on bars having a large flat or "dead" surface, on which the fuel does not readily ignite.

I believe a lighter fire may be carried on the rotary grates, as it can be kept constantly clean and bright by frequently revolving the grates a trifle, thereby causing the boiler to steam freer, and, as is well known, a dirty fire requires much more coal than a clean one.

There are no levers, arms, bolts, nuts or other weak and complicated parts to the rotary grates to break or get out of order at a critical moment, and they may be fitted to any firebox or furnace at a merely nominal cost, and bars can be removed or replaced in a few moments' time without taking down the ash-pan, or in some cases without knocking the fire out. How this is done is shown in upper sketch. They drop into an L-shaped slot, and are prevented from coming out by the shield.

The bars are cast hollow to avoid unnecessary weight, and have apertures in each end allowing the air to circulate through them, thereby cooling them and rendering them less liable to be burnt or warped, and this contingency is further reduced by the fact that the bars are being frequently revolved.

The spiral arrangement of the blunt diamond-shaped teeth on bars offers the least resistance in revolving same, and affords the greatest leverage in crushing clinkers, etc., present at all times a uniform surface to the body of the fire; they have no edge, point or surface to be broken or burnt off, and permit at all times the freest circulation of air around and between them.



Andrews' Proposed Grates.

Motion is imparted to bars by means of gears cast on one end of each bar, which is in mesh with adjacent bars.

A journal, terminating in a slight

shoulder, is on each end of every bar, fitting into holes and L-shaped apertures in the side strips which support the bars, and in which they revolve.

A shaft extends the length of the fire-box, supported at each end by lugs fastened to the under side of the mud-ring, on which are mounted gears, beveled to engage with corresponding gears mounted on studs attached to the lower side or side strips supporting bars.

These latter gears have also a flat face, which, in turn, engage with gears on the bars at back end of shaft, outside of furnace is mounted a ratchet-wheel (worked by pawl) to arm of which a rod is attached which leads to deck of locomotive, by which operator imparts motion to the bars.

A perforated hood, which may be made out of old boiler-plate in any desired length, extends over the gears of bars, preventing the lodgment thereon of fire or other substance, and is perforated to allow air to pass to fire resting on top of it. The hood has lugs fitting into suitable apertures in the side strips, which lock it and also the bars in position, avoiding the use of bolts or nuts for this purpose.

The best results will be obtained by operating the bars frequently a trifle, and an arrangement for this purpose can be readily and cheaply effected by a small cylinder, using steam or air.

### An Index of Some Account.

Fred. De Land, publisher of *Electrical Engineering*, Chicago, issues an index of current technical literature, which he calls a "synoptical index." It tells what the article is, whether editorial or correspondence, how many words it contains, how many illustrations and how many tables, with the briefest kind of a synopsis of the article itself. Here is a specimen from October:

"Railroad Coppersmithing" By John Fuller (Suggestions on planning and equipping a coppersmith's shop, based on the railway shops in London. 1½ p., 5 i.) *Locomotive Engineering*, September.

This shows that the matter occupied 1½ pages, had 5 illustrations and can be found in the paper named for the month of September. It's the only index of mechanical literature that is worth anything. Most of them give titles only, and in many cases a title does not tell what the article is about.

There was a splendid exhibit of wood-working machinery at the World's Fair, several foreign countries having made a most creditable display in this department. The exhibits by American manufacturers was exceptionally fine. The J. A. Fay & Egan Co., Cincinnati, carried off the highest honors, and everybody familiar with machinery of this class who examined the various exhibits will agree that the honors were fairly awarded. The exhibit obtained the "Premier Medal." The machines that took prizes were Medal and diploma, for car mortising and boring machine, automatic double cutting-off saw, fret scroll saw, triple cylinder, lightning flooring machine, sill and timber dressing machine, automatic dovetailing cutting machine, triple drum sand-papering machine, Universal wood-worker; double planing and smoothing machine; band re-saws, car graining and tenoning machine, spoke lathe. Special mention was made of the triple drum sander as being the latest and showing the most advancement in this class of machinery.

The exhibits of rolling stock and machinery at the World's Fair have constituted good sources of information to the numerous railroad men who visited the place. This was particularly noticeable in the case of machine tools and wood-working machinery. The writer visited the Manning, Maxwell & Moore exhibit and that of Pratt & Whitney with several railroad master mechanics and they all found tools and appliances that they had never seen before, and which are made specially for railroad work. The railroad companies are likely to have requisitions made for tools that would not have been thought of but for the new light thrown upon them by the exhibition. We noticed that the J. A. Fay & Egan exhibit of wood-working machinery attracted the superintendents of machinery and the master car builders. One of the former, who is in charge of the machinery of a large railroad, remarked that the machinery in this single exhibit was capable of turning out more finished work than all the machinery now owned by his company.

The passenger cars exhibited at the World's Fair attracted extraordinary attention from visitors, there having been a constant stream of people passing through the different cars every day. The day coaches were noted for the simplicity and elegance of their interior finish, and for this were highly commended by those who had good judgment as to the furnishings best adapted to passenger cars. The seats and the upholstery were particularly worthy of admiration. For this the Hale & Kilburn Company deserve much credit, for all the day coaches we examined were equipped with their seats.

There has been a great deal of talk for several weeks about having a race between the New York Central's locomotive "999" and the London & Northwestern Webb compound, exhibited at the World's Fair. A race of this kind would have no engineering value. It would make some excitement, but it would prove nothing and mean nothing, except giving some advertising to the projectors of the scheme.

The Pullman Car people built a large number of cheap sleeping cars to accommodate the World's Fair travel, and we feel assured that those cars have done more to bring the owners into disrepute with the traveling public than anything ever done by a corporation that has incurred the enmity of many people. The cars are poorly built, and have inferior seats upholstered in third-class style. The greater part of them have neither dressing-rooms nor smoking-rooms, and they are indifferently lighted with oil lamps. We happened to travel several times in these cars, and each time we heard bitter complaints about the accommodation, and violent abuse of the company that charged first-class rates for third-class cars.

The H. W. Johns Manufacturing Company, of New York, are making asbestos gaskets for air-pumps which are highly spoken of by the engineers using them. A case lately came to our attention where these gaskets had been applied to the air-pump of a switching engine. The engine was in use night and day, and there was a good deal of trouble in keeping the steam piston-gland of the air-pump tight. With common packing, it had to be repacked every two weeks. When we saw the engine, one set of asbestos packing had been in use fourteen weeks, and was still in good order. All the attention that it had required during that time was to screw up the gland a little once or twice.

The Baldwin Locomotive Works have received an order for ten Vauclain compound locomotives for the Philadelphia, Reading & New England Railroad. Of these, seven are consolidation freight locomotives, with high-pressure cylinders 13½ x 24 in., low-pressure cylinders 23 x 24 in., and driving-wheels 50 in. diameter. They will weigh, in working order, about 125,000 pounds. The other three are passenger locomotives, with high-pressure cylinders 12 x 24 in., low-pressure cylinders 20 x 24 in., and driving-wheels 68 in. diameter, estimated weight, in working order, about 96,000 pounds.

General Manager Payson Tucker, of the Maine Central, has issued a timely official order to all employés concerning the care of steam-heating apparatus. Mr. Tucker proposes that every trainman shall know his duty about the heaters, and will hold the proper parties responsible for all cases of freeze up or other alleged failure. The road uses the Consolidated Company's system and believe that, properly handled, nothing seriously can happen to or from it.

The Wells & French Co., of Chicago, have contracted to build one hundred refrigerator cars for the Armour Packing Co., of Chicago. The cars will be first-class in every particular, with M. C. B. couplers, Westinghouse air-brakes and Cambria steel axles treated by the Coffin process.

The Hicks Cattle Car Co. are figuring on the ordering of some new cars, and the order may probably reach 1,000. In spite of the depression of business, this company has been doing a heavy business, which would have been greater if they had had sufficient cars to meet the demands.

At the last meeting of the New York Railroad Club, Mr. D. L. Barnes' paper on Building and Inspecting Locomotive Boilers to Prevent Explosions was read and illustrated by lantern slides. The paper will be discussed at the next meeting of the club.

The Mt. Vernon Car Mfg. Co., of Mt. Vernon, Ill., have secured the contract for 250 coal cars for the Louisville, Evansville & St. Louis road. They have orders enough on hand to keep the plant running full time until February.

The Falls Hollow Stay-Bolt Co. started up their mill on October 1st, after a shut-down of less than three weeks for repairs. They have nearly doubled the capacity of the plant.

An improved form of metallic end panel for car seats has been patented by Henry Cochran, of Chester, Pa. It is a very simple and strong form.

## New Ten-Wheeler for Chesapeake and Ohio.

We show three sections of a new ten-wheel engine, recently designed by Mr. W. S. Morris, superintendent of motive power of the Chesapeake & Ohio, for handling the heavy passenger trains which are common on the road. Some portions of the system are noted for having steep grades, and the engines are well adapted for working trains in such districts. For the engines to be used on the mountain divisions, the driving-wheels are six inches smaller than those employed on the other portions of the line.

The leading characteristics of the engine are ample heating surface and great tractive power. No essential has been sacrificed to combine these in an unusually large ten-wheel engine. The cylinders are 20 x 24 inches, and the diameter of the driving-wheels is 68 inches for ordinary service, and 62 inches for those employed on the parts where grades are steep. With the latter size of wheel, the engine develops 155 pounds of tractive power per pound of cylinder pressure. As the boiler pressure is 180 pounds to the square inch, the engine will be capable of exerting about 24,000 pounds on the drawbar in starting a train.

The boiler, as will be seen in the engravings, is of the extended wagon-top type, with radial stays to support the firebox crown. The dome is set in front of the firebox on a section that is kept of the same diameter as the firebox. The latter has the mud ring set above the frames, but it is dipped down toward the back flue-sheet to give as much depth as possible at that point. The boiler is 60 inches diameter at the front sheet, and has 247 2-inch tubes, 13 feet 10 inches long. The firebox is 8 feet 9½ inches long, and is 41¼ inches wide, and has 30.2 square feet of grate area. In the tubes there are 1,790 square feet of heating surface and 170 square feet in the firebox, making a total of 1,960 square feet. The fire area through the tubes is 593.6 square inches and the ratio of grate area to heating surface is 1 64.9. The cylinders being 20 x 24 inches and there being 1,960 square feet of heating surface, it will be found that there is about 224 square feet of heating surface per cubic foot of cylinder capacity. This is precisely the ratio of cylinder to heating surface that the Lake Shore engines have that were built by the Brooks people for the fast trains that run from New York to Chicago in twenty hours.

The weight is transferred to the driving-wheel boxes by means of underhung springs arranged in a very skillful manner. The expansion-link is located behind the front axle, and transmits the motion through a radius-bar which spans the axle. This plan dispenses with the long, heavy eccentric rods found on so many ten-wheel engines. The cross-heads are of alligator pattern, supported by a guide above and below. Richardson balanced valves are used covering ports of generous size. All the most approved fittings are used on the engines, which include Westinghouse air-brake, with American brake applied to drivers and tender wheels, Nathan triple sight-feed lubricators for valves, Jerome packing for glands. Monitor injectors are used in both sides. The boiler is covered with asbestos, the mud-ring is double riveted, and the firebox contains a brick arch supported on tubes.

The following are a few of the leading dimensions

Cylinders, 20 in. diameter and 24 in. stroke.

Steam ports, 1¼ in. wide, 17 in. long.

Exhaust ports, 2½ in. wide, 17 in. long.

Lap of valve, ⅞ in.

Travel of valve, 5½ in.

Diameter of driving-wheels, 62 or 68 in.

Driving-wheel base, 13 ft. 6 in.

Total wheel base of engine, 24 ft. 4 in.

Total wheel base of engine and tender, 49 ft. 3 in.

Diameter of truck wheels, 30 in.

Diameter of boiler at smokebox end, 60 in.

Thickness of boiler sheets, ⅝ in.

Number of tubes, 247.

Length of tubes, 13 ft. 10½ in.

Thickness of tube sheets, ½ in.

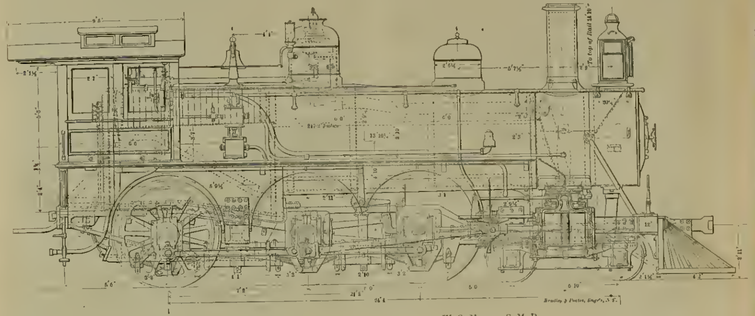
Steam pressure, 180 pounds per square inch.

Weight on drivers, about 108,000 pounds.

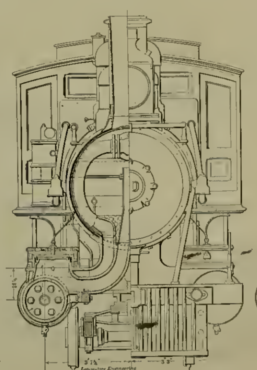
Total weight of engine, about 139,000 pounds.

Total weight of tender, about 68,300 pounds.

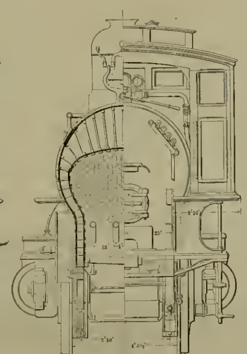
Tank capacity for water, 4,000 gallons; coal, 7 tons.



New Ten-Wheeler for C. & O. Ry. Designed by W. S. Morris, S. M. P.



Through Cylinder. Front Elevation.



Through Firebox. Rear Elevation.

## The Jackson Accident.

The month of October of this year has been memorable for the number of fatal accidents to passenger trains. An accident which happened at Jackson, Mich., on the Michigan Central, was not the most sanguinary in the list of disasters, but it was deplorably bad, for it cost thirteen lives besides much suffering to a long array of people who were severely injured. As the peculiar character of this collision has led to considerable discussion concerning the cause of the collision we have carefully collected the essential facts and submit them to our readers.

The first section of an excursion train to Chicago stopped at Jackson station to allow the passengers to eat breakfast. While standing there, protected by a semaphore signal, it was run into by the second section of the train. The rear car was crushed by the heavy locomotive, and it smashed the next car ahead killing and wounding the greater part of the unfortunate passengers who failed to get outside before the collision happened. The engineer of the train alleges that on approaching the station he applied his brakes, and finding that they failed to check the train he whistled for hand brakes. The conductor of the train, on hearing the whistle, pulled the air-valve in one of the cars, and his evidence is that no air escaped, so his prompt action was useless. After the accident occurred, it was found that the angle-cock at the back of the tender was shut, and attempts have been made to lead to the belief that a tramp, or some evil-disposed person, who was riding on the platform of the baggage-car, closed the angle-cock as the train was approaching Jackson station. When the railroad men went to pull back the train which had done the damage, they had to bleed the auxiliary reservoirs under the cars before the train could be moved.

The distance from Detroit to Jackson is seventy-six miles. In the course of that run the train was stopped four times and the brakes are reported to have worked perfectly. The last stop before reaching Jackson was at Grass Lake, which is ten miles distant. When stopping at this

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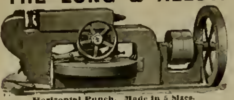

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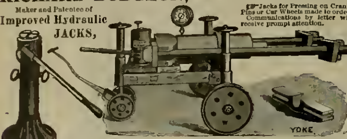


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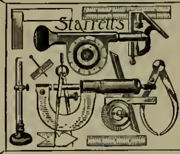


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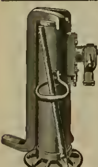

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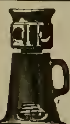

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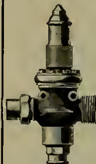

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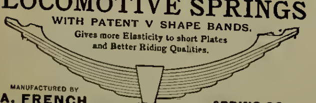

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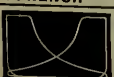

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place to take water, the brakes stopped the train short of the water tank and the engineer had to use steam to reach the desired point, which indicated that the brakes were powerful enough to hold the train easily. The distance from Grass Lake to Jackson was passed at a very high rate of speed, evidence being given that the ten miles were run over in thirteen minutes. There is a descending grade all the distance of 14 feet to the mile. Jackson yard, which embraces the tracks connected with the locomotive repair shops, begins about a mile and a half east of the point where the accident occurred

It is in evidence that the engineer reduced the speed of his train as he entered the valve in the car. The natural inference is, then, that the engineer applied the brakes, but that the air supply left was not sufficient to control the train. Railroad men who were on the train say that there were several applications of the brakes made as the train was approaching Jackson. The supply of air was in this way exhausted

This reputed failure of brakes was like many others. There was excessively fast running, there were repeated applications of the brakes on approaching the stopping place, and when the final application was made there was not enough pressure of air remaining in the reservoirs to stop the train promptly.

pany; J. A. Hill, Locomotive Engineering; Geo. Royal, Sr, Nathan Manufacturing Company; N. S. Moore, C. & N. W.; ——— (can't remember name.)

*Back Row*—C. E. Shearwood, N. P.; W. J. Anthony, C. & N. W.; J. W Hall, St L. Southeastern; L. S. Putnam, C. & N. W.; M. W. Burk, Wabash; M. M. Mast, C. & E., Chas Davis, Erie; J. R. Bravo, Erie; W. A. Murdock, C. & N W

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It is surprising the number of freight cars that have been built within the last two years without having air brakes or couplers of the standard form. This seems to indicate very short sighted policy on the part of the owners. The extra cost of

It would have surprised some of the members of the Master Mechanics' Association to have noted the interest of the Traveling Engineers at their recent convention. Out of a total membership of 107 there was 78 answered roll call, and although the convention was held at the main gate of the great fair, 78 men answered every morning, and 90 per cent. got up on their pins and said something in debate. More interest was manifest than at any meeting of men we have ever attended.

During a speech to railroad men at Louisville, Ky., recently, Eugene V. Debs made the following statement "The

Group of Traveling Engineers, Taken on World's Fair Grounds, at the First Annual Meeting of the Association.

the yard, and that the brakes at that time showed no signs of failing in their functions. Engineer Whalen also asserts that he applied them again at a point which is about half way through the yard, and he had no reason then to suppose that anything was wrong; but that when he attempted to apply them as he came near the station they failed to check the train, and he called for hand brakes. These are the facts as they are carefully sifted by evidence submitted. It may be added that Whalen, the man in charge of the engine which did the damage, was a freight engineer.

The numerous air-brake experts among our readers will be certain to form conclusions for themselves as to the cause of the collision. For ourselves, we attach no importance to the theory that the accident was caused by the angle-cock being closed behind the tender, even though the cock was found closed half an hour after the collision. If the angle-cock had been closed when the train was running with the brakes released, there would have been a good pressure in the air-pipes, and that being the case the conductor would have heard the air escape when he pulled open the valve in the train; but if the angle-cock was open and the engineer applied the brakes with full force the train-pipe would be empty and the conductor would hear no air escape when he pulled open

### The Traveling Engineers Group.

This picture was taken on the World's Fair grounds with the thermometer at about 98 deg., so that about half the party refused to be parboiled for the sake of a picture. Commencing at the first row and reading from left to right the victims are

J. S. Bander, Lake Shore; A. S. Work, Nickel Plate; Geo. Holmes, Norfolk & W.; Geo. O Taylorson, W N Y. & P, H. M Curry, N. P.

The second row is headed by S. J. Kidder, Westinghouse A. B. Co., W. E. Miller (treasurer), Vandalia, W. T. Hamar, E. T. V. & G, W. O. Thompson (secretary), Lake Shore; C. B. Conger (president), C. & W. M; J. E. Goodman (1st vice-president), N. P.; R. D. Davis (2d vice-president), Ill. C.; M. M. Meehan, D. S. S. & A., J. B. Johnson, C. M. & St. P

*Third Row*—N. Bischoff, Nathan Manufacturing Company, C. F. Schragg, M. K. & T.; C. P. Lovell, N Y Air Brake Co, M J. Reams, E. T. V. & G., P. A. Rossiler, G. S & F.; ——— (we can't recall name), Curtis McCullum, C M. & St. P., Martin Monroe, D. & R. G., D. C Woods, C. R. I. & P.; C M. Brinsley, C. & E. I.

*Fourth Row*—Lewis Gleason, Brooks Locomotive Works, T D. Fenn, Crane A. B. Company; Theo. A Hedendahl, U. P.; Robert McVicar, Galena Oil Com

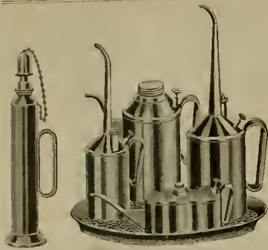
these improvements would not be very great when the cars are contracted for. As air-brakes and vertical plane couplers will be compulsory attachments soon for cars engaged on interstate commerce, it is strange to witness the apathy in some quarters about having the cars so equipped There is a belief that the day of reckoning can be put off, but we do not think there is much likelihood of the law being suspended to accommodate those who have displayed no disposition to comply with it.

In the course of a private letter, one of our most intelligent railroad master mechanics, who has visited the World's Fair many times says "One of the exhibits generally neglected by mechanics is the Ferris wheel. This is worth notice and study mechanically. It is a bold design, most skilfully and thoroughly executed in all details, and, to my mind, is the distinctive feature of the Exhibition. A creation, in fact, as creditable to the designer and executor as the Fair itself Most singularly, I do not find that railroad mechanics I meet are interested in the wheel generally. This is a mistake, I think, as it not only deserves its full share of attention, but cannot help leaving its influence on the average mind if made enough of a study to make its mechanical features understood."

home is the foundation of American government. Destroy that home and you destroy the government. I know railroad men pretty thoroughly, and I know they do not spend enough time in their homes. You spend too much time about the roundhouse, telling old chestnuts and descanting upon impossible runs you say you have made that were never made or never will be made. Spend your time at home, showing the pictures to the babies, or, if you are not married, spend your spare time with your sweetheart. Remember this No man ever landed in the penitentiary who spent all his leisure time at home."

Hereafter the Lukens Iron and Steel Company will conduct its railroad department direct from the works at Coatsville, Pa. Messrs Coolbaugh & Pomeroy, of 29 Broadway, this city, have been the railroad agents of this mill. The Lukens mill was established, in 1810 and made the first steel boiler plates in America. Their plates are being used very extensively by railroads now.

Don't fail to secure our three Educational Charts—if you don't want or don't need the yourself you know some bright apprentice boy who would think them priceless The paper is worth more than the $2 to you.



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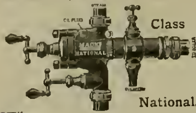

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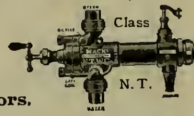

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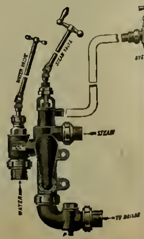


## Over the Chesapeake & Ohio.

"What brings so many Americans abroad to do European scenery when you have such magnificent scenery at home?" This question was asked by a Scotch gentleman, as a passenger train was speeding over the fine track of the Chesapeake & Ohio Railway through the Kanawha Valley, in West Virginia. The party had gone through from Washington, and were filled with admiration of the rich country through the battle-fields of the war that are so numerous between the Potomac and Staunton, Va. Between Alexandria and Staunton we hear such names as Manassas,

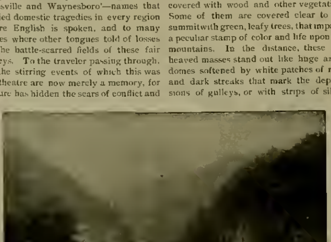
HAWK'S NEST CAÑON.

Rappahannock, Rapidan, Orange, Charlottesville and Waynesboro'—names that carried domestic tragedies in every region where English is spoken, and to many places where other tongues told of losses on the battle-scarred fields of these fair valleys. To the traveler passing through, all the stirring events of which this was the theatre are now merely a memory, for Nature has hidden the scars of conflict and it looks as if the red rain of that fierce strife still makes the harvest grow.

As time heals the sores of the great conflict the trip through the battle-fields of Virginia will grow in popularity, for no scenes on earth attract the attention of mankind so eagerly as the fields where brave men fought and fell. These scenes will be classic ground that future generations will ponder over as seriously as they now do over the battle-fields of Marathon, of Bannockburn and of Waterloo.

As the train speeds westward the traveler's eyes are feasted with fine views of the Piedmont Valley, with its smiling farms and picturesque woods—a valley so striking to view that Governor Spotswood on first seeing it gazed in admiration and exclaimed, "Behold! the Valley of the Euphrates!" He had seen the most imposing scenes in many lands, and compared this with the most striking within his memory; and yet the Virginia Valley was the fairest of them all. Crossing many a clear running stream, darting through stretches that look English manor parks, but richer in foliage and more luxuriant in vegetation, we draw toward the Alleghany Mountains. The railroad in its way from the Chesapeake to the Ohio follow a series of natural passes, and traverses the route that the earliest inhabitants of this continent used in their journeys for trading or war purposes. After a long climb, twisting round bold hillsides and toiling over many a rock cutting and steep embankment, we rush into the darkness of a long tunnel which cuts through the summit of the highest mountain pass. From here we descend into West Virginia through the most picturesque scenes of the Alleghanies.

The mountains present many majestic views from the east side, but the wildest, most rugged and most impressive scenes are witnessed as we descend the western slope. While the scenery possesses peculiar grandeur, its magnitude is on a smaller scale than the best known Rocky Mountain scenery; but nevertheless, it is more attractive to those having an eye for variety of tints and harmony of coloring. The Rocky Mountain scenes are striking for their savage desolation where the projected rocks tower up in lifeless bareness. The Alleghany scenes are all clothed. Everywhere we see gray rocks and rugged crags standing out in all their native bareness, but the mountains as a whole are covered with wood and other vegetation. Some of them are covered clear to the summit with green, leafy trees, that impress a peculiar stamp of color and life upon the mountains. In the distance, these upheaved masses stand out like huge azure domes softened by white patches of rock and dark streaks that mark the depressions of gulleys, or with strips of silver where water brooks and cascades gleam in the sunshine.

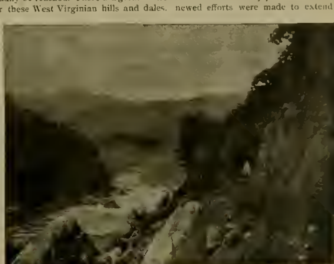


NEW RIVER.

From the summit of the mountains to Charleston, a run of about 150 miles, the scenery is the finest I have ever seen, but the earth, torn into fantastic forms, is not the only attraction. There are mixed with the scenery the source of natural riches which await only the hand of labor and the breath of capital to fill the wilderness with comfortable homes. Running into the wilds there are numerous small valleys with excellent farm lands. These will some day be cultivated, for they lie in

NEW RIVER VALLEY.

a genial climate, where all varieties of crops can be grown. Some of them are now under cultivation, but these are merely enough to show the natural riches of the land. The woods afford fine protection for stock, and thousands of cattle could be wintered in the lower regions with next to no attention. The mountains are full of iron and coal, and their sides are covered with valuable timber that can readily be reached. There is a great future for these West Virginian hills and dales.



CAÑON OF NEW RIVER.

The railroad that has opened up this wilderness to easy reach is worthy of more than a passing notice. It is many years since efforts were made to join the Chesapeake and Ohio rivers by a railroad traversing the shortest passes through the intervening mountains. Railways were no sooner demonstrated to be a more successful means of intercommunication than canals before the progressive statesmen of Virginia began to agitate the connecting of the Old Dominion with the rising sun of prosperity beyond the mountains by means of a railroad. A dearly cherished, far-seeing scheme was to bring the agricultural products of the Mississippi Valley to the Chesapeake for shipment. There appeared to be a possibility of making Norfolk or some other port on the Chesapeake Bay an active rival of New York.

In 1835 the Louisa Railroad Company was incorporated, with authority to build from a point on the Richmond, Fredericksburg & Potomac to Gordonsville, or beyond to the mountains if found desirable. This was the first link in the chain that subsequently formed the Chesapeake & Ohio system, but it was a weak one for many years. Others were slowly forged. The Virginia Central Railroad Company was formed out of several valuable railroad fragments, and it did the first important work of connecting the broken links. It swallowed the Louisa Railroad among others. When the war broke out in 1861, there were detached railroads with small intervening blanks that dotted the route from Richmond to Charleston, W. Va. The war put an end to this kind of improvement for a time.

Peace was scarcely proclaimed when renewed efforts were made to extend the railroad westward. The States of Virginia and West Virginia offered valuable inducements for the Virginia Central to push the line through to the Ohio River. In 1867 the offers were accepted, and the following year active operations were commenced, the name of the reorganized company being changed to the Chesapeake & Ohio. The work of building the blanks connecting the finished portions of the system proved much more expensive than was anticipated, but the work was accomplished within five years, and a splendid new route between the East and West established. Prosperity did not smile for many years on those who had risked their money in building this boon to the Virginians. The road had been costly and trade developed slowly. The towns and farms and mines and timber lands along the route increased rapidly in value, but

## OUR ENGRAVINGS.

Of late we have had a great many inquiries as to who made the fine half-tone plates shown each month in LOCOMOTIVE ENGINEERING. Credit is due the expert anywhere and we are glad to recommend the engravers of our plates to those wanting good work at reasonable prices. All the half-tones and reproductions we use are made by the STAR ENGRAVING & PRINTING Co., 607 & 609 Sansom St., Philadelphia, Pa. SINCLAIR & HILL.

the road struggled on in poverty till within a few years. It may now be regarded as one of the best railroad properties in the country.

Of late years the management have devoted close attention to developing the natural resources of the country traversed, and the road is reaping the benefit. Road-bed and rolling stock and methods of operating display the effects of good management. There are about 1,300 miles of track operated. The company have 350 locomotives and 13,000 cars. No railroad in America has a better quality of cars and locomotives. President Ingalls has reason to be proud of the material progress of the road since he took charge. His policy of management is fairly carried out by an excellent staff of executive officers, with General Manager Stevens at their head.

### Engineer to Be Responsible for Protecting Train.

In the course of an admirable article on railway accidents, read at World's Railway Congress by Colonel Haines, president of the Plant Railway System, the following paragraph occurs

"It is safe to say that a majority of the rear collisions between stations are due to a failure of the flagman to comply with the rules prescribed by the standard code for his guidance. Here is the principal cause of rear collisions, and here a remedy should be applied by relying less upon the intelligent and willing discharge of the duties thus placed upon the flagman. The most intelligent and most experienced man in the train crew should be the engineer; the best acquainted with the curves, grades, bridges, cuts, embankments and other physical characteristics of the road; the best informed as to the trains passed and to be passed, and when a stop is made or the train slows down at an unusual place he knows the cause and the probable detention, not only after it occurs, but also before, and can often select the safest place for a stop. It is he, then, and not the flagman or conductor, who should determine when the rear of his train is to be protected, and the flagman should act promptly when the signal is given to him, but not before, except in emergencies that can readily be suggested. If the burden be plainly put upon the engineer to determine and upon the flagman to act, the action of the latter would be controlled by the most intelligent and best informed man of the train crew."

Throughout the paper Colonel Haines argues with much force in favor of the block system, but admitting that many railroads cannot afford to introduce this system, owing to the great expense, urges the adoption of improved methods of flagging. The plan of protecting a train by sending back a flagman is such a crude one that most people consider it unworthy of being reduced to a system, and so the protection of trains stopped between stations is put on a brakeman, who may or may not think it necessary to go back. The proposal to put the protection of the train in control of the engineer is good, but it has its drawbacks. Colonel Haines is an old locomotive engineer himself, and has probably considered all the disadvantages, as well as the advantages, of the plan he proposes, but concludes that the gains in the interest of safety are sufficient to offset the losses. One objection which occurs to us is that the engineer being at the head of the train might have difficulty in finding out if the flagman has obeyed the order to go back. Another objection is that the train may be stopped owing to some disorder of the engine, which monopolizes the attention of the engineer to such an extent that he forgets all about protecting the rear end. We understand, however, that the plan is in operation on the roads of which Colonel Haines is president, and presumably it works well or it would not be recommended for general adoption.

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We have received a very fine specimen of work done on a new forming lathe built by the Meriden Machine Tool Co., Meriden, Conn. For small brass parts they fit up special tools for their lathe, that finish an ordinary piece, such as a torch-top, at one movement of a lever.

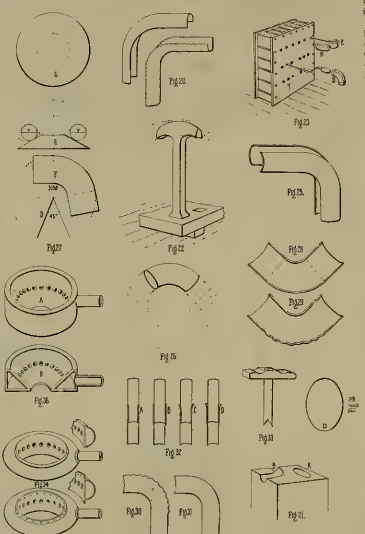
### *Railroad Coppersmithing—III.

By John Fuller, Sr.

MADE BENDS.

When bends are made directly from the sheet, and not formed by filling the ready-made pipe and then bending, we have two ways of doing it. One way the seams are at the sides, the other the seams are in the throat and at the back. When the seams are at the side, the inner piece is called the saddle, the outer piece the back. To make a bend saddle and back, take two strips of copper, each one-half the circumference of the pipe desired in width; let the saddle piece be nearly the diameter of the pipe shorter than the back piece; file brought round to the template by hollowing the center of the back in a hollowing-block, Fig. 21, allowing the wrinkles to come up regularly until the back has curled about a third less circle than the template. Now gradually work out the wrinkles, first a little on one side right around it, and then on the other, then over a T stake, as shown in Fig. 22, until they are all worked down and the sides are smooth and the edges fit the edges of the saddle half. Then thin each side with a double piened hammer, Fig 5, on the inside of the two half saddles and back and file the edges true along them.

They will now be ready for softening and cleaning, which is done at one and the same time by covering the parts with a




edges of each piece up carefully, half-round, with a fine-cut file, so that there are no rough burrs nor small cracks made by the shears in cutting the strips left in them. Bend each piece to the working template. It will be found that the saddle, as the edges are being worked over on a mandrel, has a tendency to straighten out too far away from the template; this may be obviated by bending the saddle piece before commencing a third smaller than the bend is required when finished, as shown in Fig. 20; that is, if a mallet is used in making the saddle. If the saddle is made with a hammer and drawn over on the anvil, shown in Fig. 4, the hammer will curl it round enough to bring it to the template as the work proceeds, because the edges will be drawn longer. When the work is performed with a mallet, the center is upset nearly as much as the edges of the strips are drawn, and therefore the thickness is more equalized and a much better bead obtained. The back is turned in a similar way, under the same conditions as the saddle, and the edges are puckered or wrinkled at regular intervals and then

strong brine of salt and water and heating them to a cherry red (out of the sunshine), and quenching them in a vessel or trough of clear water, and scouring them with a clean wisp of tow and clean sand and water. The saddle is now ready for cramping, as shown in Fig. 20. When cramped, open the outside cramps with the tweezer (Fig. 9), and bring the back to the saddle; let one cramp go inside and one outside; pull them up together in a vise, and see that the joint is evenly lapped along it, and wire them fast together as shown in Fig. 23. Dress down the cramps and hammer them close and even on a bent mandrel *H*, and a cod to fit. A cod is an egg-shaped casting, Fig. 24, having a square hole through its transverse axis, so that it can be keyed on a square iron mandrel, bent as shown at *D* and *E*, one end of which is fastened in the mandrel block *T*, Fig. 23. After the joint is laid and the cramps are hammered down smooth, chatter the joint, when it may be charged with spelter and made ready for the fire.

SEAM IN THROAT AND BACK.

We will now work on the other two halves, top and bottom, Fig. 25. In working these two halves into shape, the method usually adopted by workmen is to draw down the throat on an anvil, Fig. 4, and then hollow up the back in a block, but this is not at all satisfactory, nor can a real good job be done in this way, because the throat is drawn much too thin by the hammering, and there is considerable difficulty in keeping the work to the template; then, again, there is an excess of stuff in the back which must be cut off; yet this method is still in use. While engaged at this kind of work, the writer discovered a very much easier and better way of doing this work, by which the throat is scarcely touched and no excess, if proper care is exercised in working, and when the bend is finally shaped, the throat is practically the same thickness as the sheet from which it was cut.

This method I have never taught to any but one apprentice boy, and it is given to the trade direct for the first time now—that is, the formula for cutting the pattern and the manner of working it up. It is known that bends are in the abstract but sections of a hollow cylindric ring, and a square bend is one-fourth of a hollow ring, having the straight part, if any, joined to it or left unbent. A little mathematical knowledge is now necessary for one to be able to fully understand the groundwork or the theoretical part. Referring to Fig. 26, let the inner dotted diameter of the diagram be equal to 9, and the diameter of the pipe *X* equal 6; then the outside diameter of the diagram will be 21. Now we want to unroll the outside edge of one-half of this hollow ring (see Fig. 27) when cut horizontally, }`}'¹, and form it into a frustum of a cone, *E*. To do this we proceed thus First find the convex surface of the whole ring. Here the inner diameter of the ring is 9, and the thickness or size of the pipe is 6; then

$$(9+6)\times 6=15\times 6=90, \text{ and } 90\times(3.1416)^2= 90\times 9.8698=888.2820,$$

the convex surface of the whole ring, then $\frac{888.2820}{2}=444.1410$, one-half the surface, and $\frac{444.1410}{.7854}=565.4964+$. Now add the square of 9, the inner diameter of the bend or ring, to this last result, and $565.4964+81=646.4964$. Extracting the square root of this last sum gives us 25.4262, the outside diameter of the circular disk *G*, Fig. 27. Now we want to transform the flat disk-ring, *G*, into a frustum of a cone, *E*, whose convex surface is equal to the flat disk-ring, *G*. Practice has shown that a frustum of a cone formed of 315° of a circular ring is the best pitch it can have to obtain the result required with the least work. To raise this disk-ring *G* to a frustum of a cone, proceed thus

$\frac{25.4262\times 3}{5.25}=14.5292$, the radius or slant height of the complete cone, of which the frustum *E* is a part. Now take for a square bend one-fourth of 315° of the circle *D*, or 78.75°, one-half the circumference of the pipe in width *F*, and add to it whatever is required for the straight part at either end, if any; then round up the edges (as before directed) smooth with a fine-cut file, and the pattern is then ready for forming up into a half bend, proceeding as follows Take two pieces of copper, *F*, and curl them round a third smaller in diameter in the throat, Fig. 28, than they are required to be, the circular part forming one-fourth of the cone *E*, and turn them right and left in opposite directions, forming one-fourth of a cone with the part intended to form the bend. Now turn the throat in a course, Fig. 28, on a suitable mandrel with a round-faced mallet to begin the forming; then turn the outer edge up a course, and pucker or wrinkle the edge at regular intervals, as shown in Fig. 29; then take it to a hollowing-block, Fig. 21, and sink it in the hollow in the corner, letting the wrinkles come in regularly all alike, until it is curled up enough, Fig. 30; now work out the wrinkles partly in the block on the inside, and part on a cod outside, until the

Midland, together with a justification of their authenticity, he will add a valuable page to his history of the locomotive engine, but until then we must accept Mr. Hedley's version as the probable one.

*London, Eng.* MERNOK

### That Foreigner.

*Editors*:

The engine illustrated on page 397 of your issue for the month of September is not a German, but a French one, belonging to the Paris, Lyons & Mediterranean Railroad. It was built in 1854 by André Koechlin, of Mulhausen (now the Societé Alsacienne de Constructions Mécaniques, in Belfort, France).

The engine has since been reboilered, the new boiler being of the type adopted since 1869 by the P. L. M. R. R.

The dimensions are as follows

Diameter of driving-wheels, 5 ft. 5 in.
Heating surface, firebox, 72.44 sq. ft.
" " flue tubes, 927.31 "

Total, 999.75 "

Grate area, 12.27 sq. ft.
Working pressure, 106 lbs.
Diameter of pistons, 15¾ ins.
Stroke of pistons, 22 ins.
Wheel base, 10 ft. 10 in.
Weight, empty, 60,390 lbs.
Weight, in working order, 67,364 lbs.
Weight on each coupled wheel in working order, 24,860 lbs.

The tender accompanying the engine is a four-wheeled one; it was built in 1856 by Parent et Shaken (now the Fives-Lille Co.).

Weight, empty, 25,102 lbs.
Capacity of water-tank, 1,498 gallons.
Weight of coal carried, 8,800 lbs.
Weight in working order, 48,400 lbs.
Diameter of wheels, 3 ft. 7.3 ins.

Amongst features of interest note forked connecting-rod, overhanging firebox, and the position of cylinders ahead of the smokebox. There are many engines of this type still running on the French railways.

E. GOBERT.

*London, W. C., Eng.*

### Jigs for Drilling.

*Editors*:

About the first thing that caught my eye in the September issue of your paper was the clipping from an English paper and your comments thereon, under the above heading.

"A jig is merely a device for holding work so that machine work may be done on a number of the same kind of pieces precisely the same way"

Probably it is in your office, but it is not so always in modern shop practice. I have made a great many jigs in my time and the work held the jig, especially in use on a drill-press.

When a device is secured to the machine it becomes a chuck, nothing more nor less. A chuck is a device for holding the work to be operated upon. It may be either movable or fixed. If attached to the rotating spindle, it is movable; if rigidly secured to the platen or table, it is fixed. Its shape or form alters not its real name, although when in the latter condition it sometimes is termed a vise.

Suppose, for instance, we have several flanges 8 inches square to have holes drilled in them equi-distant; our jig would be a cast-iron, spider-shaped affair having ears projecting at right angles to its face from the edges, and a clamp-screw to prevent its lifting from the work, and where the holes were to be drilled in the flanges we would put hardened steel thimbles in it, with holes in them just the size of the holes to be drilled. This is the simplest form of jig, and the piece to be operated upon actually holds the jig, and is perfectly free at all times to be moved about upon the table Often the nature of the work requires a special form of drill, which is used for no other purpose whatever

There are some people who call this type of a jig a "template," but a template is used for *laying out* the work to be done, and is not used for doing it; skilled labor being required to secure "accuracy and perfection" afterwards, which does not exist in any form whatever. The "jig" does the multiple parts perfectly, and requires generally nothing more than a good stocky boy.

"A device that insures accuracy and interchangeability without 'setting' or measuring each piece," as you state it, is not a "jig" always by any means, as an angle plate could be used to do all that you state, and nobody in the shop would think of calling it a jig.

W. S. ROGERS.

*Troy, N. Y.*

[Mr. Rogers may have only stated the facts in his letter, yet this does not prove that our description of a jig was not correct. Other things may be used for the same purpose, yet a jig is just what we said it was.]

### Fast Running Half a Century Back.

*Editors*:

Below I give an old English "working time-table" for Great Western express trains. It is dated 1845. The engines employed on the service had 16 x 24 in. cylinders, a single pair of 7 ft. driving-wheels, and were practically smaller editions of the "Lord of the Isles" (1847 type now at the World's Fair. The original gauge of the Great Western was 7 ft — the widest ever employed, I believe. Eventually the company used the broad and standard gauges in conjunction, but up to the last the 7-foot gauge maintained its popularity with travelers, and the fastest passenger trains were always run on it.

| MILES | STATION. | HOUR |
|---|---|---|
| 0 | Paddington.................. | 9 45 |
| 9 | Southall. ................ .... | 9.58 |
| 13 | West Drayton...... .. | 10.03 |
| 18 | Slough................ .. .. | 10.08 |
| 23 | Maidenhead.......... ...... .. | 10.14 |
| 31 | Twyford.............. . | 10.53 |
| 36 | Reading... .............. | 10.28 |
| 41 | Pangbourne ... ......... | 10.34 |
| 47 | Wallingford......... ..... | 10.41 |
| 53 | Didcot..................(arr.) | 10.53 |
| | " ....... ......(dep.) | 10.55 |
| 56 | Steventon .............. .... | 11.01 |
| 77 | Swindon ....... ....(arr.) | 11.27 |
| | " ... .. .. ....(dep.) | 11.28 |
| 107 | Bath.. . . ... (arr.) | 12.06 |
| | " ....... ....... ..(dep.) | 12 08 |
| 125 | Bristol.... ... | 12.25 |

*Abilene, Tex.* HUGH SHARP.

### A New Safety Angle-Cock.

*Editors*:

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On investigation, it was found that the end of a broken brake-rod had thrashed around on the ground until finally it turned up in such a position as to close the angle-cock, and the inevitable accident happened, and as is always the ease, was head-lined in the papers as an accident caused by "failure of air-brakes." In reality it was a failure of air-brakes, but one that could have been avoided.

Why is it that in this age of progress this condition of affairs is allowed to exist? Air-brake companies and some "first-cost" railroad officials may say that there is a great deal of imagination or apparent fear that is causing the demand for a safety or automatic angle-cock. Now, imagination is one thing and a twenty or thirty thousand dollar accident accompanied by the loss of several lives is another, and very substantial evidence that something is wrong.

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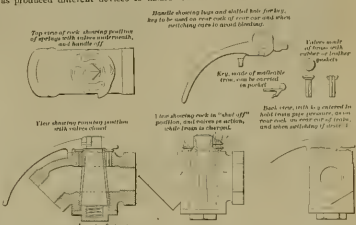
There have been of late a great many articles written and suggestions made to overcome this dangerous point in air-brake practice. I notice that inventive genius has produced different devices to insure safety, which are worthy of only a passing notice, from the fact that their operation causes a delay in pumping off brakes at division terminals or points on the road where it is necessary, from any cause, whatever, to cut the train. Delay is one thing, disaster another. But the former frequently contributes to to the latter. Why not do away with both as near as lies in our power.

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Some time ago I found an engine blowing through, we placed her in proper position and tested her, when all the signs showed the blow was in piston packing on left side. A few days previous it was decided she was blowing through in that manner; the old packing rings were taken out and new ones that fitted the cylinder very close and nice were put in, but she blowed just as bad—if any change was noticed she got gradually worse. Of course, after that, it was a sure thing that the blow was in the valve, which must be faced. To settle the matter we placed the engine, where she blowed through worst, just back of top quarter left side, took off the forward cylinder-head, hooked her clear in ahead, gave her steam, and it was easily seen by the way the steam came past the piston where the trouble was. The rings were just a little too wide, and were "follower bound," so the first time the engine was shut off the play up and down of spider crowded the rings in and they did not spring back. Those rings were dressed down to the right thickness and stopped that blow

Here is another case The engine blowed bad in 10 inches, but not any when valve covered all ports, of course, it was settled that the packing was at fault Cylinder-head was taken off engine brakes set and throttle opened a little. No steam came past the piston when in any part of its stroke, but when the valve was moved to forward end of its travel, steam came out of the port in great volume The valve-seat was hollowed out, and, as usual in such cases, the valve did not fit tight at all parts of its stroke Both of these engines, when tested out on the road, gave the same symptoms, yet had different diseases.

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Midland, together with a justification of their authenticity, he will add a valuable page to his history of the locomotive engine, but until then we must accept Mr. Hedley's version as the probable one.

*London, Eng.* MERNOK.

### That Foreigner.

*Editors*:

The engine illustrated on page 397 of your issue for the month of September is not a German, but a French one, belonging to the Paris, Lyons & Mediterranean Railroad. It was built in 1854 by André Koechlin, of Mulhausen (now the Societé Alsacienne de Constructions Mécaniques, in Belfort, France).

The engine has since been reboilered, the new boiler being of the type adopted since 1869 by the P. L. M. R. R.

The dimensions are as follows

Diameter of driving-wheels, 5 ft. 5 in.
Heating surface, firebox, 72.44 sq. ft.
" " flue tubes, 927.31 "

Total, 999.75 "

Grate area, 12.27 sq. ft.
Working pressure, 106 lbs.
Diameter of pistons, 15¾ ins.
Stroke of pistons, 22 ins.
Wheel base, 10 ft. 10 in.
Weight, empty, 60,390 lbs.
Weight, in working order, 67,364 lbs.
Weight on each coupled wheel in working order, 24,860 lbs.

The tender accompanying the engine is a four-wheeled one; it was built in 1856 by Parent et Shaken (now the Fives-Lille Co.).

Weight, empty, 25,102 lbs.
Capacity of water-tank, 1,498 gallons.
Weight of coal carried, 8,800 lbs.
Weight in working order, 48,400 lbs.
Diameter of wheels, 3 ft. 7.3 ins.

Amongst features of interest note forked connecting-rod, overhanging firebox, and the position of cylinders ahead of the smokebox. There are many engines of this type still running on the French railways.

E. GOBERT.

*London, W. C., Eng.*

### Jigs for Drilling.

*Editors*:

About the first thing that caught my eye in the September issue of your paper was the clipping from an English paper and your comments thereon, under the above heading.

"A jig is merely a device for holding work so that machine work may be done on a number of the same kind of pieces precisely the same way."

Probably it is in your office, but it is not so always in modern shop practice. I have made a great many jigs in my time and the work held the jig, especially in use on a drill-press.

When a device is secured to the machine it becomes a chuck, nothing more nor less. A chuck is a device for holding the work to be operated upon. It may be either movable or fixed. If attached to the rotating spindle, it is movable; if rigidly secured to the platen or table, it is fixed. Its shape or form alters not its real name, although when in the latter condition it sometimes is termed a vise.

Suppose, for instance, we have several flanges 8 inches square to have holes drilled in them equi-distant; our jig would be a cast-iron, spider-shaped affair having ears projecting at right angles to its face from the edges, and a clamp-screw to prevent its lifting from the work, and where the holes were to be drilled in the flanges we would put hardened steel thimbles in it, with holes in them just the size of the holes to be drilled. This is the simplest form of jig, and the piece to be operated upon actually holds the jig, and is perfectly free at all times to be moved about upon the table. Often the nature of the work requires a special form of drill, which is used for no other purpose whatever.

There are some people who call this type of a jig a "template," but a template is used for *laying out* the work to be done, and is not used for doing it; skilled labor being required to secure "accuracy and perfection" afterwards, which does not exist in any form whatever. The "jig" does the multiple parts perfectly, and requires generally nothing more than a good stocky boy.

"A device that insures accuracy and interchangeability without 'setting' or measuring each piece," as you state it, is not a "jig" always by any means, as an angle plate could be used to do all that you state, and nobody in the shop would think of calling it a jig.

W. S. ROGERS.

*Troy, N. Y.*

[Mr. Rogers may have only stated the facts in his letter, yet this does not prove that our description of a jig was not correct. Other things may be used for the same purpose, yet a jig is just what we said it was.]

### Fast Running Half a Century Back.

*Editors*:

Below I give an old English "working time-table" for Great Western express trains. It is dated 1845. The engines employed on the service had 16 x 24 in. cylinders, a single pair of 7 ft. driving-wheels, and were practically smaller editions of the "Lord of the Isles" (1847 type now at the World's Fair. The original gauge of the Great Western was 7 ft.—the widest ever employed, I believe. Eventually the company used the broad and standard gauges in conjunction, but up to the last the 7-foot gauge maintained its popularity with travelers, and the fastest passenger trains were always run on it.

| MILES | STATION | HOUR |
|---|---|---|
| 0 | Paddington | 9.45 |
| 9 | Southall | 9.58 |
| 13 | West Drayton | 10.03 |
| 18 | Slough | 10.08 |
| 23 | Maidenhead | 10.14 |
| 31 | Twyford | 10.53 |
| 36 | Reading | 10.28 |
| 41 | Pangbourne | 10.34 |
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On investigation, it was found that the end of a broken brake-rod had thrashed around on the ground until finally it turned up in such a position as to close the angle-cock, and the inevitable accident happened, and as is always the case, was head-lined in the papers as an accident caused by "failure of air-brakes." In reality it was a failure of air-brakes, but one that could have been avoided.

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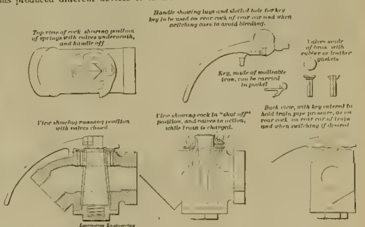


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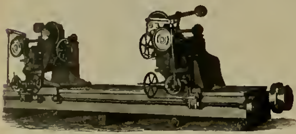

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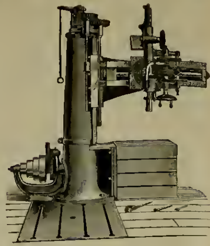

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broken valve would get up under the check and hold it open. Each time the check was inspected, when the valve was lifted out, the piece would drop back down into the delivery-pipe and stay there, ready for the next chance to hold the check up. Moral—When you have a check that stays up too often, examine the delivery-pipe for stray chunks of scrap.

Some of the old-style Sellers injectors refuse to prime. An engine came in the other day, neither injector would prime. After a long trial, a bucket of cold water was secured to cool them off. Just as we were going to pour it on one of them, the bottom of the iron bucket hit the body of the injector a smart blow, and presto! she primed at once before the cold water touched it. The combining tube was stuck, probably the jar loosened it. The regular engineer for this engine was "onto this case," as the head of the bolt holding the injector to the boiler bracket was pounded flat where he had jarred it to loosen combining tube.

One of our engines kept shearing the bolts in front end of main rod off; did it right along for steady business, one or two each trip; so the engineer carried three or four extra bolts always on going out. The holes in strap and rod were reamed out to a perfect fit, pin in crosshead trued up, brasses made O. K., but it did not help her any. Finally, it was seen that the key did not touch the end of rod, but that all the bearing was on the back part of slots in strap. A thin liner was put in between the key and rod, so key did not touch the bottom of key-way in strap, and no more bolts were broken. After the trouble was located the key-way in strap was filed out so all the bearing was on the rod, and trouble was over.

A fast express engine with a good record of nearly a year's service without a hot box, suddenly began to have a hot driving-box every trip. She was put on a local freight to cool her down so she could be used on her own run again, and still got very hot. Engine was jacked up, so box was lifted off axles, when it was seen that oil recess in top of brass was worn out, leaving a spot half an inch in diameter for oil to get at the journal. It was not enough for that purpose. A good deep crease was made with a cape chisel. The box has not been warm since in the fastest kind of service.

One of the air-pump governors refused to attend to its work as it should. When engine had 125 pounds of steam, pump would pick up to 40 pounds of air. When she had 160 pounds of steam she would get about 55 pounds of air, and not stop altogether, but pump very slow. Took down the governor, and took out a small scale of iron that had got under valve 14, Plate B 2, N. Y. A. B. Co. Steam at 125 pounds just about balanced air at 40 in the governor. Of course, at 160 it would hold the valve open against a greater pressure of air. The small hole drilled through the seat in the New York governor gave the pump a chance to work slow.

The above are not hard puzzles when you know how, but they "tied up" some good men when they first happened.

C. B. Conger.

*Grand Rapids, Mich.*

### What is a Patent Good For?

*Editors:*

Will you kindly advise through your next issue the reason for the following

Presuming that A wishes to obtain a patent, and he has taken the proper course through a regular patent attorney at Washington, paid all necessary fees and obtained his letters patent, which he considered gave him the legal right to manufacture or dispose of same as he thought proper. He manufactures and places the article on the market for sale, when he is prosecuted for an infringement on a patent issued some eight years prior, judgment is obtained, and he is compelled to pay heavy damages, besides losing his patent and the government and attorney's fees originally paid by him. What kind of a law is this or what protection has a patentee? Was not the patent that A was prosecuted for infringing upon on record in the Patent Office at Washington? Was there any good reason why A's attorney could not have ascertained through the Commissioner of Patents from the records if A could have possibly infringed, before granting him his patent, as this fact was developed later in the suit against him by other attorneys. Is there not something radically wrong in such a system? A patentee depends entirely on the judgment and experience of his attorneys when he wishes to obtain a patent, and they should be able to say conclusively, before issuing a letters patent, if the patentee was fully protected.

J. B. Michael.

*Knoxville, Tenn.*

[Inventors are having lots of trouble of this kind. Some of it is due to the ignorance, but more to the cupidity, of patent attorneys (?)—many of them will get *some kind* of a patent (a combination on a combination or something of that order) for the purpose of pocketing his fees. There are many who believe that, for a very small fee the government should grant a patent to any applicant, and that the validity of same should be decided in a court—if the patent is worth anything it gets there anyway. The present system is doubtless a very faulty one, but an entirely satisfactory substitute has not yet been suggested.]

### Early Engines With Cast-Iron Valves—Some Old Timers—Chances of Education Forty-five years Ago.

*Editors:*

I saw an article in your October number about Mr. E. N. Underwood, stating that he put the first cast-iron valve on a locomotive in this country, and that was in the fifties. You are very much mistaken as to time, if not altogether. I went to work for the Central Co. in 1849, in the Rochester shop on the Rochester & Auburn division, just after a collision between a Baldwin and an inside Hinkley & Drury engine. I helped rebuild the Hinkley; both engines had cast-iron valves. The road was stocked with Hinkley & Drury, Baldwin, Rogers, Chetchem and Grosvenor engines, and each and every one had cast valves.

In the spring of '50 I went to Cleveland, Ohio, and the first job I had there was on an old engine called the "Pioneer," brought by Stone, Harback & Witt from Springfield, Mass. She had cast-iron valves. She had one pair of drivers; her crank fastened to hub of driver by bolts and keys.

It was here I served my apprenticeship. In '51 or '52 they commenced building locomotives at the Cuyahoga shop, in Cleveland, under the superintendency of Thomas D. Simpson. The first three six-feet drivers that were built there were erected by Robert McMillen and myself. I have never seen anything just like them. My son takes Locomotive Engineering, and it certainly is (as I told him) the most interesting jurnal I ever read. I could not help contrasting our facilities for learning forty-five years ago and now. I see you recommend the Correspondence School of Mechanics. If I were ten years younger, I should be strongly tempted to take a course myself, and avail myself of the advantages of this school.

Andrew J. Cole.

*Los Angeles, Cal.*

### Was the Engineer to Blame?

*Editors:*

I should like to hear a discussion in your columns by practical men as to what an engineer shall do in an emergency with driver and tank-brakes. Shall he reverse his engine or not? If so, shall he "give her steam" or not when she is in back motion? Then, too, if he has independent brakes on engine (air or steam), shall he use them or not, and is it well to reverse engine under those conditions?

We had a case a short time ago where an engineer reversed his engine with air set on it and ten cars, slid bad spots in drivers, and then hit the rear end of train ahead. Had he stopped twenty feet sooner, would not have collided. Was this engineer blameworthy, and would disciplining him be unreasonable in such a case.

Edward W. Pratt,
Air-Brake Inspector C. & N W.

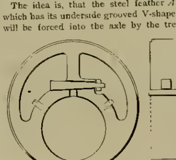
*Chicago, Ill.*

### An Eccentric Fastening.

*Editors:*

For the benefit of master mechanics who are wedded to the ancient form of eccentric with set screws as the only fastening, because of the ease of adjustment, I would submit the enclosed sketch.

The idea is, that the steel feather *A*, which has its underside grooved V-shape, will be forced into the axle by the tre-



mendous leverage obtained by the nut and wedge *B*, sufficient to hold it against any force less than that which would break the eccentric.

Fred. E. Rogers.

*Corning, N. Y.*

[If this form of fastening would not spring the eccentric out of true we don't know what would.]

### He Fired the Old "11."

*Editors:*

That engine No. 11, of the New York Central, shown in the September number, I was firing in '57; but not with that stack. She was a daisy in those days, and was named "Noah Vibbard." She was pulling a passenger train between Utica and Schenectady. It was lots of fun to go out and oil her valves—toe it along on the frame to get over to the steam-chest—she had no running boards; but I was young and supple then. She could pull three cars, I thought, then, to beat the world.

*Omaha, Neb.* J. C. Perkins.

### Would Links Move if Reach-Rod Broke?

*Editors:*

In your reply to J. A., No. 83, page 377, August number, with reference to reach-rod breaking when engine was running in back motion, I think you are mistaken. Links would not drop in forward motion; lower end of links might not stay up against link block, but would raise high enough to relieve engine through exhaust. To demonstrate it, let an engine be running in back motion, unlatch lever, and hold the latch with your hand to prevent dog dropping in quadrant, and give the links a chance to assume the position they would take if reach-rod broke, and I think you will find engine will drift right along, and if throttle was opened on an engine in condition described by J. A., the engine would be given an impetus in the direction it was running, same as if reach-rod had not broken.

*Newton, Kan.* W. R. Scott.

[When engine is running in back motion, it is the friction of the eccentrics that causes the pull-back of the lever—the tendency is for this friction to lift the eccentric-rods and link up. In running ahead, the friction acts in the same manner to pull them ahead. This pull, then, depends upon the fit of the straps on the eccentrics and the speed at which they are moving. If running fast, they might stay up, but when a slow-down was made, they would be very liable to drop ahead, unless held by a strong counter-balance spring or excessive friction somewhere. —Eds.]

### A Relic of Old Times.

*Editors:*

I have a plumb bob that was turned out of a pump plunger of the first English engine owned by the Philadelphia & Reading Railroad.

It was turned by Tom Barnett, formerly one of the first engineers in the company's employ. He quit the road and ran a brass lathe in the shop at Reading. He turned it and gave it to me in 1846. I was working there at the time as a machinist.

*Newton, Kan.* John Bourne.

### How Jackson Clark Knew He Had Lost a Main Tire.

*Editors:*

While looking at the article in the *Master Mechanic* about the wide firebox engines on the D. L. & W. R. R., it reminded me of times "en durin' de wah," and the names of the six "Smith & Jackson" engines was wonderfully refreshing to the memory of one who was there, and it called to my mind a circumstance that was somewhat amusing at that time.

Old Man "Jackson" was running the "Pennsylvania" on a coal train from Scranton to New Hampton Junction, and Gordon was firing for him. After they left Moscow, going towards Lehigh Summit, at the "Big Fill" one of the tires (it was cast-iron with chilled surface) broke, and left the wheel without doing any further damage, and it was not noticed until they got to Lehigh Summit, and then only when the old man went to oil around. These engines had six wheels connected, no truck, and it was the tire on main wheel, left side.

This occurrence caused much "roundhouse talk" among the engineers, all wondering how anyone could be so dumb as not to know when he had lost a tire, and a main one at that; and there was a plug-puller named Colvin who ran opposite to "Old Man Jackson" (kinder mean cuss), who did not have that brotherly feeling, such as is attributed to the man of Nazareth and other men we read of. He told Johnny Roach, a roundhouse man, that Jackson would not have missed the tire when he did if it had not been for a wood-chopper that come along with an axe on his back where Jackson was oiling, and asked him "Why he did not have one of *them things* on that wheel same as the others?"—and would you believe it, that made the "Old Man" real angry.

*Scranton, Pa.* James Hicks.

### Who is Neglecting His Work?

*Editors:*

I am employed by a certain railroad company, and my run calls for some careful air-brake work over a portion of the road, which is quite hilly.

We haul thirty loads for a train with heavy consolidation engine, and frequently we haul from eight to fourteen cars equipped with air on the head end of our trains. The engines are kept in good condition, as far as the brakes go, and they are expected to hold the train everywhere necessary. Brakes generally seem to be working all right before leaving, but when a stop is attempted, they are found to be almost useless. Brake-shoes badly worn, and so much slack in brake rigging that, were it not for the engine brakes, the train could wait for the friction of the journals and gravity alone to stop it.

When you have a set of brakemen not over anxious to get out on top in a stormy night, and must stop at a grade crossing

at the bottom of a steep hill, the "throttle-jerker" does a mighty lot of guessing as to whether he will make the stop or go in the ditch at the interlocking switch. Who is to blame for the brakes on these cars not being in proper order? E. F. H.

*Scranton, Pa.*

### Engineer's Brake-Valves that Work Hard—A Cure.

*Editors:*

The trouble with engineer's brake-valves working hard, as complained of by Fred. B. Armstrong, in your paper of October, 1893, is not on account of the lubrication or the kind of oil used. By referring to plate D 8, Fig. 1 (which is the valve he speaks of), you will see the joint for stem 11 is made by the leather gasket No. 12. This gasket gets worn so it allows the flat surface on the stem 11 to touch the under side of the nut 2; it is made so that the outside edge touches first, and they soon make a joint by working together. This gives an air pressure on such a large surface that it makes the lever work very hard. In every case I have relieved the trouble by putting in a new gasket or putting a piece of pasteboard under the old one. C. F. MILLS.

*Florence, Kan.*

### "Where Did This Air Come From?"

*Editors:*

I was called to go out, and when I got to the engine I found the pump working and air blowing through train-pipe exhaust port. I could stop it only by putting valve on lap, and when restored to running or release position, it would blow as before. I thought something was wrong with piston 17 to prevent it from seating. I took the valve apart and found piston 17 O. K. I put it up, and it worked same as before; could get no pressure, of course. When coupled on to train, and ready to pull out, I discovered the cause of the trouble and fixed it, and went on my way rejoicing. What was it? W. C. WESCOTT.

*Albert Lea, Minn.*

### Those Air-Pump Disorders.

*Editors:*

In answering Geo. Bailie, of Topeka, Kan., I think that the trouble with air-pump No. 1 was a worn reversing-valve plate—that is, the plate was worn on the bottom very badly where the button or knob of the reversing-valve stem strikes on the down stroke. Such being the case, the reversing-valve would not be drawn down far enough to make the pump work properly. In answer to problem No 2, I think the steam port between reversing-valve bush No. 19, Plate D 6, and reversing cylinder No. 22 was stopped up with a piece of gum washer or something, preventing steam from getting on top of reversing piston No. 23. If such was the case, main valve would be lifted up, allowing steam to enter through steam ports in upper main valve bush No. 25, to the top of main steam piston 10, and the piston would be forced down and reversing-valve would uncover the end of the port leading to top of reversing piston, but if the port was stopped up, the reversing piston and main valve would remain up, preventing steam from getting under main piston to lift it; consequently, there would only be one stroke, and that would be downward.

While I am talking about pumps, I would like to say a few words against the oiling of pumps through the receiving-valves, which I think should never be done unless the oil passage is closed up from air-cylinder oil-cup. I caution engineers and firemen about it, but I often see them with the tallow-pot lid partly full of stuff called oil or lubricant, dosing the pump through the bottom valve chamber. All the oil should go through lubricator and air-cylinder oil-cup. It will go then direct to the pistons, where it should go without passing through the receiving-valve. Putting oil through the valve will cause it to become gummed up, so that it in many cases will stick to its seat, preventing air from being drawn in, thereby causing the pump to pound on the stroke towards the gummed-up valve, supplying only about half the amount of air that it should, and jarring the piston loose.

The air-valves, in my estimation, need no oil, and the pistons very little at a time—just enough to keep them from making a noise—and the oil should be the right kind, too. In choosing oil for the lubricator, for steam end, it is not nearly so particular, as the steam will cut it up and carry it through, leaving no gum. Any one who will give the subject a little study will readily see that as the receiving-valve has only the atmospheric pressure to lift it, and being only an inch in diameter, it has an area of only .7854 of a square inch exposed to the atmospheric pressure. This, along with loose packing rings, which do not produce a very effective vacuum, is almost sure to make the valves stick. The discharge-valves will not stick because they are forced open by the action of the steam on the steam piston.

FRED. B. ARMSTRONG.

*Camden, N. J.*

### Angle-Cocks—How to Tell How Much Air is Coupled Up—Oiling Air Cylinder—The Air-Brake Puzzles.

*Editors:*

LOCOMOTIVE ENGINEERING right on time, and contents perused, as usual, with care and pleasure. I have made the Westinghouse air-brake a study for the past four years, and with our Texas friend find my only "kick" is in the stop or angle-cocks at ends of train-pipe. With the army of unemployed men now roaming the country, there are, doubtless, many who, in "beating their way," have been put off by trainmen. There are doubtless many with such evil dispositions that will be fiendish enough to wait until air has been tried at terminals, and under cover of darkness when train starts, slip in between cars and shut off cock. There is many a wretch, in the disguise of a man, who knows enough to do such a dastardly deed. If trainmen and air inspectors were equipped with a handle each (and handles on cocks were taken off), they would soon become so proficient in their use that there would be really no more delay than at present in turningthe handles.

Another thing about these same stop-cocks I do not like is, that cars equipped with plain triples have handles on stop-cocks working just the reverse, to open or close cocks, to cars having quick-acting triples. The former, when cock is open, handle stands at right angles to train pipe; the latter, when open, is in direct line with train pipe. No matter how careful a brakeman is, once in a while he will (unless he looks at slot in plug) turn one of these handles wrong; of course, if an engineer is watching, and understands by the pressure he has lost in coupling up, and by the working of his pump, just about how many cars are coupled, he can instruct brakemen to look for cock turned the wrong way; or if he "tries the air" every time cars are picked up, he can tell by exhaust from brake-valve just about how many cars of air are coupled up. But as it is not always practicable to do this; it would be far safer if all stop or angle-cocks turned the same way. I have, several times, sent brakemen back to open cocks that they were positive they had opened, and were surprised to find I was right. I can always tell, within two or three cars, just how many cars of air I have coupled, and the brakeman knows this, and does not attempt to dispute me, but goes right back. A good many runners, who are not very observing, and consequently not so sure how many cars of air they have coupled, sometimes have to nearly quarrel with trainmen to get them to look over train twice; and if these handles were all put on plugs the same, time and accidents would be saved and harmony would prevail. This is a good subject for our "air-brake men" to discuss.

I would like to ask any engineer to whom the question may apply, why they run their air-pumps so fast, when as a rule there is no necessity for it? It only serves to burn the pump up and therefore to wear it out. It is all right to run the pump at a fair speed, but if oil is kept out of air-cylinder and piston is kept packed, and connections kept free of leaks, it is surprising how moderately a pump can be run, and still supply air to forty or fifty cars. I have been running an engine on these long trains for three years, and she was run a year before I got her, and the same pump is on her yet, and all the work that ever has been reported is "lift of air-valves reduced" once. Engine is now in shop for overhauling, but pump is as good as ever. Air-cylinder has not had oil more than a dozen times in four years. I use a little of the oily water out of lubricator every two days. Our trains are all heavy ore trains, the grades very steep, and we never have less than thirty-five cars of air. It would be only fair to state, however, that air is well kept up on cars, that piston travel of brakes rarely exceeds seven inches, and that we only carry sixty pounds of air, train-pipe pressure.

In answer to W. N. Horton's "Curious Brake Action," would say that graduating spring in one of the quick-acting triples was either weak or broken, allowing triple-valve to move far enough to open port on top of emergency piston; air pushing it down, of course, carried emergency-valve away from its seat, and this brake went on quick action, and of course the rest had to. Still, with ninety pounds reservoir pressure and only eleven cars of air, train should have charged up to at least sixty-five pounds unless main reservoir was very small. In answer to Paul Synnesvedt's question of safety, would say that I would not care for a quick-acting triple-valve on tender except in passenger service. As in switching, hostling, etc., on a freight or switch engine, quick action would be used so often that wheels would be injured. Think in passenger service a quick-action brake on tender would be proper. As to the large feed-groove on tender triples, it should only be used on passenger trains where train has to be charged quickly; as if it is used on long freight trains, tender auxiliary will charge first, and when air equalizes tank-brake will set.

We have at different times on this road had same trouble with engineer's valve, as W. F. Relyea mentions, and found packing ring on graduating piston a little too strong or stiff. This ring must be adjusted with care, as if joint opens too much air can get out of train-pipe through joint as fast as through preliminary exhaust port, consequently piston won't raise, and if ring is too stiff and joint butts together, it won't raise either.

The air-brake men have a grand field before them. They have my best wishes for success, and are welcome to any assistance I can give.

L. D. SHAFFNER.

*Anaconda, Mont.*

### The New Equalizing Discharge Valve.

*Editors:*

In the August number Geo. Holmes gives a good illustration of the difference between old equalizing discharge valve and the new pattern with reducing valve attachment. For my part, I cannot see any benefits that can be derived from the use of the reducing-valve attachment. In fact, many things can be done with valve equipped with feed-valve, Fig. 5, Plate D 5, that cannot be done with valve equipped with reducing device. On a freight train, for instance, composed of from twenty-five to fifty cars, train breaks in two, engineer blanks valve, to accumulate sufficient pressure to release brakes; but owing to governor being attached to main reservoir, can only get about 90 pounds. This is not enough to release the brakes, and he has to stand till brakes are pumped off or have trainmen bleed cylinders. If some switching is being done, and a few switches have been made while holding on to a number of cars, pressure has been reduced in train line below the maximum; owing to the equalizing device you have no excess pressure to insure a prompt release of the brakes. You may also want to pick up eight or ten cars whose auxiliaries are not charged with air. They are coupled on to those already charged, with the same result as breaking in two; wait till the pump can help you out.

The advocates of the valve will say you should make several applications in backing down to couple on to those cars, and in place of equalizing your reservoir and train-line pressure each time, just let enough back to throw the triple, and then move brake-valve to lap. In this way you reduce train-line pressure and will be able to release the brakes. What a waste of air to help out the reducing-valve! and then too this device was got up to prevent brakes creeping on, caused by leaks in train. If you lap brake-valve when you are going to couple on to those cars, you will have to arrange with the brakes not to creep, otherwise you will have no excess pressure. With brake-valve containing feed-valve and excess pressure regulated by feed-valve spring, and governor on train-line, these precautions would not be necessary. In case of break in two, sufficient pressure can be acquired in main reservoir to release all brakes and enable engineer to get train moving as soon as train is coupled up. On roads where trains are numerous this might prevent a rear-end collision. With brake-valve containing feed-valve attachment, engineer can make any number of switches and still retain the excess pressure regardless of how much train-line pressure has been reduced, and can pick up quite a number of cars not charged and not have brakes stick, and not have brake-valve on lap either, although the latter is a precaution that should be taken.

There is another bad feature about the reducing-valve, the feed-valve may be held off its seat by dirt and allow main reservoir pressure in train line. This pressure in the hands of a careless individual would probably result in some slid wheels. The same thing would obtain when warning port in brake-valve gets stopped up so handle can be carried in release position without engineer's attention being attracted by escaping air. Constructively, without the reducing-valve attachment, the new valve is a marked improvement over all the preceding ones. The reducing-valve, I believe, is retrogressive and will not prove to be a successful feature of the brake-valve. Its object, as stated, to allow engineer to carry brake-valve handle in running position no matter how bad the leaks in train line, is nothing more than feed-valve will do. With the new device no excess pressure can be obtained with brake-valve in running position until maximum pressure in train-line has been obtained. With a leaky train of twenty-five or thirty cars, the average pump will hardly compress sufficient air to enable you to get the excess pressure, and if you don't you might just as well have your brake-valve in release position; not so with the feed-valve. If your train leaks so you can only get 40 or 50 pounds in train-line, you can carry brake-valve in running position and have 20 pounds excess pressure in main reservoir. "Oh, yes," the Westinghouse people will tell you, "we know it can be done, but how many of your engineers will carry brake-valve handle in running position with the old equalizing valve?" If they don't carry it in running position with the old one, they won't do much better with the new one. Better inaugurate a campaign of education than try to overcome ignorance with mechanical devices.

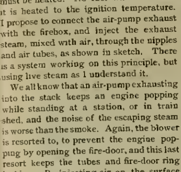
*Newton, Kan.* W. R. SCOTT.

### Something About Smoke.

*Editors:*

We are taught that smoke is the unconsumed parts of fuel, principally carbon. Wye Williams's theory is to prevent smoke by a perfect combustion of the fuel or its combustible gases. What finer illustration have we of perfect combustion than in the ordinary kerosene lamp? Well, smoke is a nuisance, and might be abated when we find out just the right way to do it. If it is burnable, let us try to burn it. If we can get *enough* heated air in contact with the gases, smoke is prevented; but the air must be heated. No fuel will burn until it is heated to the ignition temperature. I propose to connect the air-pump exhaust with the firebox, and inject the exhaust steam, mixed with air, through the nipples and air tubes, as shown in sketch. There is a system working on this principle, but using live steam as I understand it.

We all know that an air-pump exhausting into the stack keeps an engine popping while standing at a station, or in train shed, and the noise of the escaping steam is worse than the smoke. Again, the blower is resorted to, to prevent the engine popping by opening the fire-door, and this last resort keeps the tubes and fire-door ring leaking. By injecting air on the surface




of the fire we dispense with the evils of the blower and noise of air-pump, and possibly get rid of some, if not all, the smoke. Fig. 1 shows a 2-inch pipe with elbow at end of pipe and tees to suit the air-tubes through water space. *A* is a piece of 2¼-inch pipe about 8 inches long, and screwed on the injector-pipe *B* near the first nipple. (The number of nipples being optional.) The air-pump exhaust-pipe *D* enters the piece *A*, leaving an air inlet *C C*, in the form of an injector. By taking in a portion of the air at this point, it gives us a chance to raise the temperature before forcing it into the firebox. Fig. 2 shows another design or scheme to get hot air into the firebox. *A* shows the arch-brick, *B* is a piece of 1-inch pipe put in the brick at the time it is moulded. When the arch is put in, these pipes are to correspond with the air openings in leg of boiler. Knowing that the arch is about as hot as anything about the engine, we know that air forced through the pipe *B*, would be of a very high temperature, giving us a chance to get our work in on the smoke. I have no patented interest in this system. Use it if you want to.

*Indianapolis, Ind.* W. de Sanno.

### A Valve Out of Order, with Nothing the Matter with It.

*Editors:*

There recently came under my notice a very interesting experience with air-brakes, which is so instructive I cannot let it go unpublished. It was told me by Mr. Hedendahl, air-brake man on the U. P. R. R.

An equalizing discharge-valve of the 1890 pattern was found to act very queerly every time it was coupled to a certain train of passenger cars, while with the lone engine or any other train it seemed to work all right. In reducing pressure in the service application the blow-out of the train-pipe exhaust would first open for a time, then close for a couple of seconds, and then open again and continue to blow as long as air was allowed to escape from the equalizing reservoir. The action was not intermittent, but, on the contrary, only occurred once during each application of the brakes.

The valve was very carefully examined and found to be in first-class condition, there being no gum or dirt anywhere. The conclusion was very manifest, therefore, that the trouble was in the apparatus on the train, and so it was found to be after a little experimenting.

The engineer was instructed to set the brakes several times, while the doctor went back and watched the action of the valves under the cars. One of the triple valves was tardy in setting, and then, when it did set, applied with quick action. Here, then, was the cause of the trouble. This action made a sudden reduction in the train-pipe of about 20 to 30 pounds, which, of course, caused a seating of the equalizing discharge valve until the pressure in the upper cavity was again reduced below that left in the train, when the valve opened again, and thenceforth continued to blow until the handle was moved to the lap.

This case is one of the most striking on record to emphasize the fact that each and every part of the brake is dependent on each and every other part. That a defect in one part may show itself in another with which it seemingly has no connection. The engineer's valve was out of order, not from any fault of its own, but because the triple valve was not working properly.

*Chicago, Ill.* Paul Synnestvedt.

### Testing Air-Brakes.

*Editors:*

A bad wreck occurred to a passenger train a few days ago, and the account given in the daily papers attributed the cause of the accident to a failure of the air-brakes. The superintendent of the road was interviewed by a reporter, and his statement was that the train stopped at a junction about a mile from the place where the wreck occurred, and there the brakes were tested and found to be all right; that it was down grade from there to the scene of the accident. The engineer had the speed of his train pretty well controlled, but on nearing the station he saw the train he was following standing there, and attempting to apply his brakes, found they would not work. He whistled for brakes, and the conductor opened his valve in the passenger coach; but "the brakes would not work," and a serious collision occurred. The officials were mystified, and the engineer stated that he had never before known of such peculiar action of the brakes.

Car inspectors usually test brakes by seeing that they all apply, and then signal the engineer to release them; then, if they don't all release automatically, the inspectors bleed them off and it's no test at all, for the engineer should be able to apply and release all brakes in his train if they are in good condition. Now, suppose that the engineer had tested his brakes at the junction by an emergency application and exhausted all, or nearly all, of his train-pipe pressure; the inspector gave him the signal to release the brakes, and he pushed his valve-handle around to the left; but being hurried, suppose that he only moved it as far as the "lap" notch. When the spring brought up against the shoulder he may have thought he had struck the release position. The inspectors were in a hurry to get the brakes off and the train out; thought the engine didn't have air enough to knock the brakes off, and they may have bled every auxiliary reservoir in the train. If the engineer's valve was of the 1890 pattern, the black hand could have registered a good pressure in the train-pipe if there wasn't an ounce of air in it. It isn't very far from lap to running position, and the engineer may never have noticed it, and when he tried to apply his brake he didn't have the stuff to do it with.

This theory may explain why the Westinghouse Company have made their brake-valve of 1892 to empty the small reservoir when handle is at emergency—in order that the gauge may not register a train-pipe pressure when there is none.

But I wonder why the duplex gauge is connected as it is with the new valve. There is no more use of gauging the main reservoir pressure than there is of gauging the signal line—not as much. The governor regulates the main reservoir pressure, and when you want to know if it cuts off steam from the pump at the right pressure, just place the brake-valve handle in full release position, and the black pointer will tell you by registering main reservoir pressure. I believe a better way would be to have the red hand indicate direct train-pipe pressure, and not gauge the main reservoir. Then it would be unnecessary to waste the air from the valve reservoir in an emergency application, and the engineer would always know just exactly how much pressure there is in the train pipe.

Speaking about testing brakes, I was passing through a coach yard the other day, and stopped to look at a new coach just out of the shop. While I was there, two car inspectors came along to test the brake, triple-valve, signal-line, etc. They had a hand force-pump with hose attached. Connecting it with car hose they pumped up a pressure, and then tested the triple-valve—plain triple—*by turning the four-way-cock handle to straight air*, of course the brake applied. Then they turned it back to automatic, and what knocked me out—the brake released. They had stopped pumping when they began testing and the train-pipe pressure under the one car after being reduced by filling the brake cylinder was sufficient to force up the triple and release the brake. When the four-way-cock handle is turned to straight air, the pressure below triple piston escapes through the exhaust ports and the piston falls, until the slide-valve pulls down far enough to close the exhaust port; and the fact that the brake released immediately on turning the handle back to automatic, would lead one to think that the auxiliary reservoir had not been fully charged. This is one way that air-brakes are tested, but the two men appeared satisfied and disconnected the hose and went away.

*Terre Haute, Ind.* Will W. Wood.

[Our correspondent is misinformed about the train being inspected so near the wreck.]

### That Sticky Engineer's Valve.

*Editors:*

Mr. Fred. B. Armstrong, of Camden, N. J., inquires through the columns of your valuable journal what causes the Westinghouse equalizing and discharge valve of the old pattern at certain times to stick and handle hard. I can say that I have had the same trouble with the valves, which is nothing more than friction, caused by wear. The trouble can be overcome by rounding the corners of the ports of rotary valve and seat and grinding them with powdered glass and put tallow on. That friction is overcome on the '92 valve by the seat being of iron.

S. G. Ogden,

*McComb City, Miss.* Ill. Cent. R. R.

### Answers to Air-Brake Questions.

*Editors:*

Pump No. 1.—Reversing piston stem was broken off close to head. It had been running in that condition for some time, but on this particular occasion, and at end of upward stroke, the piston cocked itself and refused to descend when pressure was applied above, through action of reversing valve; hence it is plain to see why main piston stopped.

Pump No. 2.—By close scrutiny, Mr. Wright noticed that the reversing valve bushing had the appearance of having been recently renewed. He thought possibly it might have been improperly fitted, so removed it. Upon examination, file marks were plainly discernible, showing that the bushing had been found to be a little too large for its fit, and was reduced by hand filing. As a result, an untrue surface was produced, causing the bushing to bear in spots on the wall of its cylinder.

The course of the steam could be easily traced from the live steam port, between the bushing and its fit, to the small exhaust port provided for the escape of the exhausted energy above the reversing piston. The action of the steam had made slight depressions in the surface of the bushing fit.

When the live steam reached this bushing, enough passed directly to the exhaust passage to make deficient the energy required to reverse the main steam valve.

The top head was swung in the lathe, the bushing fit trued up, new bushing put in, after which pump worked properly.

*Topeka, Kan.* Geo. Bailie.

### Those Rules that Can't Be Lived Up to.

*Editors:*

I have noticed in your columns a statement, sometimes direct, at others implied, by your correspondents. It is one very many accept of and advocate. It is that the laws governing the practical operation of railroads embraced in their book of instruction cannot be followed in all cases successfully by employer or employé.

For the general enlightenment of your readers, will you invite a short statement, comprising a synopsis of case and number of rule that could not have been obeyed, that has come under the observation of your subscribers. As the rules on the majority of roads are about the same, a glance at instruction book would enable those interested to follow.

*Jersey City, N. J.* L. W. Evans.

[Cast-iron rules about not exceeding certain speeds, and then train orders that invite higher speed in order to get over the road, without authority to run it, will be considered as very common practice. We hope our correspondents will mention any others that may come under their notice.]

### Good Advice to a Young Man.

*Editors:*

I would like to advise the young man who, in asking for advice on page 761 of the October issue of your paper, signs himself "J. B. R., of Indianapolis, Ind.," or any other young man who is anxious to learn and willing to devote some of his spare time to study, to take a course of study in the "Correspondence School of Mechanics," of Scranton, Pa. I believe it to be just what he needs, and in my dealings with them have found them to be reliable parties. M. E. Watts.

*West Nanticoke, Pa.*

### That Cylinder-Head That Was Knocked Out by Compression, Again.

*Editors:*

Mr. Charles A. Greene asks in the October number how I managed to keep steam in the cylinder until compression ran up to 1,920 pounds.

Perhaps Mr. Greene don't remember that it often happens that a piston travels as much as 16 inches without any port opening whatever "on the other side;" and sometimes engines run ahead while in back gear; and that there are in use such things as balanced-valves, where the pressure "on top" is very little instead of "150 square inches," being exposed to a pressure of 80 pounds or more per inch.

*Waycross, Ga.* A. A. Brown.

### Those Pump Disorders.

*Editors:*

Under above heading, I see Mr. Bailie, of Topeka, puts two problems:

Pump No. 1. The probable cause in this case was the reversing plate was very badly worn, or more probably was loose on the piston, consequently on the bottom of stroke the valve stem wouldn't get movement enough to move reversing valve

Pump No. 2. If the main steam-valve stop was broken it would, I believe, cause the pump to work in the manner described.

*Raton, New Mexico.* W. Upward.

# Car Shops and Car Builders.

### A Sleeping Car Used in 1840.

One of the best-informed men in the country concerning details, past and present, of railroad rolling stock is Dr. Williams, of the Baldwin Locomotive Works. Dr. Williams has an exceptionally retentive memory, and can relate with accuracy particulars of things he has seen away back in his boyhood. A peculiarity about him is that he remembers things *accurately*, a very rare characteristic with reminiscent people. Those who are interested in the development of the American railroad car will read with pleasure the following extracts from a letter written to us by Dr. Williams

"In the October number of your paper, page 457, you make an inquiry as to the construction of the first sleeping car. Now I cannot answer that question, but I can give some information which may be interesting Some time when you are here I will show you in our model-room a little model of a car constructed on a scale of three-quarters of an inch or thereabout to the foot, which has on it the following legend 'Made by Richard Imbrey and Jacob Dash, car builders, Bush Hill, Philadelphia, built in 1840.' This model has been in our possession ever since I first knew the Baldwin Locomotive Works, years before I became connected with it, and very soon after I first heard the subject of a sleeping car mentioned.

"Our late Mr. Parry told me that this car was modeled from one constructed for the Cumberland Valley Railroad, at the time that it connected with the canal at Harrisburg and the National road—a highway of which you undoubtedly have knowledge—extending from Washington to Wheeling, in Virginia. He said the car was run regularly on trains, and that a charge of fifty cents, in addition to the regular fare, was paid for its use There were two tiers of berths, the lower extending like sofas along the sides of the car, and the upper folding against the side. They were covered with leather, and the person in charge informed passengers that they were not permitted to get into the berths with their boots on, because the car was a very expensive affair, costing not far from $800.

"With regard to the fact of the car running I have no knowledge, but this one thing I do know, that the model evidently dates back beyond any car built in New England. In this connection, there is another interesting feature. Alba F. Smith, at that time general superintendent of the Hudson River Railroad, patented, in 1860, the raised roof for passenger cars. This model has a raised roof, and on the car is the legend, in addition to the one I quoted above, as follows: 'They made car "Victory" with a raised roof in 1834.'

"I frequently talked with Mr. Parry about this matter, and his mind was always perfectly clear in connection with it. I think the model came to us, together with a lot of patterns and other things which Mr. Baldwin at one time purchased from Richard Imbrey."

### Hot Car Boxes.

"Those who are anxious to avoid trouble from hot boxes ought to keep a sharp lookout on the gang that works on trucks," said Mr. Bronner, of the Michigan Central, at a recent meeting of the Central Railroad Club After it was certain that the trucks are put together square and the weight evenly distributed on the wheels, the boxes are in a fair way to run cool, and the wheels to wear out without cutting the flanges. To keep the boxes running cool they ought to have good brass bearings well fitted, and they should be started with a thin lining of soft metal. The box should be filled with wool waste saturated with good oil. These were Mr. Bronner's remedies for hot boxes. Our private opinion is that they cover the whole field. If all trucks were well made, the bearings properly fitted, and good lubricants employed, hot boxes would be unknown, unless attempts were made to have the bearings carry a load away beyond the cool limit. What we see on a good many roads, however, is trucks thrown together by hazard, the poorest kind of brass for bearings, with no attempt at fitting, and the axle-boxes anointed with the worst oil to be found in the market because it is the cheapest, and then all concerned are mystified because hot boxes are common and cannot be cured.

### Disputes in Car Interchange.

The St. Louis & San Francisco had to change worn-out wheels under a car belonging to the American Live Stock Co., and put in axles with journals 3½ x 7 inches, although there was stenciled on the truck axles 4 x 7 inches. It was held that the journals of the axle removed were worn down to 3½ inches diameter, and that therefore, those put in were as good as those taken out. But the stock company refused to pay for the new wheels on the ground that the axle put in was too small. The contention was advanced that as the axles were originally 4 x 7 inches, and as that size was stenciled on the truck, no smaller size ought to have been used. On the case going to arbitration, it was decided that the San Francisco company were not required to put in a larger axle than the one removed. Also, that stenciling a size on the truck had no bearing on the case.

A rather interesting dispute lately arose between the Richmond & Danville and the Alabama Great Southern concerning a broken drawbar. The former road had carded a Lake Shore car delivered to the Alabama Great Southern for a cracked Hinson coupler. The latter road renewed the coupler, and charged the Richmond & Danville the cost of a complete coupler. This charge was objected to on the ground that the full charge included the knuckle which was not broken. The repairing road replied that the repairs had to be made with a form of coupler which took a steel knuckle, and that the malleable iron knuckle would not fit, consequently it was good only for scrap On the dispute being referred to the Arbitration Committee it was decided that the carding company were not responsible for the knuckle when it was not broken.

Another curious dispute about a drawbar was settled. The Choctaw Coal Railway carded for a wrong draw-bar a car delivered to the San Antonio & Aransas Pass The latter company applied a new draw-bar and charged the carding company 40 cents for labor. Payment of this was refused on the ground that the wrong draw-bar was of malleable iron, and it had been replaced by one of cast iron. Instead of paying the 40 cents the claim was made for $1.30, because the malleable iron draw-bar removed was worth more than the cast iron one put in. The Arbitration Committee decided that the claim for $1.30 on account of the removed draw-bar being malleable iron was not fair, and that the charge of 40 cents for labor was all right.

A dispute arose between two roads about the value of a car that had been entirely destroyed in a wreck. The settlement is well worthy of attention. A car belonging to the Louisville, Evansville & St. Louis was destroyed on the Cleveland, Cincinnati, Chicago & St. Louis. A bill was sent in for the value of the car, less 6 per cent. yearly depreciation for three years and ten months. A question arose about the age of the car, and confession was made that the body of the car was built in 1889 to replace one totally destroyed, but that the trucks were old ones rebuilt equal to new. The C. C. C. & St. Louis refused to consider the rebuilt trucks as new, and the case went to arbitration. The decision was that the body of the car should be paid for with the depreciation for three years and ten months deducted, but that the deduction for depreciation of the trucks should be made from the time the trucks were originally built.

The New York Central carded a car belonging to the Cudahy Packing Co. for a wrong draw-bar, and when the repairs were made a charge was sent in for bolts and nuts used in applying the proper draw-bar. This part of the bill was disputed, and the case went to arbitration. The decision was that a charge for bolts and nuts is not admissible. The Cudahy Packing Co are becoming noted for raising disputes that have to be appealed to the Arbitration Committee.

**CHART for Ascertaining the Amount of Power Required or in Use on a Passenger Car with 10-inch Brake Cylinder, Hodge System of Levers, 4½ and 4 to 1 Truck Levers, 4-Wheel Trucks, and One Brake Beam to Each Pair of Wheels.**


| Westinghouse figures, representing total braking power, per hole | Multiply original power by distance to fulcrum, divide for power received by distance from fulcrum to Hodge lever hole used. | Power obtained or strain on Hodge lever rod | Proportion of Hodge lever | Pull on top end truck lever. | Proportion of truck lever | Power on each pair wheels | Number pair wheels | 90 per cent braking power | Total weight of coach on rail |
|---|---|---|---|---|---|---|---|---|---|
| 28,600 | 4.700 x 12 / 17.75 | 3.177.46 | ÷ 2 = | 1.588.73 × | 4<br>4½ to 1 | 6 354 92<br>7.149.28 | × 4 = | 25.419.68<br>28 597.14 | or 28.244.08<br>or 31.774.6 |
| 30 800 | 4.700 x 12 / 16.50 | = 3.418.18 | ÷ 2 = | 1 709.09 × | 4<br>4½ to 1 = | 6.836.36<br>7.690.90 | × 4 = | 27 345.44<br>30 763.62 | or 30 383.8<br>or 34.181 8 |
| 33 300 | 4.700 x 12 / 15.25 | = 3.698.36 | ÷ 2 = | 1 849.18 × | 4<br>4½ to 1 = | 7 396.72<br>8.321.31 | × 4 = | 29.586.88<br>33 285 24 | or 32 874 3<br>or 36.983 6 |
| 36.200 | 4.700 x 12 / 14 | = 4 028.57 | ÷ 2 = | 2.014.28 × | 4<br>4½ to 1 = | 8 057.14<br>9 064.28 | × 4 = | 32 228.56<br>36.257 13 | or 35.809.5<br>or 40 285.7 |
| 39 800 | 4.700 x 12 / 12.75 | = 4.423.52 | ÷ 2 = | 2 211 76 × | 4<br>4½ to 1 = | 8.847.04<br>9 952 92 | × 4 = | 35.388.16<br>39 811.68 | or 39.320.1<br>or 44.335.2 |
| 44.000 | 4.700 x 12 / 11.50 | = 4 904.34 | ÷ 2 = | 2 452 17 × | 4<br>4½ to 1 = | 9.808.68<br>11 034.76 | × 4 = | 39.234 72<br>44.139 06 | or 43.594.1<br>or 49 043 4 |

Strain on fulcrum is original power at one end, added to power obtained at the other end.

Brake cylinder pressure or original power.

INSTRUCTIONS.

The pressure is 4.700 pounds at brake-cylinder, and the leverage from there to fulcrum remains constant, power being increased or diminished by shifting position of Hodge lever-rod. The strain on this rod should be 10 per cent of the total weight of coach with 4½ to 1 truck levers, this multiplied by 9 should be 90 per cent. of the total weight of coach.

Half the pull on Hodge lever-rod is strain on top end of truck lever in any case, 4½ times this strain is the pull on one brake beam; 2 25 times strain on Hodge lever-rod should be the same, and 4 times this should again be 90 per cent. total weight.

Where truck levers are 4 to 1, twice the strain on Hodge lever-rod will give power on each pair of wheels; 4 times strain on top end truck lever the same, 4 times this is 90 per cent total weight. 8 times strain on Hodge lever rod also 90 per cent. This sum divided by 9 and multiplied by 10 should be total weight of coach.

Standard 4 to 1 truck levers measure 28 in., 21 on long end and 7 at short end. Short end divided into total length gives proportion of truck lever, 28 ÷ 7 = 4.

Standard 4½ to 1 truck levers measure 36 in., 28 on long end and 8 at short end. Short end divided into total length gives proportion of truck levers, 36 ÷ 8 = 4½.

AIR BRAKE LEVERAGE CHART, USED BY GEO. HOLMES, AIR BRAKE INSPECTOR OF THE NORFOLK & WESTERN R. R.

The Peoria, Decatur & Evansville applied some brasses to a car belonging to the Terre Haute & Indianapolis, and, according to Rule No. 8, made a charge for the amount of brass used, giving credit for scrap. Heavier brasses than those used by the T. H. & I. were applied, and the latter company objected to the charge on the ground that too much brass had been charged. The company applying the brasses replied that the actual quantity used was charged for, but the other company insisted that they had no right to pay for more weight than their own standard brass. On the case going to arbitration, it was decided that the charge was correct and ought to be paid.

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A dispute arose between the Philadelphia & Reading and Lake Shore companies concerning the proper charge for a broken Janney coupler on a car that was carded by the latter road. Against this card the Reading people made a bill for $12.50, and the Lake Shore people held that the manufacturers' price was $10. The case had to go to the Arbitration Committee for settlement, and they decided that $10 was the correct charge.

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An extraordinary dispute arose between the International & Great Northern and the Houston & Texas Central people concerning a question as to whether brake-beams and rigging belonged to the body of the car or to the truck. The latter road repaired trucks of one of their own cars, carded by the I. & G. N., and sent in a bill for the work done, which included a charge for four brake-beams complete. The carding road refused to pay for the brake-beams, on the ground that they had settled for the car body, which was destroyed, and that the brake-beams belonged to the body of the car. The H. & T. C. insisted that the brake-beams belonged to the truck, and the matter went to arbitration. The Arbitration Committee decided on the common sense ground that a truck is not complete without the brake-beams, and, therefore, held that the charge was correct.

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A dispute arose between the Choctaw Coal & Railway Company and the St. Louis & San Francisco concerning a charge for axles. The first named company had repaired some of the latter company's cars, and put in new axles for which they charged $10 each. The San Francisco people objected to the charge, and said that according to the Master Car Builders' rules it ought not to be $10 unless the car were 60,000 pounds capacity, while the car in question was only 50,000 pounds. On the case going to arbitration it was pointed out that the latest edition of the Master Car Builders' Rules of Interchange provide two charges for axles. Cars of 60,000 pounds capacity have the axles charged at $10, those of 40,000 pounds capacity are charged $9. As the car that the dispute was about was of 50,000 pounds capacity, the committee decided that the charge of $10 was correct, although the rules did not specify the exact charge.

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That fertile subject of dispute, the amount to be deducted for depreciation for a destroyed car, led to a quarrel between the Chicago, Milwaukee & St. Paul and the J. I. Case Threshing Company. A car belonging to the latter company had been destroyed on the C. M. & St. P., and the railroad company decided to settle for the car. The car had originally been built in 1885, but it had been repaired and air-brakes applied in 1892. The railroad company were willing to pay the cost of the air-brake equipment, and then figure the depreciation from the time the car was originally built. The owners of the car wanted to charge the expense of the repairs effected a year ago, and the railroad company would not agree to this. On the case going to arbitration, it was held that the railroad's position was correct. A great many disputes have arisen on this question, and always have been settled in the same way. It is about time that the owners of cars were beginning to understand that depreciation stands against the car from the time it was originally built, and not from the time it received repairs, no matter how thorough the repairs may have been.

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A car belonging to the Northern Central was destroyed by the Pittsburg, Shenango & Lake Erie, and the latter company elected to return the trucks. They sent them to Baltimore, but they did not deliver them to the Northern Central depot, and a charge for $10 was incurred for cartage. It was held that the owners of the trucks had a right to pay this charge of $10 because the trucks were delivered in a town where they had a depot. This was disputed, and the case went to arbitration. The decision, of course, was that the road returning the trucks was bound to deliver them free of charge.

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A dispute which arose between the St. Louis Southwestern and the Houston, East & West Texas, illustrates the fact that specific complaints must be made to receive the attention of the Arbitration Committee. The former company had rendered various bills against the latter for renewal of car brasses, and complaint was made that brasses were changed when efforts ought to have been made to make the brasses run cool by proper oiling. It was also mentioned that the road had no trouble with hot boxes with the cars on its own line, and that they did not expect bills for changing brasses anyway, or they would have sent off-setting bills against the other road. A number of other vague complaints were made. On the case going to arbitration, the H. E. & W. T. were ordered to pay the bills.

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### Iron Axles Running Hot.

During a discussion at the Central Railroad Club on the lubrication of cars, Mr. A. M. Waitt, of the Lake Shore, expressed the opinion that the principal cause of hot boxes is the use of iron axles that have seamy journals. Mr George W. West, of the Ontario & Western, agreed with Mr. Waitt, and insisted that good steel axles wore with a smooth journal that ran cool with little lubrication. Others expressed similar views, and strong preferences were manifested for axles made by the Coffin toughening process. This axle was held to be superior to all others, not only in strength and durability, but also in the smooth skin that the journal quickly acquired in use. For these reasons the speakers considered that the Coffin-treated axle was, in the end, the cheapest that could be used.

### Holmes's Chart of Air-Brake Leverages.

The chart on page 503 is reproduced from a large one furnished to air-brake inspectors and repairers on the Norfolk & Western by George Holmes, the general inspector.

Mr. Holmes early found out that there were very few men, even those holding responsible positions, who could figure out the leverage on a car, and that the number who could take the Westinghouse Instruction Book, and, beginning at page 44, figure out the leverage by their formula, was about as scarce. To put this problem into such shape that they could *see into* the whyfor, he got out this chart. It puts the matter into such unmistakable shape that any man can follow it out. In very many cases the sizes of levers and weights of cars he gives will tally with the work on hand, but where they don't, the way to figure is so plainly put that no one could go far wrong. We will send this chart, printed on tough paper to carry in the pocket, to any one interested whose name is on our subscription list to the end of 1894.

## ?A. What You Want to Know. ?A.

**Don't ask questions that simply require a little figuring to determine; make each question separate. No notice taken of anonymous questions.**

(102) J. Lundburg, Gothenburg, Neb., asks

Does the crank-pin, in passing back dead center, cause the crosshead to rest a longer time at that point than at forward dead center? *A.*—No. Crosshead stops and starts the same at each center; but it takes longer for it to go from the center of guides to *back* end and return to the center of guides than to go from the center of guides to the *front* end and return—this is because of the angularity of the main rod.

(103) John Torber, Cleveland, O., asks

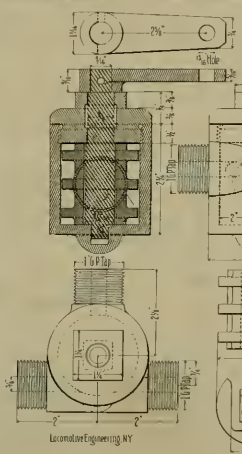
1. After having found the dead center of an engine, how do you proceed further in setting a slide-valve when an engine is being put up in a shop? *A.*—See article on setting valves in our January issue of this year. 2. What is meant by the rigid and total wheel-base of an engine? *A.*—The rigid wheel-base is the distance between the centers of the coupled wheels, the total wheel-base is the distance between centers of the front and rear wheel on the engine, regardless of what wheels they are.

(104) Thos. F Hall, New York, asks

Will you please answer following question in your November paper. In the Vauclain 4-cylinder compound engine is it possible to admit live steam to all the cylinders at the same time—if so, where does the high-pressure cylinder exhaust when using steam in that way? *A.*—Yes. When high-pressure steam is used the low-pressure cylinders do all the work, steam is admitted to *both sides* of the high-pressure pistons and they are thus balanced, or are in equilibrium.

(105) J. H. H., Danville, Ill., says:

Please mention in the columns of your paper the weight per yard of steel used on the mountain roads of the West; also, where the heaviest steel is used in the United States. *A.*—The Rocky Mountain roads use on their mountain grades steel of from 65 to 72 pounds per yard; narrow-gauge rails, 50 to 55 pounds. The heaviest rails we know of in this country are in the Fourth avenue tunnel on the New York Central & Hudson River road, in this city, and those in the St Clair tunnel, under the Detroit River, they weigh 100 pounds per yard.




### A New Cylinder-Cock.

The device shown herewith is a very efficient form of cylinder-cock designed by Mr. Frank Hedley, master mechanic of the Lake Street Elevated Railroad in Chicago.

Only one cock is used on a cylinder, this is located midway between the cylinder-cock holes and is connected to them by pipes and elbows.

As can be seen by the engravings, the valve consists of a series of disks cast solid on a plug; for about one-third of the circumference the plug is solid and *bottoms* in the case.

By turning this plug to a certain position, both cylinder-cock pipes can be opened to the drain-pipe or opening, but it cannot be turned to connect the two ends of the cylinder.

This valve cannot stick, requires no packing whatever and is as cheap as one ordinary cylinder-cock. Only two are used to an engine. They are smaller than one ordinary cylinder-cock, and call for just half the rigging to operate them.

By putting packing rings on the disks, an absolutely tight three-way valve would be had for many other purposes than that for which they are now used. Mr. Hedley has recently received a patent for this valve. They are in extended use on the elevated roads of Brooklyn.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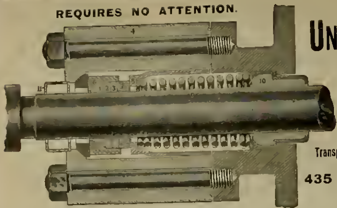

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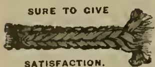

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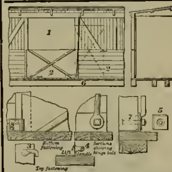


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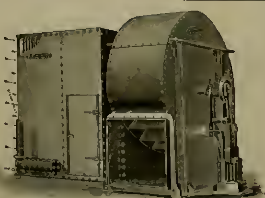

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# UP TO THE TIMES!

The management of **Locomotive Engineering** arise to remark that they have secured more original articles on Special Railroad subjects, from well-known railroad men, for publication in 1894, than has ever before been offered to railroad men who read and think. See our Special Announcement next month of new features—It will be of especial interest to you. We will make this paper so interesting that a progressive railroad man

CAN'T LIVE WITHOUT IT!

# LOCOMOTIVE ENGINEERING

A PRACTICAL JOURNAL of RAILWAY MOTIVE POWER AND ROLLING STOCK.




VOL. VI, No. 12. NEW YORK, DECEMBER, 1893. 20 Cts. Monthly
$2.00 Per Year.


Designed by THEO. N. ELY, Chief of Motive Power.] PENNSYLVANIA RAILROAD'S NEW CLASS "T" COMPOUND, WITH 84-INCH WHEELS [Built at the Shops, Altoona, Pa.


Designed by THEO. N. ELY, Chief of Motive Power.] PENNSYLVANIA RAILROAD'S NEW CLASS "P," WITH 78-INCH WHEELS. [Built at Juniata Shops, Altoona, Pa

### Some New Express Locomotives for the Pennsylvania Railroad.

On our front page will be found engravings of two new locomotives recently built at Altoona for the New York division of the P R. R. In the upper picture railroad men will find something new in design—the P R R 's new compound "1515." called class "T" This engine is fairly well described by a P. R R. engineer, who said, "She is a cross between a 'K' and 'Jack the Ripper'"—the Webb compound.

In many respects the "1515" is one of the finest looking locomotives we have ever seen She stands up boldly and looks clean and business-like. Her running boards are low, like the English practice, and she has wheel houses; this may not be as handy as our own engines, but it looks well.

A six-wheel tender, very Englishy, is used, and the men say that it is a very easy riding tender, too.

The hurricane deck is curved down in front to the standard height for P R R. pilots, and has trap doors through it to work on valve chest heads, etc

The engine is a two-cylinder compound, having one 19½-inch and one 31-inch cylinder with 28-inch stroke.

She has a direct motion valve-gear, no rockers, the link blocks are on the back of the valve-stems She has piston-valves 12½ in in diameter located in the saddle between the cylinders, this leaves the cylinders without chests on top, and they look very neat

The engine has steel drivers 84 in. in diameter and truck wheels 42 in. in diameter, the wheels of the tender are also 42 in.

The boiler is of the Belpaire type, built entirely of steel, 65 in. in diameter at the smallest ring. The firebox, 9 ft long inside and 40 in. wide; there are 289 flues, 1⅞ in. in diameter and 11 ft. 9½ in. long The working pressure is 200 pounds.

The drivers are 8 ft. between centers, and from center of front driver to center of cylinder is 12 ft. 1¼ in.

It is 15 ft from the rail to the top of the stack, and 9 ft. to the center of the boiler, while the center of the cylinders is 42½ in. above the rail.

The total wheel base of the engine and tender is 48 ft 1 in, while the total length over all is 58 ft. 6½ in.

The engine weighs 145,500 pounds, 48,500 being on the main drivers, 46,700 on the rear drivers, and 50,300 on the forward truck.

The tender weighs, ready for service, 77,000 pounds, it carries 3,000 gallons of water and 15,000 pounds of coal

This engine is now running on heavy, fast express trains between New York and Philadelphia, and has made up time with twelve Pullmans.

Taken altogether, the "1515" is the greatest departure from what may be called regular practice, or standard engines, that has appeared in this country since the Strong and Raub engines were turned out to astonish the world, but she seems to be quite a practical engine, and, barring her piston-valves, there is not so much to be criticised in her design, for all the details have been admirably worked out. She was built at the old shops in Altoona, the new "P" having been built at the Juniata shops, Altoona, these shops build new engines only.

THE NEW CLASS "P" ON THE PENNSYLVANIA.

Some of the handsomest locomotives running in this country come into Jersey City, opposite New York, and among those in the front rank are Mr Ely's new "P.'s" They have the well known Pennsylvania ear-marks, but there has been considerable change over the old "P."

They have a box for dry sand, the old wheel cover boxes of wet sand having been abandoned for this class of engine, at least. The Belpaire boiler is 57 in. in diameter at the smallest course, 175 pounds of steam is carried, and 78-in. wheels used.

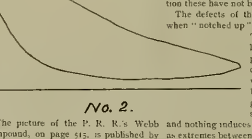
The air-pump is located on the left side, out of the engineer's sight, the engineer's valve is on the left side of the boiler, the handle being on the right side and connected to the valve by bell cranks and a reach-rod.

The cut shows the door in the front of the water-tank leg. This space is a box, the water only coming to the row of rivets just ahead of the striped panel. In the left side box is located the pump used to return the water of condensation from the train heating system to the tender, this is not unlike the air-pump in appearance.

The following are the general dimensions of the engine

Cylinders, 19 x 24 in.
Diameter of drivers, 78 in.
Diameter of truck wheels, 36 in.
Spread of drivers, 7 ft. 9 in.
Spread of trucks, 6 ft 7 in.
Size of boiler (Belpaire), 57 in.
Length of firebox (inside), 9 ft 11⅛ in.
Width of firebox, 3 ft, 4 in.
Number of tubes, 258.
Length of tubes, 11 ft, 4⅞ in.
Diameter of tubes (outside), 1⅞ in.
Working pressure, per square in., 175 lbs
Height from rail to top of stack, 15 ft
Height from rail to top of cab, 13 ft 4 in.
Weight of engine (empty) on drivers, 80,600 lbs.
Weight of engine on trucks, 41,700 lbs
Weight of tender, 23,800 lbs
Weight of tender (loaded), 63,800 lbs.
Capacity of tender (coal), 15,000 lbs
Capacity of tender (water), 30,000 gals

These engines are handling the heaviest and fastest express trains between New York and Philadelphia.



*No. 2.*

The picture of the P. R. R.'s Webb compound, on page 515, is published by request of many readers. "Wes" Hartman looms up well, and it will be seen that he has a box to sit on, the roof of the cab extended back twice its original size, a bell, a headlight and a pilot—American improvements that have been grafted on to "Jack the Ripper" here.

### A Tender Subject.

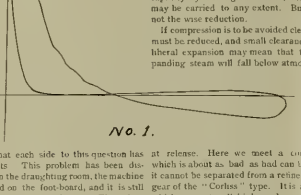
A speaker at a meeting of the Western Railroad Club made the following remarks about locomotive tenders "The American roads have followed the stereotyped design for tenders. There is no originality about them at all. Every tender on any New England road is just like the tender on the Union Pacific or Georgia Central. There has been no attempt made to improve. It is inconvenient in many respects and unworthy, I think, of our American genius in designing locomotives."

We do not take such a despondent view of the American invention of tenders as the speaker quoted appears to entertain. We do not believe that the uniformity in tenders arises so much from poverty of inventive fertility as from the form being susceptible of little improvement. The American tender did not at once assume the form that is now so familiar. It grew up gradually into that form, and the arrangement is the survival of the fittest. We have never seen tenders that were much different from the American form that were not inconvenient to the fireman. He is the principal man to be accommodated in the design of a tender. If it suits him the tender may be considered about right.

### Cylinder Compression.

BY HARRIS TABOR.

An editorial in your September issue on schemes for reducing compression in locomotive cylinders and a reply to the same by Mr Paul Sords, in November number of *Journal of the Brotherhood of Locomotive Engineers*, furnish very conclusive



*No. 1.*

proof that each side to this question has adherents This problem has been discussed in the draughting room, the machine shop and on the foot-board, and it is still an unsettled one in theory. The advocates of compression (which really means the present link motion) point to its long and successful use on railways, and its opponents keep in mind the more economical results obtained from stationary engines with elaborate valve-gear and small clearance. Whenever this question comes up there are certain railway conditions to be met with which the disputants are inclined to ignore, and in the controversy in question these have not been considered.

The defects of the link are felt most when "notched up" to the earliest cut-off. This position of the link gives greater expansion in a single cylinder than economy warrants. We must bear in mind that the greatest foe to expansion is condensation, and nothing induces condensation so much as extremes between high initial pressure and low terminal The builders of single valve automatic engines, which have practically the same distribution as the locomotive, do not advise cutting off earlier than quarter stroke, and many recommend even later cut-off. Excessive expansion in locomotive practice is more likely to be reached than in stationary engines, for the reason that they are running in an atmosphere of much lower temperature, which gives an increased condensation.

If the link was never abused by being "notched up" beyond its economical limit, its defects as a valve motion would not be so apparent. It is only when cutting off so absurdly early, that locomotive diagrams look so infernally "ornary" And it is only when working under such conditions that excessive compression and early release occur.

If a canvass of the runners who have a reputation for economy were made, it would show that very little running is done with the link in position cutting off earlier than one-third of stroke; such a canvass might also show that when the load to be hauled would not warrant a full throttle, the position of the link would not be changed, but the throttle would be partially closed to suit the work. The fact is the link is more likely to be condemned by cards it ought not to make than by cards taken under average running conditions.

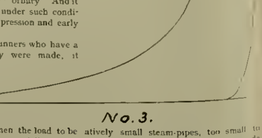
Within certain limits, variable compression, as produced by the link, is a source of economy. While it may not be necessary, as Mr. Sords suggests, to have large cylinders to start all trains, it is necessary, on nearly all American roads, to have a larger cylinder than is necessary for average hauls to help over grades; and where such necessity exists, it is important to have some means of making cylinders larger or smaller at the will of the engineer. The Lake Shore is an exception. On that road the famous Exposition Flyer is drawn by locomotives with 17 x 24-inch cylinders. On the N. Y. C the same trains, at slightly increased speed, call for cylinders 2 inches larger.

It is true that a valve-gear which gives a small amount of fixed compression and a variable cut-off may reduce cylinder capacity by cutting-off earlier, and this may be carried to any extent. But it is not the wise reduction.

If compression is to be avoided clearance must be reduced, and small clearance with liberal expansion may mean that the expanding steam will fall below atmosphere at release. Here we meet a condition which is about as bad as bad can be, and it cannot be separated from a refined valve gear of the "Corliss" type. It is an evil which comes to all high-grade expansion engines with small clearance when running under too light a load. If the steam in cylinder expands below atmosphere and makes a partial vacuum, this space will be filled with cold air as soon as exhaust is opened. (See diagram No 1.) The cylinder is at once cooled by the air and the incoming steam for next stroke is condensed It is much better to reduce the cylinder by paring off the card at both ends by variable expansion and compression than by depending solely on cut-off.

It is questionable if compression, treated independently of all other conditions, produces economy. It may be considered as a spring which consumes force in compression and gives back that force when extended. Of course this generates heat, which helps to warm the cylinder, but at the same time it lessens the cylinder's capacity, and this must be made up by carrying steam farther in the stroke, which means a higher terminal pressure The effect of this will be understood when we consider that the *power* given off by an engine is determined by the area of the card and the *cost* of the power by the pressure at terminal or release.

In locomotive practice compression undoubtedly increases expansion. This may seem paradoxical. One of the bad conditions in locomotive cylinders is excessive clearance. It is a necessary evil As a rule, this amounts to from 10 per cent to 12 per cent. of piston displacement These cylinders are supplied from compar-



*No. 3.*

atively small steam-pipes, too small to give a fair initial pressure at piston speeds above 500 ft. per minute, but quite as large as the limited steam room in boiler will permit. The clearance makes the cylinder so much larger that its effect would be to further wire-draw the steam in the insufficient pipe and thus reduce expansion Compression relieves the steam-pipe by filling the clearance, thus giving a higher initial. That quality in the link which reduces port openings as expansion is increased makes a variable compression necessary. But care should always be taken to see that neither expansion nor compression is carried too far

The influence of compression on the running repairs cannot be gauged by comparison. It may be safely assumed, judging from high rotative speed practice in stationary engines, that it is beneficial. Whether it is or not, it would be difficult to find engines of any type doing as hard service with so little cost for repairs.

Reduced clearance in locomotive cylinders would give better coal results. The question is whether this service will safely stand such reduction. The limited steam room, bad water, and constant agitation from running induce priming in locomotive boilers. When this occurs there must be a storage reservoir somewhere for this non-compressible fluid to avert broken cylinders. Large clearance furnishes this reservoir, and since this waste room is necessary why not relieve the steam-pipe by filling it with compression The fact that no engine builder in the country would attempt the rotative speeds at which locomotive engines run without liberal compression is in itself a strong argument that its effect on running qualities is beneficial.

It is hard to imagine a combination of lines more pleasing to the eye than a diagram from the cylinder of an engine of the "Corliss" or "Buckeye" type, cutting off at about quarter stroke. When the great master, Hogarth, described the curve as a "line of beauty," he could not have had in mind a finer example than the expansion line of such a diagram. It is the hyperbola, the most beautiful of all curves. But this line is pleasing only when it harmonizes with other lines on the diagram. It is the one line on the indicator card which determines economy in steam consumption. When this line sweeps gracefully from the point of cut-off to a terminal of such pressure that fair expansion is assured, without undue loss from condensation, we call it right.

What is needed to insure economical lines on an indicator card? The load of the engine must be equal to a given mean effective pressure to warrant the results often obtained from mill and factory engines. When the successful engineer makes a contract to furnish an engine which shall deliver a horse power for a given amount of coal per hour he does not accept conditions which may be fatal to his contract, but he builds to suit a fixed load, which is practically an unvarying one. If an old engine is to be replaced, the contractor sends an expert, with an indicator, to determine the exact amount of power required before his guarantee is submitted. He guesses at nothing, and as a result the factory will get an engine which will furnish 500 or 600 horse power at an expense in coal of less than half of what would be burned in the firebox of a locomotive to produce the same energy

The question of load is not the only one to be considered. High grade expansion calls for an initial pressure closely approaching boiler pressure, which may be obtained only through large ports and pipes. An 18-inch cylinder with a piston travel of 500 feet per minute, will require a steam pipe of at least 6-inch diameter (and this must not be too long) to insure fairly high initial. These conditions are easily obtained in stationary practice, and they are absolutely necessary to the steam economy, which has made the "Corliss" type of engines famous.

The locomotive designer is met at the start with restrictions which do not hamper the stationary engine builder. He must confine his work to a 10 ft roadway; within this narrow space and with length limitation he must construct a machine, self-contained, capable of delivering power on call in quantities varying from 50 horse power to 1,300 horse power, he must conform to rotative speeds, ranging anywhere between 50 and 350 per minute, and with mean effective pressures quite as variable; the piston velocity may have a maximum of 1,400 ft, and run through the whole scale down to 150 ft. The more favored designer of stationary engines may have any where from 10 square ft. to 14 square ft. of heating surface per horse power in boiler, but the locomotive must be content with less than one-third of this amount. His grate area is reduced to such small dimensions that at least four times the coal burned under the stationary boiler, per square foot of grate, must be consumed. With all these limitations against him, his boiler must be supplied with water varying in temperature from 35 deg. to 60 deg, and his cylinders are exposed to blasts from 25 deg. below zero to 100 deg. above. Given such a problem, the builder of stationary engines would, if wise, furnish his customer with a single-valve automatic, which would make indicator cards wonderfully like those from a locomotive doing the same duty.

Diagram No. 2 was taken from a passenger engine with 19x26-in cylinders, 78-in. drivers, running sixty miles per hour, revolutions per minute 280, and piston travel 1,313 ft. per minute, with a total horse power for both cylinders of 960, the actual cut-off was at one-third stroke.

Diagram No. 3 was taken from a "Buckeye," 14x28 in., running 120 revolutions per minute, with a piston speed of 559 ft. It is a beautiful card, and one that will bear a close analysis.

These cards are so unlike that it seems unfair to compare them, yet each is a fair representative of its type It is such comparison that make the average believer in the indicator feel like reforming the valve gear of locomotives

Card No. 2 is possible within certain speed limits. Now let us see what is necessary to approach perfect cards from locomotives With a rotative speed of 280 a positive valve motion would be imperative, with a piston velocity of 1,200 ft. the ports must be at least 20 per cent of the cylinder area, which would make them 3x19 inches to be uncovered; this would call for a valve travel of at least 15 inches, and probably it would equal the stroke of piston. A high initial, such as prevails in "Corliss" engines, would call for main steam-pipe not less than 11 inches diameter, with branch-pipes leading to cylinder at least 8 inches diameter With such steam passages, fed through a wide open throttle, there would be mighty little water left in the present form of locomotive boiler after the first few turns, so we must have a boiler with more steam room. Such changes would not produce the fine card of the higher grade of stationary engines, they would only approach them. Economy from such changes as have been outlined might result occasionally, but for all-round work, such as the average locomotive performs, the coal consumption would not be diminished, and the cost of running repairs would be multiplied.

The majority of men who have taken up the study of steam enthusiastically, have, at some time, had an itching for revolutionizing the locomotive. Many have attempted it, as abandoned monuments of "revolutionizing" scrap iron throughout the country will show. This disposition on the part of steam engineers to carry reform to the rails, attacks men just as the red necktie and hair oil period of Dickens does the boy, luckily it comes but once and is soon outgrown.

*Elizabeth, N. J.*

## Cost of Maintaining Locomotives.

The committee appointed by the Master Mechanics' Association to investigate the "Cost of Maintaining Locomotives," has sent out a very copious circular of inquiry with a view of securing information on which to base a good report. The chairman, Mr. G. W. Rhodes, may be depended upon to submit a valuable report if he succeeds in obtaining the required data The committee is expected to report on the comparative cost for repairs of locomotives built in contract shops and those built in railroad shops, a subject which has excited no end of private discussion, and one which deserves to be thoroughly investigated Nearly all master mechanics who build locomotives in the shops under their charge will argue that they can do the work as cheaply as contract builders, and that the engines turned out are greatly superior to those purchased, but we have never seen figures to sustain these claims There is good reason to believe that the latter part of the claim is well-founded, but we do not think there is a railroad shop in the country that can fairly compete with the first-class contract shops. Locomotives are now selling on very small margin of profit, and the margin has never been high of late years The method of doing work in railroad shops and the tools provided put the men in charge at a great disadvantage with those engaged in regular manufacture, where every possible means is taken to keep down the cost of production.

Manufacturers are constantly devising improved methods which cheapen production, and any new tool put upon the market which saves labor is promptly purchased. The railroad shop is different from this, for it is almost impossible to convince the purchasing authorities that a tool ever gets too old for economical service, and it is nearly as hard to obtain permission to order new tools on the plea that production would be cheapened. The prevailing policy is to make the tools in use last till they can no longer be used, and only to purchase new ones when it is represented that the shop can no longer do the work without them This is the general practice. While it is followed, there is little use in a railroad shop trying to compete in price with a contract shop. It is well, however, to find out the relative cost of work done in the different kinds of shops, and the report of the Master Mechanics' Association on the subject will be highly interesting.

We believe there is good ground for the complaints so often heard about defective work on the locomotives turned out of contract shops, which materially reduces the service of the engine and sends it prematurely into the back shop. The committee call for information on the failure of firebox sheets, frames and cylinders, the request no doubt being inspired by the frequent failure of those parts before new engines have performed a decent mileage Loose cylinders is a defect which is extremely common with new engines, and is doubtless due to the contract system, which induces workmen to pay more attention to quantity than to quality. Badly fitted cylinder fastenings are hard to detect by inspectors, and therefore many engines leave the builders with the cylinder bolts poorly fitted.

The failure of firebox sheets in new locomotives is nearly always due to the purchase of inferior material. The remedy for this is with the company submitting the specifications for the engines First-class material in locomotive fireboxes very rarely fails prematurely, third-class material as seldom gives satisfactory service. The purchasing agent who saves a few dollars per engine by ordering cheap steel imposes upon his motive power department a very expensive article. There is no single article purchased for railroad companies where cheapness in first cost proves so dear in the end as in the ordering of cheap firebox steel. The cost of applying a new firebox, or the expense entailed by leaky sheets is out of all proportion to the first outlay. There are three or four concerns in the country that make first-class steel, and the character of their material is well known. There are other

THE WEBB COMPOUND ON THE PENNSYLVANIA. PUBLISHED BY REQUEST concerns that make notoriously inferior steel, and the quality of their product is equally well known. We seldom hear of the inferior steel being specified for fire-boxes, and yet it is used as much or more than good steel. When no maker is specified, railroad companies may depend on getting the cheapest, and therefore the most inferior, material. To specify that the steel must pass certain physical or chemical tests is merely to invite deception, unless the mechanical department has the reputation of seeing that the tests are rigidly carried out, and those that do this are the exception. As the quality supplied by the different makers is well known, it is a wise course to mention the make of the steel in addition to the physical and chemical properties required.

An investigation into the cost of maintaining locomotives will not be complete unless the influence of good or bad material in all important parts be considered. In addition to this, the proportions of the engines ought to receive careful attention. Badly designed engines, with tractive power and adhesion out of proportion are expensive machines to maintain and directing attention to the fact always exerts a beneficial influence. There have been great improvements effected in the proportions of locomotives in the last ten years, and much of it has been due to the educational work performed by the Master Mechanics' Association. Another costly form of engine to keep in running order is that with deficient heating surface. In engines of this character, an intensely hot fire must be maintained to keep up steam, and the firebox sheets get burned out through incessant forcing of the fire. Then there are engines with poorly designed valve motion that cause destructive strains to mechanism, and others so badly counter-balanced that they hammer themselves apart.

The committee call for a great many particulars about the cost of repairing locomotives. If efforts are made by most of the members to answer all the questions, there will have to be various home investigations engaged in. Incidentally this investigation may lead to more uniformity in the keeping of motive power accounts, a consummation devoutly to be wished. At present there is great diversity in practice. The majority of roads cannot show what any separate operation costs, and many of them act as if they did not want to know. Any influence that will help to change this condition of affairs is certain to prove beneficial to railroad companies.

## Forty Years of Throttle Pulling.

Such is the record of Charles H. Burr, the oldest engineer in point of continuous service now in the employ of the N. Y. C. & H. R. R. Co.

"Charlie" Burr entered the company's employ, as engineer, in 1853, he is one of the best-known railroaders along the whole system; capable, energetic and fair, and always manages to retain the respect and regard of men who have been under him, as well as the officers above him.

Though several years past the three-score turnstile of Time, he is rated as one of the best railroad story-tellers in the Brotherhood, of which he has always been a prominent and active member, refusing office from his fellow members on several occasions.

Charles H. Burr was born in Boston, 1830, after leaving school going to Taunton, Mass., where he was apprenticed for five years to learn the trade of locomotive machinist, serving under that well-known locomotive builder, William Fairbanks.

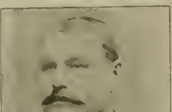
Finishing his apprenticeship, he accepted an engagement with the N. Y. C. & H. R. R. Co. to take the position of engineer at the Greenbush roundhouse, then in course of construction, the machinery and whole plant being put in under his supervision.

At that time railroading in America was in its infancy, and no trains on the H. R. R. ran through to Albany, a stop being made at Poughkeepsie, half way.

Mr. Burr afterwards was sent on the road, his first train being the Emigrant, which he ran from Poughkeepsie to Albany, relieving the well-known "Harry" Dawson, there, who was in charge from New York to Poughkeepsie, also having the honor of running the first "newspaper" train.

In 1854 he removed to Poughkeepsie, N. Y., and has held the throttle continuously since. Among the famous engines, which in those days were wood-burners, he pulled the throttle on, were the "Matteawan" and "Putnam," the latter being entirely rebuilt by him.

Men have come and men have gone, and changes unlimited have occurred on



the "greatest railroad in America," but this old "Knight of the Throttle" is still in the harness, beloved by all for his genial, sunny ways and even disposition.

He is stationed permanently at Poughkeepsie, and with his family occupy a pretty home on Harris street in that city.

During his forty years of railroading he has not forgotten an incident of his experiences, never was injured or in a wreck, and regales acquaintances for hours at a time with stories of the infancy of American railroading.

He has been importuned on different occasions to accept political honors at the hands of Poughkeepsie's citizens, but persistently refused, preferring the congeniality of the cab to aldermanic and other civil honors.

His habitual care and attentiveness to duty manifests itself in his every-day life by the exactness, taste and carefulness in dress, it is safe to say the Central has not a better dressed man in its employ than the Brummellesque old throttle-jerker at Poughkeepsie, N. Y.

## Dangers Encountered by Surveying Engineers.

The reading world has received many romantic stories about the hardships endured and the hair-breadth escapes made by engineers surveying railroads in the Western States, when wild Indians and all sorts of other wild animals prowled over the wastes that the railroad engineers were laboring to bring within the supremacy of civilization.

But the perilous experience of engineers has not been confined to the West. The men who located railroads had occasionally exciting experiences in some of the mountainous regions of the South. Moonshiners have always been afraid of strangers, and they never displayed much discrimination between an engineer looking for a practicable route and a gauger searching for illicit distilleries.

A well-known railroad engineer talking of exciting experiences said:

"I was building a railroad down in Georgia in my younger days. I am a Georgian, you know. Once following our surveys I saw a chance to ride across the mountains, and thence to my home to visit my father. It was early in the afternoon when I started on my long ride. The moon was shining high in the heavens when I began to climb. I was jogging peacefully up the incline, when from a shadow a horse and rider came out from the side of the road and fell in at my side.

"'Good evening, stranger,' said the man politely.

"'Good evening, sir,' I said, glad of even unknown company.

"'Which way you going?' asked my new companion.

"'Over the mountains,' I answered.

"'Reckon I'm going that way, too,' he said, and then I had an opportunity to look at my friend's face. It was a strange face. Smooth-shaven, young and yet old. It was calm and placid, as expressionless as stone, and yet there was a certain set about the jaws that kept me uneasy. And no matter how often I looked at him, how quickly I turned my glance on his face, his deep-set eyes were always watching me. I felt, even when I did not look at him, that he was watching me like a cat. We rode for hours, talking as one does with that class of people, until at nearly daylight we had crossed the mountains and were making our way along a comparatively level road. When we came to a river which we had to ford, my friend reined up.

"'This is as far as I go,' he said.

"'I am sorry to lose you,' I replied civilly.

"'Stranger,' he said, when my horse's forelegs were in the river, 'where are you from?'

"'Georgia,' I answered, 'this is my State.'

"'Who's boy are you?'

"'Judge S——s.'

"'Is that so?' he said, in a calm voice. 'Why, do you know what I took you for? Revenue! Yes, sir, and I came near shooting you, sir. Half a dozen times on that ride I made up my mind that you were revenue, sir, and each time I was just ready to do it. But I hated to do it, sir, you looked so square. I'm glad I didn't.'

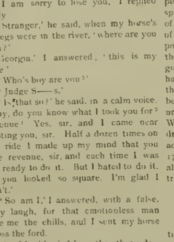
"'So am I,' I answered, with a false, jerky laugh, for that emotionless man gave me the chills, and I sent my horse across the ford.

"'Good-by,' I cried from the other side.

"'Good-by, sir,' he answered. Then his horse carried him off in the gray light, and I felt a sudden sense of great relief."

## The Mason Safety Stop.

A number of railroads have recently asked if pump governors could not be furnished with some means whereby the pressure, both from the air reservoir and




the train-service-pipe, would control the regulator. The essential point is, that as the train-pipe pressure at 70 pounds, when the brakes are set, does not control the regulator, then the reservoir pressure should be brought to bear upon the regulator and control it, in order that the reservoir pressure may not be forced up too high by the pump governor, when the train-service pressure ceases to act.

The Mason Regulator Co., of Boston, have recently put on the market such a device, and it is being used on the Pennsylvania Railroad.

The device is in the form of an auxiliary regulator, the sectional view of which is seen in the cut. The train-service connection is through the pipe 14, and the connection is made with the air reservoir at 18. The service pressure at about 70 pounds, coming through the pipe 14, goes through the passage way 13, and at the end of this passage, after curving around through the slide-valve 17, goes into the pump governor. So, it will be seen that when the brakes are not set, the service pressure controls the pump governor, as it does ordinarily. When, however, the brakes are set, and the service pressure at 70 ceases to work, and the steam-pump still going, as it is allowed to do, by the governor, the pressure in the air-reservoir soon rises above 90 pounds. This pressure is connected through the pipe 18 and through the passage way 12 and the chamber 9, under the diaphragm 7, and when it exceeds this pressure of 90 pounds, it lifts this diaphragm against the spring 6, thus opening the check-valve 8, letting the excess pressure down on the top of the piston 15, forcing that down against the spring 19, and carrying with it, by means of the pin 16, the slide-valve 17. The top of this slide-valve is carried from the upper port 13, closing the lower port, but opening the upper part of the port 13 into the governor to the reservoir pressure, which has come up through the pipe 18. It will thus be seen that the pump governor will be under the control of the reservoir pressure instead of the train-service pressure. When the reservoir pressure at 90 again drops below that amount, the reverse action will take place, and the slide valve 17 will again return to its normal position, allowing the pump governor to be controlled by the train-service pipe.

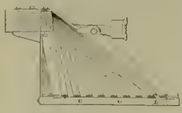
## Answer Circulars Promptly.

At every one of the mechanical conventions there are complaints heard repeated year after year that few members display sufficient personal interest in the association to answer questions raised by circulars. It frequently happens that those who take an active part in the proceeding at the annual meetings, display no disposition to help during the remainder of the year, even to the small extent of answering circulars. A suggestion has recently been made by the chairman of a committee that notices of those who answered and those who failed to answer the circulars be incorporated in the reports of committees. We think, should this suggestion be carried out, that it would shame not a few members of the associations into a realizing sense of the duty they owe to the organizations they belong to. The season is now at hand when investigation committees' circulars of inquiry will be reaching members of the different associations. We wish to mildly proclaim that a pigeon-hole is not the place for these circulars. Keep them at hand and proceed at once to answer them. If the necessary data is not at hand call for it, but do not push the circulars aside to be taken up when a slack time comes. The slack time will not arrive before the convention, and if you wait for it the circular will not be answered at all.

The Committee of the Master Mechanics' Association appointed to investigate the subject "Cracking of Tube Sheets," have sent out a circular calling for facts bearing on this troublesome and expensive defect. We understand that the members of the committee are making vigorous personal efforts to collect information on the subject. If the members answer the questions asked in the circular there will be valuable data collected, which will point the way to an effectual remedy.

### A Folding Pilot Coupling.

The annexed engravings illustrate an improvement invented by Mr. Pulaski Leeds, of the Louisville & Nashville, on the coupling used for locomotive pilots. It is well known that with the ordinary bull-nose used on the pilots for coupling, there is great liability of stock being thrown on the track when struck, in which position they



are very likely to derail the train. Owing to this, the safety of the pilot is very greatly decreased. To obviate this danger, Mr. Leeds designed a bar that could be turned upward, as seen in the engraving, at the same time providing the means of holding it very secure when set for coupling. The improvement is already very favorably received by roads using this kind of push-bar, and the indications are that they, the folding-head, will soon be generally adopted. The engravings are so plain that a detailed description is not necessary, the "backbone" of the device is a steel casting and the draw-head can be made of the same material or a forging, we believe both kinds are in use.

### Good Work in the Motive Power Department of the Union Pacific.

When Joseph McConnell became superintendent of motive power of the Union Pacific road some three years ago, he found a great many varieties of locomotives, all kinds of draft appliances and all kinds of road delays. He set to work to get heavier power in place of the worst engines by building new ones and charging them to repairs, and to standardize as much as possible. He took off the extension fronts of every kind and put on short fronts and diamond stacks. The men say this did the business, but of course, everything done to bring the power up contributed its share to the general improvement, which is shown in the statement, just made, that in 1892 the road handled 189,000,000 tons of freight one mile in excess of what it handled in 1890, and this was done with 2,335,000 less engine miles and 87,000 less tons of coal.

During the first six months of 1893 they made 140,000,000 car miles as against 130,000,000 car miles made the first six months of 1892, but the engine miles was 117,000 less than in '92, and they hauled 60,000,000 tons of freight one mile more than they hauled in the same period of the year before.

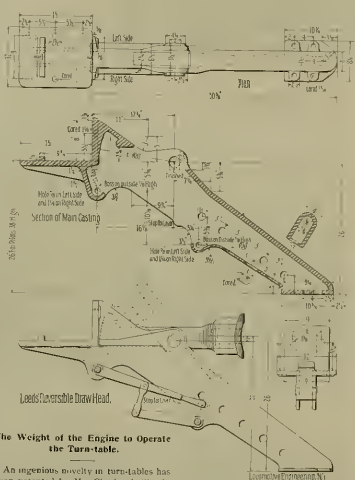
The Union Pacific has more than a thousand locomotives in service.

This record of improved engine service shows up wonderfully for the motive power department, and the head thereof ought, it seems to us, to have had his salary increased in some ratio to the saving he has made—but they cut him 10 per cent. this summer, just the same as the rest.

### Whitewashing by Air Pressure.

We have several times lately received inquiries from railroad men about the apparatus used by the Southern Pacific mechanical department on whitewashing shops, and which was referred to in Locomotive Engineering. In answer to a letter of inquiry, Mr. H. J. Small sends us the following particulars of the apparatus and method followed

"The portable outfit used for whitewashing shops, last year, consisted of an 8-inch air-pump, two locomotive main-air reservoirs for holding the whitening mixture under pressure, the lime to be slacked and thoroughly mixed and strained before putting into reservoir. Add 35 pounds common salt to each barrel of lime used. Air-pump can be located at any point convenient for the work and steam connections. The pump discharge to be connected to the air-reservoirs with 1-inch hose, in lengths as circumstances may require, the air to be discharged into the drums through 1-inch perforated pipe running parallel with and near the bottom, thus keeping the whitening agitated under pressure of about 70 pounds. The discharge from drum to be connected on top, having the discharge-pipe run down into drum within one inch from the bottom, using ½-inch hose with piece of ¼-inch pipe of suitable length, with stop-cock, for the discharge, and to the end of the ¼-inch pipe attach the spray-nozzle with 1/16-inch hole for the discharge. Make the end of nozzle cupped, or spoon shaped, so that the mixture, striking against face of spoon when discharged through the 1/16-inch hole, will form a spray of fan shape, at an angle of about 45 degrees to the surface to be whitened."




### The Weight of the Engine to Operate the Turn-table.

An ingenious novelty in turn-tables has been patented by Mr. Charles A. Shank, Albany, N. Y. His idea is to arrange the track that carries the turn-table in the form of an inclined plane and make the locomotive turn itself by gravity. The theory of operation is that the locomotive being so placed upon the table that the greater part of its weight is upon the end of the table toward the higher part of the track, the wheels under the weighted end will tend to run down the incline until the lowest point is reached, the other end of the table being entirely clear of the track. If it is necessary to turn the engine beyond the lowest point in the track, its weight is shifted toward the opposite end of the table, bringing its wheels down upon the higher part of the track when the table will turn by gravity as before

This thing looks practical enough, and we do not see why it should not work all right. It it works as well as it looks on paper, it will be a great benefit to men in charge of engine-houses. The labor of turning heavy turn-tables is very tiresome at places where many engines are handled during the day and night

### Material for Boiler Tubes.

At the last Saratoga Convention of the Master Mechanics' Association there were some remarks made about the most suitable material for locomotive tubes which indicated that the subject is well worthy of investigation. In the report on tests of iron and steel, the committee said "We are advised that in the case of a large number of steel tubes, the results, so far as wear is concerned, have been unfavorable. . . . An engine was equipped with 114 iron tubes and 113 steel tubes in December, 1890. The iron tubes were placed on one side of the center and the steel tubes on the other side. All the tubes were removed in March, 1892. Seventeen of the iron tubes were condemned on account of pitting and corrosion, while 64 of the steel tubes were condemned for the same defect."

In the discussion that followed the reading of this report, Mr William Forsyth said "I agree with the conclusions of the committee in the fact that steel tubes do not seem to be as durable as iron tubes, and that has been our experience with steel tubes. The fact of the matter is that steel blooms can be made a great deal cheaper than iron blooms, and the tendency of the manufacturer is to supply steel tubes at the same price as iron tubes, and thus force them upon the market A steel tube at the same price as an iron tube, I cannot believe to be as good. There may be steel tubes drawn solid and seamless which are as good as iron, but they cost a great deal more.

"In addition to the trouble from corrosion, we have had trouble with the weld of steel tubes. It is difficult to weld a steel tube and make it stand in locomotive service. So I will caution our members to look out for this matter when manufacturers try to give them steel tubes of an ordinary quality at the same price as iron tubes"

We have brought up what was said on this subject because we have heard a great deal lately about the failure of steel tubes in service. Steel is becoming popular for boilers, and this increasing favor of the material seems to induce motive-power men to accept steel tubes without looking into the suitability of steel for this purpose. There is good reason to believe that steel is more susceptible to corrosion than iron under the action of bad feed-water; but its liability to corrode is not the worst feature about a steel flue. It is well known that tubes are made by bending a long strip of iron or steel and welding the edges. Every mechanic who has experience in the working of metals knows that steel does not weld readily When steel is used for tube making it is found that bad welds are extremely common, and that it is impossible to detect them till the tubes go into service. The welds will be tight enough to withstand a high pressure in the testing-house; but when it becomes subjected to the expansion and contraction of locomotive-boiler service the weld draws apart, and a failure of the engine on the road is the result. The failure of a boiler-tube is such a serious matter, that a material likely to make this source of delay and annoyance common should be sternly refused Those who have had the most experience with both kinds of material in tubes also say that the steel tube is much more given to getting loose in the sheet than the iron one

First-class makers of tubes use nothing but the best of iron. The best tubes in the market are made of the best charcoal iron, which consists of iron melted and refined with charcoal in a Lancashire hearth. The raw material from which the iron is made is kept as uniform as possible, and the mixture used is one that careful chemical analysis and long experience have shown to be the most fit for boiler tubes. Before the finished iron is worked into tubes it is subjected to careful physical tests which it must withstand, otherwise it is rejected. When care of this character is exercised in the manufacture of tubes, there is no fear of failure happening after the article is inside of a boiler.

Railroad men need to have this subject of boiler tubes thoroughly ventilated. Those who purchase steel tubes do so without realizing the weak point about them. Those who pause to reflect that the seam of a tube must be welded will at once be suspicious about that operation being well done when steel is used We think that this would be a good subject to discuss at the railroad clubs. It is not hackneyed, it is a subject that every mechanical man would have some ideas about, and it is one which needs the healthy breath of public opinion.

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Engine failures on the U P. are less than on any other road in this country that we know of.

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Passengers and freight are carried for less money per mile in the United States than in any country in the world.

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The picture of the "1515" on the first page was made from a photo taken by Mr. F. W Blauvelt, of the Du Bois Mfg. Co., this city

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The C M & St. P. made the best investment last month ever indulged in in the history of the company. They restored the 10 per cent cut off the men's pay in July. They won't lose a dollar by the move.

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Do you know where the injectors, the brake-valve and the gauge light should be to be handiest and safest for yourself? If you think you do, you should try for one of those $100 prizes for the best design of cab and boiler fittings.

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In Europe they have little jacks for putting in car brasses that are a little better than some of ours. They are made with claws on the base, that fit on to the rim of the wheel and reach up, on an angle, to the box. When this is lifted the wheel stays down, and there is no prying to get the journal low enough to get the brass in.

### The Illinois Central's World's Fair Train Service.

Hearing that Mr. A. W. Sullivan, general superintendent of the Illinois Central

No. 1. Loading. Dead Stop. (Looking South.)

Illinois Central had a series of interesting photographs illustrating the operating of the enormous passenger traffic which his company handled so successfully during the World's Fair, we applied for a set for the purpose of having cuts made. Mr. Sullivan had given away all that he had, but he sent us the annexed cuts, which had been made and used by the *Railway Age*. From that paper we take the following particulars about the illustrations.

"During the six months ending October 31 the Illinois Central Railroad carried on its special World's Fair trains, in cars built for the purpose and having the exclusive use of two tracks, almost 8,800,000 passengers, besides nearly 10,200,000 carried in its regular suburban trains running on other tracks. While the regular suburban service covers an extended mileage over several lines and carried the local travel to and from a large number of stations, which passengers were constantly entering and leaving, the World's Fair trains ran only between Van Buren street and Jackson Park, without an intermediate stop, so that in respect to capacity for prompt handling of multitudes the work of these latter trains was far greater than that of the suburban trains, or of any other trains that have ever been run. Ocular evidence of the rapidity with which the loading and discharging of passengers was accomplished is given in a series of photographs received from Vice-President Harahan, which we have here reproduced on a reduced scale. A study of these views tells the story of this remarkably efficient service better than any words. It may be added that only on one occasion, 'Chicago Day,' was the entire special equipment called into service, and the real capacity of the service was never fully tested. On that day the World's Fair and suburban trains combined carried 509,786 persons. The views are as follows.

"No. 1. Loading process, showing the platform and train at the instant the latter had come to a dead stop and before any of the passengers had entered the cars.

"No. 2. The same 10 seconds later—the train filled with passengers, the people shown in the foreground in view No. 2 not being the same individuals who are shown in view No. 1, this illustrating the constant flow of passengers to the platform and the facility with which they were seated in the train. Views 1 and 2 looking south.

"No. 3. Loading process, looking north at the moment train had come to a dead stop and before passengers had entered cars.

"No. 4. The same 15 seconds later. Remarks as to passengers in foreground of No. 2 apply to the background of this picture.

"No. 5. Unloading process. View looking south. As this platform has been used only for discharging passengers, there were no other people on it when the train stopped. This view shows the situation 11 seconds after the train stopped. The relative apparent sizes of the train and the crowd give a very good impression of the carrying capacity of these cars.

"No. 6. Same 80 seconds after the train had stopped. The track was cleared in 55 seconds, and the platform, as shown in the view, was cleared in 80 seconds.

"These views were not taken on days when extra large crowds were being handled, but fairly represent the normal condition of the business in connection with the World's Fair special trains. Of course, on special days the tracks on each side of the loading platforms were used simultaneously—*i. e.*, trains were loaded from both sides of the platform."

No. 2. Loading. Train Filled in 10 Seconds After Dead Stop.

The Baltimore & Ohio Railway Company have decided to form a museum at Mt. Clare, Baltimore, of all the old engines and models which they exhibited at the World's Fair. They are fitting up an old roundhouse for the purpose, and everything will be done to make the display as perfect as possible. Anything that has been missed will be added to the collection after it has been put in place. A great number of photographs, drawings and engravings which they have illustrating the development of the transportation system are to be put in a hall where there is good light to show off to visitors. There has been, in connection with this exhibit, a great many pictures and drawings, for which there was not room in the World's Fair. These will be shown with the rest, and will make a most attractive collection.

### Development of the Train Brake.

One part of the Baltimore & Ohio exhibition at the Fair attracted particular attention. This was a line of photographs and engravings showing the development of the train brake. The series begins with the crude forms of levers used on common road wagons and the more elementary form of coal car, for arresting the motion of the car. The first appliances were hand-levers pressed upon the wheels, or pushed in between the spokes of the wheel, and were very inefficient for reducing speed.

The first important development is where a lever, having blocks placed above and below the fulcrum, gives the means of braking by fairly good hand arrangement. A modification of this is still the most common brake in use in Europe for freight cars. There are some curious pieces of mechanism to be seen in connection with the first attempts made in England to attain power in applying brakes. The staff and chain that were the first steps in America from the hand-lever to a second power never came into use in England. The screw received a good deal of application, and the mechanism transmitting the power to the brake-shoe was, in many instances, very complex and ingenious. We see in the Baltimore & Ohio illustrations, methods of applying brake-blocks that jam up between the wheels like a wedge, and there are others that are pushed down from the top. One of the earlier form is a "toggle" arrangement that applied the brakes by the main connecting pin being pushed downward. When we come to the first attempt at applying steam to operate a brake the "toggle" is again used between the brake-blocks, and steam power is applied by blowing the rod upward. This is first seen in the steam brake that was tried by George Stephenson, as early as 1833. The brake appears to have all the elements of what made the American steam brake a success, and it is rather surprising that it did not get into general use. The brake was applied between the driving-wheel and the trailing-wheel of the loco-

No. 3. Loading. Dead Stop. (Looking North.)

motive. As brake-beams were not employed in connection with brakes in England, it opened the way for a great deal of curious mechanism which was attached to the frame and transmitted the power to the brake-blocks.

All the early cars, both in Europe and America, had wooden blocks for brake-shoes. The objections to them were that they generally took fire when the brake was applied for any length of time, and they were merely a good makeshift in the line of development. After Stephenson attempted to use a steam-brake on an engine, there appears to have been little done to develop power-brakes for twenty years.

In 1853 the "Creamer" brake was invented. It was an emergency brake, and consisted of a coiled spring, which was kept wound up on each car. When anything happened to require a sudden application of brakes, a latch was released which let the spring apply the brake. It did good service in many instances and was a valuable step in the line of brake development Two (2) years afterwards Loughridge applied his first continuous chain brake upon a train of cars belonging to the Baltimore & Ohio. The chains passed from the engine to all the brakes in the train, and were operated by a drum placed below the running board of the locomotive. A great many improvements and modifications of the chain-brake were carried out with a view of making it more efficient, but it was always a very unreliable appliances and no amount of improvement could make it reliable. Chain-brakes were employed on a few trains, but the great mass of cars run in every country was dependent upon hand-brakes, until 1869, when George Westinghouse brought out his atmospheric brake, commonly known as "straight air." The Westinghouses effected a revolution in methods of applying power to brakes, and after this great invention was tried improvements followed the lines, either of air, steam or vacuum.

The Smith vacuum-brake was invented in 1872 and a great many of them came rapidly into use. As a non-automatic brake it appeared to be as efficient as the Westinghouse, and but for the necessity of the automatic feature it is very likely that the vacuum would have been more popular than the air-brake. The mechanism of all the later forms of automatic air-brakes are shown and present a very interesting, graphic record. It is to be hoped that the pictures shown will find their way into some museum, where future trainmen may have the opportunity of following this line of development in a way that "He who runs may read." The exhibit in this department is very interesting, but by no means so complete as it might be A very large number of inventions were brought out to try and apply brakes by means of the compression of the draw-bar; these have been known as bumper-brakes. Only one specimen is shown. There were also a variety of steam-brakes introduced, and the Loughridge air-brake was for a time a rival of the Westinghouse, but it does not appear, although the Baltimore & Ohio was the scene of its hopes and of its failures.

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The electric heating of trolley street cars has become an important branch of the business of the Consolidated Car-Heating Co. of Albany. Such electric heaters, with regulating switch, have been applied already to cars in twenty-nine cities and towns throughout the United States and Canada. Among these cities and towns are New York, Rochester, Albany, Elmira, Yonkers, Hudson, Jamestown, Rondout, Chicago (three roads), Pullman, Cleveland (two roads), Northampton, Holyoke, Haverhill, North Abington, Brockton, New Haven, South Norwalk, Newark, Philadelphia, Allentown, Akron, Piqua, Dayton, Omaha, and Montreal, Toronto, Hamilton and Niagara Falls, in Canada

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The Indianapolis Car Works have taken the contract for building one hundred provision cars for Armour & Co.

No. 4. Loading. Train Filled in 15 Seconds After Dead Stop

No. . Unloading Train Empty in 11 Seconds After Dead Stop

No. 6. Unloading. Track Cleared in 55 Seconds After Dead Stop Platform Cleared in 80 Seconds After Dead Stop.

### Curious Railroad Accidents.

In an article on "Train Running for the Confederacy," by Mr Anderson, published in this issue, a curious accident is mentioned where, in a collision, the body of a box car was thrown forward upon a flat car, and was drawn through in the position it took on the jump.

There are various authentic records of cars jumping out of trains and going down the bank without being missed. Among the records of curious train accidents there are two mentioned by the *Railroad Gazette* as having happened last month, which are well worthy of mention

A west-bound freight of the Pittsburg, Fort Wayne & Chicago, on arriving at Alliance, O., was found to have one empty car under which there was only one truck. Investigation brought to light the fact that the truck jumped out on a descending grade, near Garfield, and had sufficient momentum to carry it completely across the adjoining main track and into the ditch. No other damage was done

This is a stunning argument in favor of the link and pin-coupler, as a vertical plane-coupler must inevitably have let the car body down upon the rails.

Another curious accident occurred near Massillon. While descending a grade the men on the rear cars discovered that the train had parted and went out to set the brakes. The first brakeman had gone only one or two car lengths, when there was a shock which knocked him down and extinguished his lantern. He recovered, however, and was setting another brake, when there was a second shock, the forward portion of the train having been stopped by a train ahead of it, and the two parts running together. Two cars were damaged, and the conductor, in examining his list preparatory to setting them off, found that he was short two cars. They were found about two and a half miles back, standing clear of the main track. These cars also were empty, and it is supposed that they were derailed by a draw-bar falling on the track. The momentum of the cars behind them pushed them clear of the track and the connection was broken without any injury to the draft rigging. The night was quite dark, so that the two men on top of the train passed by the unruly cars without noticing them.

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We have received from Mr Rotheram, locomotive superintendent of the New Zealand railways, a table showing the consumption of oil for cars on the different sections of the railway system, which is narrow gauge, for a number of years. The average is what we would consider remarkably low, being only .67 quart per box per annum. The mileage of the cars or the weight per box is not, however, given, which are very important factors missing.

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*We invite correspondence on practical subjects from all men in the Motive Power and Rolling Stock departments of Railroads.*

*We will illustrate proprietary devices that are novel or interesting and that properly come within the scope of the paper. This will be done without charge, and without reference to advertising considerations.*

*The editors reserve the right to use or discard matter for the reading columns entirely on its merits. The reading columns will not be sold.*

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### Notice to Our Readers—No Back Numbers.

Recognizing the fact that LOCOMOTIVE ENGINEERING is of no use to dead men, and that those yet unborn will probably want something fresher, we have decided that every copy printed shall get out and do some good while it is young, vigorous and alive.

On the first day of February, 1894, we shall scrap every back number in this office, except copies of January. Hereafter, there will be *no back numbers*, beyond the current year. We will have, by December 15th, about fifty bound volumes of 1893, for sale at $3 each, and a few copies of each issue as far back as June. For 1894, we will bind 100 volumes, and they will constitute the back numbers. We would like your subscription to commence with January of each year and will try to supply copies that far back—but please remember that this is no morgue.

### Notice to Subscribers—Those Charts.

We have many enquiries about those charts, and to make it perfectly plain to all, we say:

Charts will be sent *only* to those whose names are on our list to December, 1894. If your subscription runs out a month before that you can get the charts by sending 20 cents to extend your subscription, 40 cents for two months, 50 cents for three months, etc., or you can renew for another year—any way that carries your subscription to or beyond December, 1894.

Charts will be sent as they are finished, and only to those paid on our list for the whole of 1894.

We will mail the charts, without the paper, to anyone for $1.00: one Jan. 1st., one in March, and one in May.

*Don't write asking if you are not entitled to the charts, unless the date on your wrapper is Dec. '94 or a later date.*

### Notice to Club Raisers and News Agents.

We have to announce that we do not furnish specimen copies of the current number of the paper. All specimens used will be back numbers only. Please don't ask for *last month's*, we can not supply them.

### To Club Raisers.

Please don't order "a set" of those charts—The Three Little Schoolmasters—we will mail you one as soon as ready in December. The others will not be issued until March and May. If your subscribers want them, be sure they pay to the end of 1894—no others can get them free.

Remember there are but a few bound volumes for 1893 (50)—there are no back numbers for '93 beyond June, and only a few of them—first come first served.

### Present Standing of Compound Locomotives.

Many railroad companies are obtaining valuable experience concerning the real value of compound locomotives in comparison with simple ones, but there still appears to be a decided conflict of opinion about the merits of the two types of engines. During a recent visit to Cincinnati, the writer talked with different officials of the Cincinnati, New Orleans & Texas Pacific about compounds, and they were all enthusiastic about the performance of the engines they have in service. The engines have certainly been running long enough to demonstrate their strong and weak points. The Erie people have had several compounds running over a year, and they have ordered nine new ones of a lot that the Baldwin Works are building. In the West there is a tendency among railroad men to depreciate the compound, and many of them say plainly that the craze in the direction of compounds is over. The Chicago, Milwaukee & St. Paul has given apparent encouragement to this idea by changing a compound locomotive into a simple engine, and this is quoted as a positive proof that compounds are worthless. We have not been able to learn why the change referred to was made, but we think that those who regard it as decisive proof that the compound cannot compare successfully with simple engines are permitting their prejudices to run away with their judgment.

There is no railroad in the West where a closer record of locomotive performance is kept than on the Chicago, Burlington & Quincy, and that company have had exceptional opportunities of judging what a compound locomotive is worth. They have had a compound of their own at work for about three years. She is pulling freight trains where the engines are run on the chain-gang plan and it takes its turn with the others and is handled by any crew whose turn falls to take her out. The coal tickets show that the engine effects a saving of 15 per cent. over the simple engine with the best fuel record, and about 25 per cent. over the average engine. She is handled as easily as a simple engine and is below the average for cost of repairs. What is of even greater importance, the engine pulls the same train as a simple engine, and can take a car more over the heaviest grade, is always ready to go out when wanted, and has given no annoyance from breakage. The owners are so well satisfied with the engine that they have built two more like her and expect to have them soon in service. Moreover, some officers of the company, who appreciate the importance of saving 20 per cent. of fuel, confidently predict that the compound is the freight locomotive of the future. The Vandalia people, who are using a Pittsburgh compound, speak enthusiastically about the performance of the engine, and they also regard this as the type of engine that will soon monopolize the work of pulling freight trains.

On some roads, where compounds are used on passenger service, there is a strong feeling against them. There is good reason for thinking that the compound does not give satisfaction when it is run with very high piston speed, but there is certainly no difficulty in maintaining a speed which few simple engines are capable of reaching. A curious thing about some of the compounds pulling fast passenger trains is, that they are reported to be very economical in the use of water, and that they burn as much or more fuel than simple engines doing the same work. A paradox of this kind is well worthy of investigation. If an engine is doing certain work with less consumption of water than another engine, it means that she is using less steam. If a smaller volume of steam is required there ought to be less fuel employed in evaporating the water. If the quantity of fuel is not reduced, it follows that the boiler or the draft arrangements are at fault, and that fuel is being wasted from some cause or other. Where a case of this kind exists, it is the duty of the men in charge of the locomotives to ascertain why it takes more coal per unit of water evaporated in the compound than in the simple engine.

### Our Prize Designs for Locomotive Cab and Boiler Fittings.

On another page will be found the announcement of our prize contest for the best design for cab and boiler fittings for a locomotive. This subject deserves attention, and the contest cannot fail to do good and excite interest.

It has become so common to read in the papers, day after day, of the scalding to death of engineers and firemen, that little attention is paid to it. The accidents, which are intensified by escaping steam or hot water, from broken boiler fittings, form a large percentage of the total engine accidents and they furnish most of the "horrors."

Much has been said and written about this subject, but very, very little has been done.

Excepting, perhaps, the use of a few inside checks *there has never been any improvement in the safety of boiler fittings;* but on the other hand the danger has been increased, because on modern locomotives there are so many more fittings than there formerly were. Inventors of various devices seem to think nothing of putting a valve of any size into the boiler until they bristle like an armory rack.

We open this competition of design for the benefit of the 75,000 men who earn their daily bread running and firing American locomotives—to save their lives, to aid their families, and to make their daily work more comfortable and secure.

A decrease of the risks they run must benefit them in securing cheaper insurance, and benefit their brotherhoods in the reduction of the death rate.

The enginemen of our roads do not run all this risk. We have only to think of the Quincy disaster on the Old Colony, or the frightful accident last year on the Colorado Midland, where a boiler check broke off in the side of a passenger car, to remember instances, enough to make this a question of the safety of the traveling public.

The first condition is for the safety of the enginemen. The second, for more convenience in handling, meaning comfort to the crew and better service for the company. The third condition is for the benefit of the railroads, as a more convenient arrangement of parts for the economical maintenance of running repairs must be a distinct saving of money for the company.

LOCOMOTIVE ENGINEERING has no selfish motive behind this offer, it expects an interest in the subject and in the paper on account of it that is natural, but there is no "if" to the awards. There has been "oceans of talk" about doing something in this line. Let's stop talking and *do that something*.

Here is pay for designing and a chance for the poorest and most obscure man in the field to bring his idea (if it has merit) before the railroad world. Can there be an improvement made? Cannot its adoption be made quite general if the designs selected possess merit? Will railroad men take an interest in this contest? To all of those questions LOCOMOTIVE ENGINEERING would answer, "Yes."

The editors of LOCOMOTIVE ENGINEERING have each put in more than ten years on the footboard of a locomotive, and know to what extent this danger exists. They expect support and help from the men from whose ranks the victims of these frightful executions and tortures by scalding are selected.

Something can and must be done—let's do it, and do it now.

### Our Sixth Birthday.

With this issue LOCOMOTIVE ENGINEERING completes its sixth year, and is now "goin' on seven."

During the past year we have printed *and distributed* 243,601 papers, an average of 20,302 per month, and we cannot help feeling that all this has done some good in our particular part of this little world.

Although we printed 25,000 copies of the first months of the year, *not a single copy* of any of the first six months' issues are left unsold—we were entirely out of January issues in April.

That the paper has been appreciated we have had the best kind of assurances—financial ones. To be sure the hard times has affected LOCOMOTIVE ENGINEERING, as it has everything else; some advertisers have quit, some have died, failed or gone out of business—but the best business houses still have their signs on our pages, and pay for them.

We do not believe in curtailing expenses in ink during hard times, being thoroughly convinced that then is the time to advertise, and give more for the money than at any other time; we have just invested some thousands of dollars in new and original things for our readers.

LOCOMOTIVE ENGINEERING for 1894 is going to be as much better than it was in 1893 as we know how to make it. Right on the start, it will have a cover, this has long been needed to keep the paper clean, to allow of side stitching to keep it in better shape, and to admit of printing 16 pages of solid reading matter in front and 16 pages of solid advertisements behind, in order to enable our pressmen to do better work on both forms.

We are going to give away $2,000 worth of educational charts with subscriptions to the paper for '94. There are three of these going to each subscriber, and they are going to do $20,000 worth of good.

The paper will contain several series of articles from the pens of the best posted railroad men in this country on especially timely subjects.

But there will be one feature that we believe will be especially interesting and do a lot of good at the same time, and that is the prize competition for safe, handy and economical designs of boiler fittings for locomotives. We are offering $350 in cash for the best designs for two classes of engines. This contest must excite interest, because it appeals to the life saving instinct of human nature—the victims of scalding accidents reach into the hundreds every year. It appeals to the men on locomotives who seek more comfort and convenience as well as safety, and it appeals to railroad officers, as a design that means cheaper repairs means a great deal in money saved as well as more miles per month for the power.

Word comes from our 400 club raisers, almost to a man, that all the old subscribers will renew, "because they are so pleased with the paper," and that they will get new ones besides. The American News Co. have just increased their monthly order to 4,000 copies, and—well, there is an incentive for us to do something handsome by our friends for 1894.

There will be 30,000 copies of the January issue printed, and no attempt will be made to keep back numbers beyond the current year. When that 30,000 are gone, that ends it, and that issue will be "out of print" forever.

To the thousands of friends at home and abroad who have an interest in LOCOMOTIVE ENGINEERING we send greetings, and wish them a Merry Christmas. Every last one of them will have a Happy New Year if they get a copy of their favorite paper in its new overcoat.

### A New Appeal for Block Signals.

A railroad disaster which happened on the Chicago, Rock Island & Pacific, near Chicago, last month, again emphasizes the urgent necessity for block signals where trains are numerous. The men who stand out in favor of the time interval being sufficient to prevent accidents will see how it worked under circumstances which appeared favorable. The Chicago, Rock Island and Pacific is one of the best managed railroads in the West. The rules for the safe movement of trains under the interval of time system were as well framed as possible, and the personnel of the train service are fairly well drilled to follow the rules. Yet a destructive tail-end collision happened between two passenger trains and twelve people were instantly killed and many others severely injured.

A suburban train went out at 5 30 P.M. in a dense fog and lost time on the way. There was a rear brakeman at the hind end of the train whose duty it was to put down torpedoes and throw off a lighted fusee at frequent intervals. The required signals of danger were not put out, and an express train that started half an hour after the local, dashed into the rear car of the latter with the dreadful result detailed. The engineer of the express had no intimation that the local train was in the way till the rear-end lights loomed up in his face through a thick bank of fog. The brakeman and the conductor of that local train murdered the passengers who lost their lives. Yet with the loose morality about holding men responsible for performing their duties, it is doubtful if anything more serious than the loss of their positions overtakes these men.

The company are, however, by no means blameless, for it has long been apparent that the time interval is a delusion and a snare in places where trains are numerous. The heavy passenger business of last summer made railroads in the neighborhood of Chicago peculiarly dangerous when not protected by block signals. In being without the protection of a block signal system, the C. R. I. & P. were not, however, different from many other roads that needed this medium of safety as badly or worse, but they have been the great sufferers, although their loss is small compared with those who met death and suffering in the wreck. It seems that fatal accidents are necessary to force into use every improvement in railway appliances calculated to secure safety.

Tertullian's saying that, "The blood of the martyrs is the seed of the Church," has applied well to railroad management ever since people began to travel behind a locomotive. The martyrs of accident cried out against the inefficiency of hand-brakes and the air-brake was forced into use. The martyrs of another species of accident cried out loudly against the dangerous car stove and improved means of car heating were adopted. The blood of other martyrs is now lamenting over managers and directors who are satisfied with time intervals between trains, and the people are asking why are block-signals not brought into general use? This question will not long be repeated patiently.

### Spark Prevention.

The article which we published in June last which took the ground that spark arresters and other obstructions to draft often caused spark throwing instead of abating the evil, has been taken up by Mr. Fenwick, locomotive superintendent of the Formosa railway in China and discussed in our correspondence columns. Mr. Fenwick has evidently had much experience of locomotive operating in England and in other parts of the globe. His views are the same as ours in regard to spark arresters. A case is mentioned in the letter where the fuel consumption was reduced nearly one half by dispensing with spark arresters and putting in what appears to have been a well-designed exhaust-pipe. After this important change was made the engines threw less fire than they did when the spark arresters were employed.

American railroad companies have not yet got to the habit of dispensing with spark arresters altogether, but the tendency is to reduce the obstructions to draft which were long considered necessary to prevent spark throwing. Invention labored diligently for years to multiply appliances that intervened between the points where the fire gases were evolved, and where they passed into the atmosphere. The engineer and the fireman struggled to prevent the use of draft-stifling appliances, but the inventor and the fire-claim agent used their influence to magnify the necessity for obstacles to a natural flow of the fire gases, and the master mechanic was pulled to and fro by the contending interests, his own preference generally being in favor of simplicity. Sound engineering principles are slowly but surely making progress on this question. Taking the spark-arresting devices out of the smokestack was an important move in the right direction. Since then the tendency has been decidedly in favor of throwing out all the appliances that compel the gases to follow a tortuous course. The time will come when all the obstructions will be abandoned, and men will generally agree that no spark-arrester is the best provision for preventing fire throwing.

### "Poor's Directory of Railway Officials."

The eighth annual of the above mentioned book has been received. The value of a work of this character lies in its scope and in its accuracy. From a careful examination of the book, we are forced to the conclusion that it is neither so accurate nor so comprehensive as other works of the same character already familiar to railroad men. Another fault which we find with the book is that its record is too old. Changes that have been made among officials for about six months are not incorporated in this list. For instance, Mr. H. H. Vreeland has not been general manager of the New York & Northern for six months, but his name is still in this directory as general manager of the road named. Mr. J. S. Graham has been away from the Lake Shore for six months, but this directory says he is master mechanic of that road. We might fill a page with the record of similar inaccuracies. Our impression is that this list is not prepared so much as a work of reference as a medium for the securing of advertisements that few railroad officials will see. This is said to be the eighth annual number of *Poor's Directory of Railway Officials*, yet we have never seen it used in a single railroad office as a reference, although we are constantly visiting such offices, and frequently see directories of railway officials referred to. This will indicate the value of the book to those who advertise in it. It is sold for $3 by the publishers, whose address is New York.

### NEW BOOKS.

ELEMENTARY LESSONS IN PRACTICAL MECHANICS AND MACHINE DESIGN. By Robert Gordon Blaine. Cassell & Co., New York.

This book is formed principally from examples worked out by students who were learning practical mechanics at Finsbury Technical College, London. Prof. Perry in an introductory note says of the examples found in the book: "It will be observed that they are all of a much more practical character, that is they are more calculated to educate the practical mechanical engineer than the examples usually to be meet with in books on mechanics." From a careful examination of the book we are led to conclude that it is the best work of the kind we have ever seen, but the problems by no means easy for those who have not got a good grounding in mathematics. We cordially recommend it for the use of draughtsmen and mechanical engineers. The price is $1.

PROCEEDINGS OF THE MASTER CAR BUILDERS' ASSOCIATION.

The report of the proceedings of the Twenty-seventh Annual Convention of the Master Car Builders' Association has been received. The volume bears evidence of the usual careful work put upon it by Secretary Cloud, and is a highly creditable production in every respect. It covers 404 pages, besides having a number of inserts containing engravings of the principal standards. Intimation is given that lithograph copies of the drawing standards and recommended practice may be had from the secretary. They are adapted for taking blue prints from. It is to be hoped that railroad companies generally will obtain these lithographs, for their use will be certain to keep standards up to the proper dimensions.

The report contains besides the proceedings of the Annual Convention, all the decisions of the Arbitration Committee for the year and the decisions concerning the letter ballots.

PRACTICAL INSTRUCTIONS RELATING TO THE CONSTRUCTION AND USE OF THE STEAM ENGINE INDICATOR. Published by Crosby Steam Gage and Valve Co., Boston, Mass.

This valuable little book is divided into two parts. The first part treats of the general design and construction of steam engine indicators, special design, construction and use of the Crosby indicator, with directions for its attachment and the construction of suitable mechanism for operating the drum, together with full instructions for taking diagrams, computing horse power, etc., to which is added complete directions for using Amsler's polar planimeter and Peabody's calorimeter.

The second part is by Albert F. Hull, and consists of articles treating on the generation of steam, boiler tests, and other subjects which are interesting and valuable for those who are acquiring a knowledge of steam engineering. The author of this part is a little ostentatious in trying to parade his knowledge of mathematics, but that does not detract much from the value of the book to plain, practical men.

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Our correspondent, Mr. Holmes, whose letter will be found on another page, mentions a discovery that he has made with angle-cocks. He found that by striking short sharp blows with a hammer on top of the handle of the angle-cock that every angle-cock on a train could be closed. An exception was found in a cock having the spring wound left handed. When it was shut it could be tapped open. Those with the spring wound right handed could all be tapped to close. There is likely to be this tapping action experienced in service when train-pipe is insecurely fastened. A rough riding car would produce vibration enough to close a cock. As it is not wise to permit any possibility for self-closing of angle-cocks to exist, we think that springs wound to the left should be applied to all these cocks.

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Since the close of the World's Fair there has been a great deal of talk about races and competitions between the various locomotives exhibited, but there is not likely to be anything come out of it. The talk of a speed race was absurd, but we think it would have been interesting to obtain particulars of a test between two engines of about the same capacity pulling a train of the same weight at a required speed. We understand that Mr. Wimby, proprietor of the "James Toleman," was anxious to run his engine in competition with the favorite engines at the Exposition, every engine to pull a train of 200 tons a distance of 200 miles. The proposition was very fair, and we do not understand why something of the kind was not done. Before the Fair began there was a great deal of talk about having tests of the locomotives, but it all frittered to nothing.

### PERSONAL.

Mr. George P. Gardner has been appointed superintendent of the Pittsburgh, Akron & Western, with offices at Akron, Ohio.

Mr. James H. Hustis has been appointed assistant superintendent of the Harlem Division of the New York Central & Hudson River road.

Mr. Ira L. Beebe, for some time past foreman of the Dayton roundhouse of the C. H. & D., has been transferred to the Lima roundhouse in place of R. E. States, resigned.

Mr. W. W. Peabody, Jr., has been appointed assistant to the first vice-president and general manager of the Baltimore & Ohio Southwestern, with head-quarters at Cincinnati, O.

Mr. A. J. McCabe, superintendent of the Montana division of the Great Northern, has been appointed superintendent of the Cascade division, with headquarters at Leavenworth, Wash.

Mr. Henry James, the well-known railroad supply man, has accepted the position of sales agent for the railway department of Minnett & Co., varnish makers, Philadelphia, Pa.

Mr. W. D. Crosman has resigned from the editorial staff of the *Railway Age*. Mr. Crosman is one of the best known railroad journalists, having been with the *Railway Review* for many years.

Mr. Sumner J. Collins has been appointed general superintendent of the Wisconsin Central. Mr Collins has been for three years general superintendent of the Louisville, New Albany & Chicago.

Mr. W. E. Bailey has been appointed superintendent of the Lehigh & Hudson River, with headquarters at Warwick, N. Y. He was formerly superintendent of the Philadelphia, Reading & New England.

Major G. W. Vaughn, who has been chief engineer in charge of the construction of the Santa Fé, Prescott & Phœnix, has been elected general manager of the road. He still retains the position of chief engineer.

Mr. E. W. Batchelder has been appointed superintendent of the Montana division of the Great Northern, with headquarters at Havre, Mont. He was formerly assistant superintendent of one of the Eastern divisions.

Two new improvements on car couplers have been patented by Geo. W. Smillie, Newark, N. J., inventor of the well-known Smillie coupler. Both the new patents relate to improvements in the locking arrangements of the coupler.

Mr. J. E. Holtz has been appointed master mechanic of the Chicago, Rock Island & Texas road, with headquarters at Fort Worth, Tex., taking effect November 1. He will have charge of motive power, rolling stock and shops.

W. C. Walsh, formerly air-brake inspector of the St. Louis & Henderson Divisions, Louisville & Nashville R. R., has been appointed roundhouse foreman at Howell shops, Evansville, Ind., vice Irvin T. Carr, transferred to other duties.

In the death of Mr. W. H. Griggs one of the veteran master mechanics of New England has passed away. Mr. Griggs was a brother of Mr. George Griggs, of the Providence & Worcester road, who was celebrated as one of our pioneer locomotive designers.

The citizens of Dickinson, N. D., gave Mr. and Mrs. J. E. Phelan a reception before they left the place. There was a ball, a banquet and a presentation, in the latter connection a solid silver tea set and a solid silver set of knives and forks performed an important part.

J. C. Currie, the genial engineer of the new compound on the P. R. R. has just been appointed advertising agent of the *Brotherhood of Locomotive Engineer's Monthly Journal.* "Jimmie" is a genial, whole-souled fellow and deserves success and has ability to win it.

We understand that Mr. J. B. Hawks has been appointed general manager of the Detroit, Bay City & Alpena road, with headquarters at Detroit, Mich. Mr. Hawks is one of our best known railroad men, having been for years chief engineer of the Michigan Central. He left railroad work for a time, but has now returned to the fold.

Mr. George P. Hamlin, who was superintendent of construction on the railroad between St. Petersburg and Moscow, in Russia, died at his home in Baltimore, Md., November 12. Mr. Hamlin served as machinist's apprentice to Ross Winans, and he went to Russia in Mr. Winans' service, to act as superintendent of construction.

In a letter on safety and economy in car heating, Mr. William C. Baker, of car-heating fame, mentioned that in a trip from Boston to Springfield in a drawing room car heated by steam, he noted that the attendent opened and closed the regulating valve twelve times at the complaint of the passengers. It goes without saying that Mr. Baker has no use for steam.

Early in October, Thomas Baer, a crossing watchman at Catasauqua, Pa., gave the wrong signals and caused a collision, killing two engineers. Baer acknowledged that he was alone to blame, said he got excited when the two trains got close to the signal. Then he went home, got a gun and went out to a tree in his yard and blew his brains out.

Mr. A. D. McCullum, a machinist in the C., H. & D. shops, at Lima, O., has been promoted to the position of roundhouse foreman at Dayton, O., having charge of the engines and men on the D. & M., as well as the C. H. & D. division. Mr. Cullum served his apprenticeship under the late John Black, and came up through the shop, being noted as a painstaking and reliable mechanic.

Mr. W. C. Squire, who has been for several years on the editorial staff of the *Railway Age*, has been appointed western agent of the Boston Railway Equipment Company. This company handles the Marden brake-beam, and a variety of other railroad supplies. Mr. Squire was formerly in the test department of the C. B. & Q. He is an excellent writer on railroad subjects, and we regret to see that he has left the editorial sanctum.

Mr. James Meehan, superintendent of motive power of the Queen & Crescent, has resigned, the position being abolished. Mr. Meehan is one of the best known railroad master mechanics in the country, having been with the Queen & Crescent road for upward of ten years. Mr. Meehan is largely interested in manufacturing concerns in Chattanooga, and is perfectly independent of the railway business, but we understand that he wishes to obtain another position as superintendent of machinery.

There appears to be great uncertainty now about when and where the first sleeping car was run. We believe that the case mentioned by Dr. Williams in our November issue, where a sleeping car was run in 1840, tells of the very first car used for this purpose. According to the *Railroad Car Journal*, Mr. Poole, purchasing agent of the Western New York & Pennsylvania, ran the first sleeping car into New York. It was a Woodruff car, used by ladies only. There is no reason for believing that the first sleeping car used in the country was run into New York City.

Mr. W. D. Ennis, son of Mr. Ennis, master mechanic of the New York, Susquehanna & Western, has entered the Stevens Institute of Technology as one of the scholars of the Master Mechanics' Association. Mr. Ennis has been several years away from school and has been learning the machinist's trade. He had to study very hard to prepare himself for passing the entrance examination to the Stevens Institute, which is very stiff. The Master Mechanics' Association have now the full complement of scholars at the Stevens Institute. There will be an opening for one more scholar next September. Ambitious young men eligible for these scholarships ought to be preparing themselves for the examination.

Several changes were made among the mechanical officers of the New York Central Railroad on the first of this month. Mr. Geo. H. Hazelton, who has been for years master mechanic of the Rome, Watertown & Ogdensburg, has been appointed assistant superintendent of motive power of the divisions west of Syracuse, in place of Mr. J. D. Campbell, resigned. Mr. James Buchanan, who has been master mechanic in charge of the West Albany shops, has been appointed assistant superintendent of motive power of the divisions east of Syracuse. Mr. P. T. Lonergan is appointed master mechanic of the Rome, Watertown & Ogdensburg. He has been for ten years chief draughtsman of the New York Central mechanical department, and was formerly on the Delaware, Lackawanna & Western.

M. N. Forney is publishing each month in his paper, the *American Engineer and Railroad Journal*, a list of the accidents that have befallen engineers and firemen for the month. Mr. Forney is horrified at the frightful casualties to enginemen and he may well be for it makes every honest man sick at heart to read the details of the awful deaths and tortures suffered by these men. Some relief must be had, and it must be had soon, for this matter has grown to be a national disgrace. Mr. Forney collects his data from the daily press, and, of course, his report is very incomplete, yet for September he reports 40 engine accidents, in which 13 engineers and 14 firemen were killed, and 21 engineers and 19 firemen injured. Friend Forney, more power to your pen. If we can do anything on earth to help, even a little, we are with you, heart and soul.

Mr. Robert B. Campbell has been appointed general manager of the Baltimore & Ohio Railroad, succeeding Mr. J. T. Odell. Mr. Campbell rose from the position of telegraph operator on the Central Pacific road to be assistant superintendent, from there he went to the Chicago, Milwaukee & St. Paul, where he made an excellent record as a superintendent. Those who were familiar with his work on that road anticipated that he was likely to climb high on the railroad ladder. He left the West to become general manager of a railroad in Jamaica, but did not remain there more than a year, when he came back to the States and became general superintendent of the Baltimore & Ohio Western lines. His success in the latter position commended him for that of general manager. We feel certain that he will prove a great success in the position he now assumes.

The Pennsylvania Railroad people appear to have a great deal of confidence in mechanical engineers as judges of the material likely to give the best service in railroad appliances. It is said that Mr. Lewis, the chief purchasing agent will be succeeded by Mr. A. W. Sumner, who has long been his assistant, and that R. E. Marshall, superintendent of motive power of the Philadelphia, Wilmington & Baltimore, will be made assistant, the intention being to utilize Mr. Marshall's engineering knowledge in the selection of purchases. The rumor is also current that Mr. Mullin, purchasing agent for the lines west of Pittsburgh, is about to retire, and that his place will be taken by Mr. E. B. Wall, lately superintendent of motive power of these lines at Columbus, the understanding being that Mr. Wall's experience as a mechanical officer can be utilized to good advantage in the purchasing department.

One of the most unassuming of our railroad magnates is Mr. George Gould, who controls more men and interests than kings do in some of the older monarchies. His kingdom is of a particularly real character, and be it told to his credit there is no disposition on the part of this ruler to curtail the income or comfort of his subjects. He is generally to be found in the fifth story of the Western Union Building, New York, sitting in his shirt sleeves in a very plain room. All the cranks in the country appear to want to see Mr. Gould on some pretext or other, but they are warded off in an extremely amusing manner. An intensely polite young man takes the messages of visitors and goes back into another room. In about five minutes he returns, looking grief stricken, and says, with many expressions of regret, that Mr. Gould has stepped out somewhere, and he does not believe he will be back again to-day. The thing is so well acted that the visitor generally goes away under the impression that Mr. Gould will be heart-broken at not having seen him. The young man is an excellent actor.

The annual meeting of the New York Railroad Club, which was held in the rooms of the Society of Mechanical Engineers, New York, on November 23d, was very largely attended; there having been more than 100 members present. The following officers were elected: President—R. C. Blackall, superintendent of motive power and machinery, Delaware & Hudson. First Vice-President—George W. West, superintendent of motive power, New York, Ontario & Western. Second Vice-President—A. E. Mitchell, superintendent of motive power and machinery, New York, Lake Erie & Western. Third Vice-President—W. H. Lewis, master mechanic, Delaware, Lackawanna and Western. Secretary—John A. Hill, editor LOCOMOTIVE ENGINEERING. Treasurer—C. A. Smith, superintendent Union Tank Line. Executive Committee — Thomas Millen, superintendent and master mechanic of the New York & Northern; W. C. Ennis, master mechanic, New York, Susquehanna & Western; H. H. Vreeland, president Metropolitan Railway Company; W. W. Snow, president, Ramapo Iron Works; W. G. Wattson, superintendent, West Shore. Finance Committee—F. M. Patrick, H. W. Johns Manufacturing Company; F. W. Coolbaugh, Messrs. Coolbaugh & Pomeroy; R. A. Parke, Westinghouse Air-Brake Company.

The railroad men who are not acquainted with Engineer Nat Sawyer are not familiar with the leading throttle-pullers on this terrestrial sphere. Nat is the New York Central engineer. There may be others who know something about running locomotives, but Nat is the veteran. He represents them at the engineers' conventions, and takes care that loyalty and good feeling prevail among them. He was in his glory last summer, in charge of the "999" at the World's Fair, and his admiration of the fast engine never flagged, and he never tired of expatiating on her beauties and merits. It was expected that he would stay with the engine and see her home safe, taking a share of the glory that awaits the return trip, but Nat did not remain in Chicago after the close of the Fair. When Mr. Buchanan began getting letters from Nat, saying that it was absolutely imperative that he should return home, Mr. B. concluded that the veteran was tired out with his long talk to railroad men and needed rest. He was relieved, and immediately on reaching the Grand Cental Station, at New York, he made urgent application for passes to Boston. There was a doctor there whom he must see immediately. His friends were rather alarmed, and the passes were furnished without delay. Their anxiety was entirely dissipated a few days afterwards, when Nat returned with a brand new wife.

Mr. Enoch Lewis, the well-known purchasing agent of the Pennsylvania Railroad, has resigned, after a service of forty-three years with the company. Mr. Lewis, like so many other successful officers of the Pennsylvania Railroad, rose through the mechanical department, in which he had a record well worth being related. He learned the machinist trade in the shops of Eastwick & Harrison, the well-known locomotive builders, and remained with them for six years. In 1844 he went to Russia in the interest of the firm, took charge of a shop near St. Petersburg, and superintended the building of cars and locomotives for the St. Petersburg & Moscow Railroad. Returning to the United States two years afterward, he held positions with several builders of locomotives and of machine tools. In 1850, he entered the service of the Pennsylvania Railroad as a round-house foreman. From that he rose by degrees to be general superintendent of the road. This arduous position he held during the trying times of the war. When peace came he retired from active service to secure needed rest, and shortly afterward the position of purchasing agent was created for his benefit and given to Mr. Lewis. Mr. Lewis was a good draughtsman and he left his mark on some of the pioneer locomotives which brought celebrity to American builders. In March last we published an engraving of the "Gowan & Marx," from a drawing made by Mr. Lewis when he was a young man. That engine was famous in its time. She was the first locomotive ever built that pulled forty times her own weight.

In the office of Mr. C. A. Thompson, superintendent of motive power of the Jersey Central, there is to be seen part of a patched firebox, which is well worthy of examination. The material of the original firebox was Lowmoor iron, and it had been in use in a district where the feed water had a strongly corroding tendency. The firebox had been in use seventeen years, but one part was patched with a piece of steel plate five years ago. The steel shows as bad a case of pitting and general eating out as anything we have ever seen, but the iron that surrounds it shows very little traces of corrosion.

In speaking on the care of boilers at a meeting of the New York Railroad Club, Mr. G. R. Joughins, master mechanic of the Norfolk Southern, mentioned several cases where he had extraordinary trouble with boiler tubes pitting and corroding where slightly saline water was used. In some cases the tubes corroded through in a few months. He found that metallic zinc placed in a boiler proved an effective remedy. The tubes that proved most susceptible to corrosion were made of steel.

A curious invention, intended to prevent the derailment of railroad cars, has been patented by Henry W. Kirchner, Denver. He proposes to employ a middle rail. Attached to the under part of the truck is a frame that carries two wheels set in bevel shape one clasping each side of the rail. The plan would no doubt be effective, but it would greatly increase the expense of operating a railroad.

## EQUIPMENT NOTES.

The Mahoning Valley road are about to order five passenger cars.

The Illinois Central people have ordered 150 new freight cars from Pullman.

The Sinnemahoning Valley road are in the market for fifteen passenger cars.

The Philadelphia & Reading have ordered the building of 100 new coal cars.

The Columbus, Hocking Valley & Toledo are said to be in the market for 1,000 cars, mostly for coal business.

The seventy-five passenger cars required by the Long Island road will not be let until the middle of December.

The Minneapolis, St. Paul & Sault Ste. Marie are getting four new coaches for through business built by Barney & Smith.

The Laconia Car Works were awarded the contract for 300 box cars for the Fitchburg R. R. They are to be equipped with Gould couplers.

The Lake Shore & Michigan Southern have contracted with the Peninsular Car Co for 300 cars, some of them for carrying furniture, others common box

The Lake Street Elevated, of Chicago, have just ordered twenty-five coaches from Pullman, in addition to the order of 100 being built by Gilbert's, at Troy

The Illinois Central people have contracted with the Harvey Car Works, of Chicago, to convert the cars they used for the World's Fair suburban business into freight cars.

The Armour Packing Company, of Chicago, have awarded a contract to the Indiana Car Company for 100 cars and to the Missouri Car and Foundry Company for the same number.

The first deliveries on the seven engines for the Jacksonville, St. Augustine & Indian River road are being made by the Schenectady Locomotive Works. Six more of these engines have been ordered.

It is reported that before leaving for Europe, President Reinhard, of the Atchison, Topeka & Santa Fé, made arrangements for purchasing a large number of new locomotives. Baldwin's people have got the order and it is said to be for seventy-five engines.

The Long Island Railroad have issued specifications for the building of new passenger cars, most of them being intended for suburban business. The talk is that an order will be given for seventy-five cars. The intention is to have them built in first-class shape.

The Morton Safety Heating Company, of Baltimore, is now busy equipping 100 cars of the Lake Street Elevated road of Chicago for its system of car heating It also has orders to put this system on a number of cars of the Grand Trunk, which had cars equipped with this system in service last winter

The vacuum brake is slowly disappearing from the passenger equipment of the Long Island Railroad. The Westinghouse air-brake is being put on the engines on the Manhattan Beach and Rockaway Beach divisions, and also on the ten compound locomotives built in 1892. All these engines have heretofore been equipped with the vacuum brake

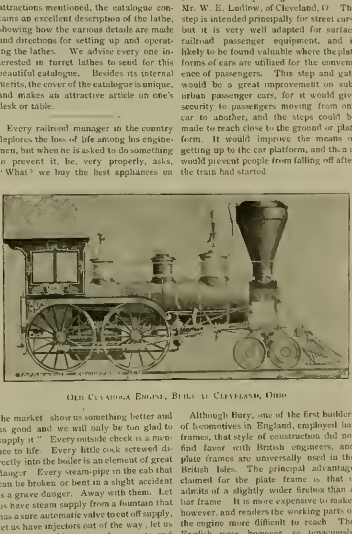
The fine train of Wagner cars exhibited at the World's Fair was brought to New York by engine "999," along the lines of the Lake Shore and the Central. The train excited as much interest on the way as a circus, thousands of people thronging the stations to witness the train and engine that have attracted so much attention. Both train and engine will be put into regular service soon.

One of the handsomest illustrated catalogues we have ever examined has lately been issued by the Jones & Lamson Machine Co., of Springfield, Vt , illustrating some of the turret lathes built by the company and the work which the lathes are capable of finishing. In connection with the tools shown, there are illustrations of the development of the turret lathe, which will be found highly interesting There are cuts of how this type of lathe looked in 1857, 1858, 1870, 1882, 1886 and 1891. It is a graphic history of the tool, and it is supplemented by an exhaustive article on the evolution of the turret lathe Besides the attractions mentioned, the catalogue contains an excellent description of the lathe, showing how the various details are made and directions for setting up and operating the lathes. We advise every one interested in turret lathes to send for this beautiful catalogue. Besides its internal merits, the cover of the catalogue is unique, and makes an attractive article on one's desk or table.

Every railroad manager in the country deplores the loss of life among his enginemen, but when he is asked to do something to prevent it, he, very properly, asks, "What? we buy the best appliances on

announcement that the Carnegie companies had determined to reduce the price of steel rails $5 a ton. There has been for several years a combination among the steel-rail makers which maintained prices of steel rails at about $30 a ton. The action of the Carnegie people brings the price down to $25 a ton. A prominent steel maker in Pittsburg, talking to the writer a few days before the announcement of the cut was made, said that steel rails could be sold for $20 a ton and leave a good profit. If the tariff on steel rails be reduced to 25 per cent , as reports say it will be, American makers of steel rails will have to sell their product at $22 a ton to compete with English rails.

We have lately examined an extremely ingenious invention, which consists of a combined car step and gate, invented by Mr. W. E. Ludlow, of Cleveland, O The step is intended principally for street cars, but it is very well adapted for surface railroad passenger equipment, and is likely to be found valuable where the platforms of cars are utilized for the convenience of passengers. This step and gate would be a great improvement on suburban passenger cars, for it would give security to passengers moving from one car to another, and the steps could be made to reach close to the ground or platform. It would improve the means of getting up to the car platform, and then it would prevent people from falling off after the train had started



OLD CUYAHOGA ENGINE, BUILT AT CLEVELAND, OHIO

the market show us something better and as good and we will only be too glad to supply it " Every outside check is a menace to life. Every little cock screwed directly into the boiler is an element of great danger Every steam-pipe in the cab that can be broken or bent in a slight accident is a grave danger. Away with them. Let us have steam supply from a fountain that has a sure automatic valve to cut off supply, let us have injectors out of the way , let us have comfortable seats and arm rests, and above all, safe and handy cabs There are brains enough in this country to devise a safer arrangement than is now in use—let us use those brains

From what has been learned about the invention of the link motion, by examining the older locomotives at the World's Fair, an impression has gone forth that to America belongs the credit of the invention of the link motion. The manly letter from Mr. Clement E. Stretton, C.E , of Leicester, England, on the subject, published in another column, shows that English engineers are disposed to give honor where honor is due on this important question. From what Mr Stretton says, it is likely that the invention of James exerted important influence on the development of valve motion in England, since the drawings sent from America by the inventor of the link induced Forrester & Co., locomotive builders, of Liverpool, to adopt the four eccentrics, which prepared the way for the reinvention of the link motion

There was considerable excitement among steel men early in the month by the

Although Bury, one of the first builders of locomotives in England, employed bar frames, that style of construction did not find favor with British engineers, and plate frames are universally used in the British Isles. The principal advantage claimed for the plate frame is that it admits of a slightly wider firebox than a bar frame It is more expensive to make, however, and renders the working parts of the engine more difficult to reach The English were, however, so tenaciously wedded to the slab frame that we supposed the idea of bars was an abomination, yet we notice in the *Engineer* that a firm of English builders have begun to construct small locomotives with bar frames

A decision has been rendered by Judge Townsend, of the United States Circuit Court, in the suits of the Westinghouse Air-Brake Company against the New York Air-Brake Company for infringement of the patents relating to the mechanism employed in their quick-action brake The decision decrees that the New York Company's engineer's valve, and all forms of their triple-valve are infringements of the Westinghouse patents. The company using the devices named are enjoined from the sale of them and an accounting in each case is ordered. The decision allows George Westinghouse, Jr., very broad claims as inventor of the quick-action brake

During the World's Fair 1,453,611 people paid 50 cents each to ride around in the Ferris wheel, $726,805 50 was "blown in" this way. After paying off $300,000, their indebtedness on bonds, they divided $426,805.50 with the Exposition management, and after paying all expenses of operation divided $150,000 among the stockholders. Now, William Somers, of Atlantic City, N J., sues the Ferris Wheel Co. for infringement of his patent, proves that Mr. Ferris rode on his little wheel at Atlantic City, and gets judgment in the Circuit Court—damages not yet decided on.

We are in receipt of several letters asking if we expect the surrender of patentable devices shown in our prize designs No , it makes no difference to us or the railroad public if a device is patented or not, if it is only good and does the business Anything new is not injured by such publication, but is protected by it It is patentable any time within two years after the description, and the publication is proof of priority of invention

The parties who have control of the Harvey process of treating iron and steel are making experiments to find out its effect on the wear of rails, tires and other parts subject to rapid wear. The process is reputed to be highly suitable for strengthening car coupler knuckles, and the Smillie Car Coupler Company are making experiments to ascertain how far the claims are well founded

The Wells & Coutan Co , of New York, have issued a notice intimating that they are manufacturing high-grade steam gauges, various forms of relief valves, and that they handle the thistle gauge class so much used for locomotive work They intimate that they depart from stereotype methods, which enables them to offer superior inducements to those who buy the class of goods mentioned.

What is said to be a certain remedy for chilblains has been sent us by Dr Helen Mack, of Boston, daughter of the well-known injector inventor, for the benefit of engineers and firemen who suffer from that trouble during the winter. It is a homeopathic remedy, and is to swallow one tablet three times a day, of xxx croton tiglium. It is said to be a certain cure

There are quite frequent requests from different parts of the country asking us to publish picture and description of the "999", these requests mostly come from new subscribers to this paper, and to all of them we must say, that it is against the law to repeat We published such a description in June, and copies of that issue can be had at 20 cents each

The officers of the two Brotherhoods owe it to their members that they aid in the crusade against dangerous boiler fittings. It is their brothers who are crushed and cooked and done to death against these boiler-heads. To lessen these accidents should be a work of love and duty—and they can be lessened.

B. M Jones & Co., Boston, are not saying a word about hard times They say that orders fell off for two or three months, but the whole year's business will compare favorably with that of other years. The sales of Taylor stay-bolt iron has been as good for November as they were for the same month last year

The men using the Hancock inspirator on locomotives say that if there is water in the tank it has to come This apparatus for feeding boilers is making a remarkably good record in districts where the feed water is heavily charged with solid matter. Incrustation does not seem to affect the inspirator

When an English engineer (driver) reverses his engine to avoid an accident, he says he "fixed" her In an accident not long since, we note the driver reported "On seeing shunting engine outside the home signal, I applied the vacuum, fixed engine and jumped off "

### The New York Railroad Club Surprises its Treasurer.

An exceedingly pleasant episode happened at the last meeting of the New York Railroad Club. A few of the officers, advised of the secret, had the venerable treasurer, Mr C. A. Smith, employed looking over the books of the club, when Mr A E. Mitchell superintendent of motive power of the Erie, rose and said

"We have sitting here at the desk, Mr. Smith, who has been treasurer of the club since 1871. He was the moving spirit among those who met to organize the club, and ever since that time he has been the most active member in keeping it alive When others were discouraged about keeping up such an organization and wished to let it drop, Mr. Smith's friendship for the club never faltered, and he succeeded time and again in reviving the flagging interest that was in danger of ending the existence of the institution. We all thoroughly appreciate the great services which Mr Smith has rendered to this club, and through it to all similar clubs in the country. It has been the success of the New York Railway Club that brought all the others into existence, and therefore we may call Mr Smith the father of all our railroad clubs. In tendering the public thanks of this club to Mr. Smith for the able work he has done for it, I wish to present this token of regard as a slight indication of our gratitude and good will"

Mr. Mitchell then presented Mr. Smith with a very handsome gold-headed umbrella, having a suitable inscription thereon.

### Weight on Wheels.

The New England Railroad Club follows a practice that is well worthy of imitation by other organizations of this kind. They bring together men belonging to the various departments of railroads, and have subjects discussed from the standpoint of the managers and superintendents, of the chief engineers and road masters, of the master mechanics and car builders, and of the inspectors and traveling engineers In following this practice they lately had "Permanent Way and Rolling Stock" discussed Were this practice followed more generally there would be less conflict between different departments, and the higher interests of railroads would be better served.

The following points were made concerning weight on wheels What is the proper weight to be employed? For many years it was considered that nine tons per wheel, or 18,000 pounds was the extreme limit. My own preference would be never to go over eight tons, provided that would furnish sufficient adhesion for the work * * * There are locomotives to-day made to run trains at high speeds, which I assume to be more destructive to the track than those at slow speeds, that have a weight of 44 tons upon the four drivers or 11 tons to each wheel—an enormous weight resting upon one point of the rail, and that point a knife edge almost, bounding along at 70, 80, 90, 112½ miles an hour. Now, I think if it is necessary, in order to get steam to do the work required by modern railroading, to have such enormous weights—and I believe it is—that we must resort to different types of engines, we must have more driving-wheels, so that this great weight may be distributed over more bearing points. I now speak of engines for passenger service This means going into the complications of 10-wheel engines or moguls. * * *

I believe the true solution is this When the character of our grades is such, and when the weight of the trains is such, that an engine running, not to exceed 55 tons, cannot do the work, it is vastly more economical and safer to divide the trains and make two where before one was run. Between Boston and New York the Boston & Albany road did this very thing a year or two ago Their train leaving Boston at 11 o'clock at night got so heavy that it was difficult to make time with it, and they wisely divided it into two. The Shore line has done the same thing within a year. I believe that is true economy, although you can figure out that it costs more to operate the trains, because it adds so much to your train mileage, but the question of whether it costs more on that account does not cover the whole argument. The question of safety is a most important factor, and I believe that if you have got to use more than an ordinary 18 x 24 cylinder engine on our New England roads, it is better to divide the train, that it is vastly safer than to attempt to run such enormous trains as some of us are doing to-day Perhaps as heavy a train as is run in New England is our Fall River steamboat train. On my last trip to New York I went by

INTERIOR VIEW MODERN PULLMAN COACH

that train We had 10 vestibule cars, weighing 32 tons each, and 3 parlor cars, weighing 45 tons each. Fourteen cars is the regular train. That train is handled by an 18 x 24 cylinder engine.

Instead of increasing the weight of passenger engines, I believe we can get better results with a lighter engine carrying a higher pressure of steam. I am free to say we have got all over being afraid of 200 pounds of steam. I do not believe there is any more difficulty in constructing a boiler that is safe with 200 pounds than with 100 pounds. It is simply a question of design, material and workmanship, and a 50-ton engine with 18 x 24 cylinder, carrying 200 pounds of steam, will handle a train that a 60 or 70-ton engine with a lower pressure would have difficulty in taking care of. It is a mistaken idea that it takes an immensely heavy engine to furnish the proper amount of adhesion to handle a passenger train. Anyone who has made experiments with the dynamometer will understand this.

With reference to freight engines the problem is different, we must have adhesion there to get the trains over the hills, and this means that we have got to have heavy engines. This problem was years ago, and on heavy freight trains you see the mogul and the consolidation. * * * On freight engines there is not so much objection to multiplying parts as there is on passenger trains, but we must not jump at the conclusion that we will order a lot of freight engines to weigh 75 or 80 tons each without consulting the chief engineer, as is sometime done by managers and directors.

The January issue of LOCOMOTIVE ENGINEERING will be printed and distributed before the holidays. Copy for changes in advertisements must be in this office by December 12th, and hereafter we cannot insure changes in adv. unless copy for same is in our hands by the 15th of each month, the new form of the paper requiring that we go to press on that day with sixteen pages of advertising.

We are informed that the Norton ball-bearing jack has received the highest award at the Chicago World's Fair. The company report that their business is very good considering the dull times in other lines.

The committee of the Master Car Builders' Association investigating the subject of steel tired wheels have sent out a very comprehensive circular which ought to bring in a great deal of information about the service of all sorts of wheels The chairman of the committee is Mr. R E. Marshall. He appears determined to find out all there is to be learned about the subject he has on hand

### Heating of Driving-Boxes and Eccentric Straps.

A few years ago there were numerous complaints heard of delays caused on railroads from the heating of driving-boxes and of eccentric straps, with frequent breakage of the latter. Numerous explanations were heard as to the cause of the trouble, and various remedies, more or less fallacious, were suggested. After a time the real cause was found out, and the trouble is disappearing as the remedy goes into operation. Too much weight for the size of the bearings was what ailed the driving-boxes and too little bearing surface for the power transmitted was the weak point of the eccentric strap. There were other minor causes of disorder, but those mentioned were the most important.

A report presented to the Central Railroad Club by Mr W. Lavery, of the Erie, covers the subject very well. He said

"Driving-boxes and eccentrics heating can be traced to many direct and indirect causes that would require pages of reports to cover, were it necessary. We are of the opinion, if these parts are properly designed, carefully constructed, of good material, and proper lubricants used, the causes for heating have been covered. And if proper care is taken by those having our locomotives in charge, the prevention also is given. Driving-boxes and eccentrics well designed should have strength without unnecessary weight, filled with oil cellars or recesses for the lubrication of the wearing parts. Constructed true and square in order that the surface may have easy contact with one another without pinching or binding. The material should be well considered, being strong and tough to carry the weights, as well as to resist the strains to which they are submitted.

"The lubricant should be of the best grade of oils, sufficiently light in body to penetrate to the surfaces, and yet not run off quickly after being applied. Presuming our locomotives are equipped as herein noted, we may reasonably expect good service if attended with care by those having them in charge, and in our judgment the heating of driving-boxes and eccentrics will, to a large extent at least, be prevented."

The Railroad Commissioners of Illinois have been investigating the condition of the track of the railroads within the State and have recommended improvements in some places and the reduction of the speed of trains on a few roads. If the Commissioners would start out on foot and inspect some of the lines under their charge, we feel certain that there would be very decided recommendations both for betterment and for reduction of speed. Inspecting a railroad while riding in a palace car is not the way to learn the condition of the structure. Some time ago the writer walked a considerable distance over a railroad in Illinois, and a good, sound tie was the exception very rarely met with. The iron was in wretched condition, and on nearly every embankment the ties stood out from six inches to a foot without support There did not appear to be a single bridge on the division that was safe. It was the worst track we had ever seen, yet the Railroad Commissioners make no recommendations about it.

A very sensible order has been issued by the President of the New York. New Haven & Hartford, to the effect that the heads of departments must not retain their relatives in the employment of the company. If a rule similar to this existed on all railroads, there would be fewer incompetent men holding important positions For years there was very little of the evil known as nepotism in the railroad world, but it has been growing very rapidly of late. On some roads there is scarcely an officer to be found who is not a nephew or cousin or brother-in-law, or some relative of a man in high authority. The thing is not fair to the company where it exists, and it is a real grievance to good men who have earned promotion.

### It Cured the Old Man.

The railroad superintendent who thinks that every detail of work, from the driving of a spike to the entering of a voucher, the repairing of a passenger car and the building of a bridge are all dependent upon his personal supervision, is fast disappearing, but he still is represented. There was once a superintendent named Pettibone, on a New England road, who was the worst representative of this class I have ever met, remarked the promoted conductor.

Pettibone was one of the small bore men who not only persistently bossed everything, but made himself intensely hateful to the men he was directing in the wrong way.

It came to pass that Pettibone fell sick, and there was rejoicing all over the road, for he was confined to bed. He fretted and fumed and acted like a mad man in bed, exciting himself in a fashion that threw him into a very serious condition. He felt that everything was going to rack and ruin, that office clerks were reading stories in business hours, that the shopmen were talking politics instead of working, and that the trackmen were devoting more time to their garden patches than to raising low joints. These thoughts were gall and bitterness. He felt that if he lay there another week all the locomotives and cars belonging to the company would be battered up in wrecks. There was not a train dispatcher on the system who could keep trains apart without his advice—so he thought, and the engineers would be running like rockets when they knew that he was on his beam ends.

Between a real fever and fretting his condition became so serious that his physician told him that he might die at any moment. On hearing this he sent for Conductor Burns, the only man on the road that he had confidence in. Burns and the super had been brakemen together.

"How are things on the road, Jim?" he asked, when Burns was shown into the sick room.

"First rate," said Burns, "they were never better."

"How many accidents have there been since I was confined in this cursed room?"

"Accident? Not any accident that I have heard about."

"No accidents! Have there been no collisions or trains getting ditched?"

"Nary a collision, and no ditching, except what the trackmen are doing."

"Do people talk much about my sickness?"

"Never heard a man say a word about it except Phil Green, the office cleaner, and he remarked that there had been peace in the place since the old man was laid up."

"But, Jim, you must have noticed that my illness must have depressed the stock of the road?"

"Depressed? It's up to 71, and it never got above 66 before."

"Well, well," groaned Pettibone. "No man is ever missed in this world. The road just going on as well as if I were around! The stock rising while I am lying here! A man might as well die and be done with it." And he lay down and resigned himself to his fate. Resignation was what his system needed, and he was out in two weeks. The first thing he did was to discharge Phil Green, but he reinstated him next day.

The old man was never quite so domineering after his term of sickness.

Scene in a street car.—Conductor comes along asking for fares. A stylish young lady takes a purse out of her bag, deliberately takes out a dime and hands it to the conductor, then closes her purse and puts it back in her bag. Next passenger is a Chinaman, who takes a nickel out of his *ear* and hands it to the conductor. Conductor hands the young lady the nickel as her change. Her purse is already in the bag and she puts the nickel in her mouth while she unfastens the bag. From Chinaman's ear to young lady's mouth! Ugh. Moral: Never put money in your mouth.

### My Experience as a Hay-Maker.

BY SAM SHORT.

Finding customers for railroad supplies these days is like searching a general superintendent's office for news about a wreck. Hard work and persistence are needed for those who are determined to succeed. It was in the spirit of the hard work part that I found myself at the headquarters of the Texas Nothern last month. Hope with no solid foundation took me there. But I did not start to tell you about my round of disappointments in the Lone Star State. A yarn which Superintendent Brown spun seems worth repeating to the readers of LOCOMOTIVE ENGINEERING.

The hard times was naturally the theme of conversation, and reminiscences of other days when work was scarce and money hard to find were in order.

"Times are not so hard as they were in '74," remarks Mr. Brown, "but when a man is out of work it pinches now just as hard as it did then, and I feel sore at having to lay off men, be they laborers or business solicitors. The panic of '73 hit me personally, and I know how to sympathize with those who are in similar luck to-day.

"When business collapsed in the Fall of '73 I was one of the unfortunate engineers laid off by the Michigan Central. I lay around Jackson all winter thinking that things would mend and that I would get back to work. They grew worse instead of better. In the spring I started out to look for something to do. Going round looking for work in hard times is about as distressing an experience as a man can go through. When I started out I was looking for a job as engineer, but it was not long before I was willing to take anything I could get.

"It is amusing to think about the different kinds of receptions a man gets from the people he asks work from. The majority of men refuse civilly but there are natural brutes who appear to enjoy insulting the unfortunates who have to 'beg a brother of the earth to give them leave to toil.' There is a wicked sentiment all over the country towards men who are looking for work. Many thoughtless people treat all men seeking work as tramps and vagrants. It was a common thing to be told that my class ought all to be sent to jail, although I was merely asking for work.

"I had gone from place to place until I found myself dead broke in Southern Iowa. There I struck a big German farmer named Hahn for a job of hay-making and was taken on with the promise of 50 cents a day and board. After I had been at work there for a day or two I found in the barn a threshing machine engine that had been through a fire. I asked Mr. Hahn what he would give me to fix up the engine. He offered me $10 but I stood out for $20 and he agreed.

"Hahn had a large family of ruddy, healthy looking children, and the eldest daughter was, I thought, the finest looking girl I had ever seen. She was the life of the household, overflowing with animal spirits and besides a standing reference for all the rest of the household. If the father lost his pipe, Bessie knew just where it was laid; if Robbie cut his finger, Bessie was the person appealed to to salve the wound. When Tillie cried because she could not do her sums, Bessie was the one to explain away the difficulty. When the older boys became unruly, it was Bessie who toned them down, and she was ever ready to take the lead in the parlor music which was the chief amusement of the household. The girl had the mental vigor that made her a leader in work, in study or in play.

"Bessie was pleased to take a compassionate interest in my case. She was full of regret that an engineer should need to turn to farm work, and doctored the blisters on my hands, that were too soft to operate a pitchfork all day without showing signs of distress. When a man is down a small word of kindness is magnified, and I looked upon Bessie Hahn as a sort of ministering angel. Her region of travel had been quite limited and she nightly questioned me about places I had seen, and seemed fascinated with my tales of railroad life. The person who has traveled is always heroic in the eyes of those who have never gone beyond their native county. A railroad engineer receives, on account of his calling, the interest that used to be taken in an old soldier. Passing through dangers and hardships brings the reward that always has been given to endurance and ungauged courage.

"I worked at hay-making for a week, and put in time evenings working on the engine. When the hay was all in I spent three days more working at the engine and finished the job by getting up steam and running her to show that she was all right. The job had turned out to be more difficult than I expected. The flues were all loose in the boiler, and the working parts were badly twisted, but patience and hard work put everything in good working order.

"I had a vague idea about how to set valves, but had never done the work myself, and I was at first considerably puzzled with the threshing engine. After a good deal of labor I managed to make the valve uncover the ports as the cross-heads moved away from the centers. That finished the job before firing up, and I was proud to have Bessie Hahn and her brothers watch what to them were mysterious operations.

"A small embarrassment was in store for me, however. When the engine was started she ran the wrong way. The thick-skinned old Dutchman roared when he saw the engine start, and I was amazed at his amusement till he told me that she was running backward. My experience with locomotives made me think that the right motion for an engine's fly-wheel was the same turn as a right-hand screw. When my rustic employer put me right in the most offensive way in his power, I soon put the machine right by moving the eccentric.

"My work was now finished and I saw it was time to go, although I felt very much inclined to linger about the place. I figured that I would leave the farm with $23.50, a sum that would help me into Kansas where I expected to find railroad work. On telling Hahn that I was ready to go and ready to take my pay he handed me $5 and said that was all my work was worth. I differed from him naturally, and we had a very sultry visit for a short time. But he would not give me any more money and ended by calling me a damned tramp and telling me that I deserved a good kicking.

"Well, I did not wait to provoke the kicking, for Hahn stood about six feet four and weighed 250 pounds. I felt very much like trying to take some of my money's worth in kicking the farmer, but finally concluded that discretion was the better part of valor and went my way. Anyway I did not want to have blows with Bessie Hahn's father. I started to walk to Oseoloosa. I had not gone far when a farmer driving a buggy overtook me. He stopped and asked if I wanted to ride, so I jumped into the buggy. He had seen me working in Hahn's field and asked how I got on with his neighbor, so I told him the story. He laughed and said that was just like Hahn. That Hahn would cheat his father if he got the chance and enjoy doing it.

"This farmer told me that they were building a railroad near Oscaloosa, and that I would be likely to get a job there if I tried. He took me as far as he was going in my direction, and I found my way to the headquarters of the railroad building. Nothing but grading was going on, and I went to work shoveling dirt. When Mr. McDonald, the contractor, came around, I offered myself as a candidate for running the first engine when track laying should begin, and got the promise of the job. Mr. McDonald appeared to take an interest in me, and always spoke when he came to the place where I was at work. I had not been wielding the shovel but two or three weeks when Mr. McDonald asked me if I knew anything about book-keeping. I answered that I had been a telegraph operator before I went into a railroad shop, and knew something about how railroad accounts were kept.

"'Come to the office in the morning,' he said, and I gladly realized that my experience doing the heavy toil of railroad building was ended.

"Next day I reported at the office, and was installed as time-keeper and book-keeper. The office was on the main street, and was a good place for seeing all that was going on in the town. About three months after I was appointed book-keeper there was a circus show in the town, and I was sitting looking at the loads of rustics driving in to see the show. In the procession I recognized Farmer Hahn and all his family, except Bessie, who was, no doubt, left to look after the farm. I thought now is the time to do some dunning; so I followed his team to the stable where he stopped. There I demanded the balance of my money, but Hahn only laughed, and said he had paid me all my work was worth.

"As I was engaged giving the farmer a bit of my mind, which was far from complimentary, Mr. Sharp, the contractor's lawyer, came up and asked what was the matter, for a crowd had collected. I explained the case, and he was highly amused. 'Come on,' he said, 'and leave the thing in my hands. We must put the mean cuss in for all the expenses we can.'

"It is for lawyers to tell how Mr. Sharp managed it, but he soon built up a long bill against Hahn. If business took him in the old man's neighborhood he would make a visit there and ask him for the money. He permitted the thing to drag on for about six months, and then entered suit against Hahn for my $18.50 and $97 expenses. Before the case came up for trial Hahn settled by paying an even $100."

"Did you get the first engine to run, as you were promised?"

"No, Mr. McDonald said he could do better by me and I remained in his office. When the operating of the road was begun I was made superintendent. It was afterwards absorbed by one of the trunk lines and I came on here."

"Did you ever see the Hahn girl again?"

"Yes, she's my wife."

The many railroad friends of Pedrick & Ayer will be glad to learn that their shop is again in operation. They are working 10¼ hours per day with about half the force, and orders are coming in fast enough to warrant continuous running. The shops are yet under the charge of Mr. James M. Hibbs, the assignee, but a new company is being formed, in which Mr. D. W. Pedrick will be the principal stockholder, Mr. Ayer retiring. These shops got their reputation on the mechanical ability of Dan. W. Pedrick, and users of the tools will be sure of the quality of the future product when they learn that Mr. P. will give the works his personal supervision as heretofore. The special tools devised or built by Mr. Pedrick have so cheapened the cost of locomotive repairs as to make his name known from one end of this country to the other.

In July, 1892, Division Master Mechanic M. L. Flynn, of the Michigan Central, at St. Thomas, Ont., built and turned out a new passenger locomotive, a 19x24 in. ten-wheeler, number 344. Since that time she has made 99,778 miles, and has just gone into the shop for her first repairs, her tire being worn down 3/4 of an inch. Pretty good service and pretty good mileage.

Please don't ask for our calendar unless you are a subscriber. It's a daisy.

### Carborundum.

Makers of machinery in the neighborhood of Pittsburg, Pa., have lately commenced using an abrading wheel made from a material called "carborundum," as a substitute for an emery wheel, and extraordinary accounts are given of the cutting qualities of the wheel. It is said to abrade metals with much greater rapidity than the emery wheel, and to do the work with less heating We understand that several railroad companies have bought carborundum wheels for trial, and that its performance is away beyond all expectation.

The material is a carbride of silicon, and the method of its manufacture was worked out by Mr E G Acheson, an electrical engineer. The hardest cutting material known to man is the diamond, which is crystallized carbon Mr Acheson believed that it might be possible to crystallize carbon after fusing it by means of the intense heat of an electric current, and he proceeded to make the experiment. His idea was to dissolve the carbon in melted silicate of aluminum and obtain crystallization as the mass cooled He succeeded in obtaining intensely hard crystals, but they turned out not to be pure carbon but a combination of carbon and silicon They were, however, so hard, that they cut diamonds, and are consequently harder than any of the oxides of aluminum, such as emery and corundum, which have generally been used for abrading wheels.

The manufacture of the compound was undertaken for commercial purposes, and it promises to take the place so long held by emery and corundum. Several diamond polishers in New York City are using the carborundum for the work that was formerly done by diamond dust, and for which no other material was previously found hard enough. Persons who are interested in learning more about this wonderful material should apply to the Carborundum Company, Monongahela City, Pa. The story of how the making of the compound was worked out reads like a romance when told by the principal actor, Mr Acheson.

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One of the railroad papers, for advertisers only, feels bad about our friendship for the Traveling Engineers, the B. L. E., John Alexander, and the Ananias Corner. It cannot see why we publish a good many things that we do, and thinks it strange that the rank and file should take Locomotive Engineering, and that railroad officials should say it was interesting instead of falling in love with the mixture of ink and wisdom turned out in their advertisement foundry It is curious that, despite the scriptural injunction to "love thine enemies," the B. of L. E., the Traveling Engineers' Association, etc., should prefer their friends. There is no accounting for taste—we do not try. "The boys" like this paper, this paper likes "the boys" and if "the boys" and the paper can stand it, why, we guess the other fellow will have to.

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The fast runs which Engineer Hogan made with the "999" on the New York Central appear to have stimulated the local muse to an alarming extent. They were evidently more gush-inspiring than the first buds of spring or the beautiful snow. Most of the effusions found early oblivion, but General Passenger Agent Daniels has snatched a few of the "poems" from the brink of the Lethean stream and given them the brief fame that folder affords. Four effusions are thus preserved Anyone who wishes to see how a fast locomotive can be done up in verse should send to Mr. Daniels, at the Grand Central Station, New York, for the folder that is "all about '999.'"

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In the course of a personal letter the assistant locomotive superintendent of one of the British railways says "I have seen it hinted in some of our papers here that the Webb compound is going to be run against Buchanan's '999.' If this is so it is the worst mistake ever made by the designer of the compound engine. If all the talk we hear about these dromedaries, as they are called, is true, they are the laughing stock of railroad men on this side of the Atlantic. It is said that before getting their train started they often have to uncouple and run forward and then back up and be attached again, only to stand slipping until some passing engine gives them a start from behind."

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We learn from an officer of the Caledonian Railway that they have adopted the six-coupled 18 x 26 class of engines for their heavy gradient passenger coast traffic, and that they rattle away at a rising grade of 1 to 75 with eighteen coaches. They have just completed at St. Rollox at Glasgow, twelve condensing tank engines for the underground Glasgow Central Railway. The engines look very much like American 8-wheel engines with a water tank added. The cylinders are 17 x 24, and the engines have 1,100 square feet of heating surface At the same shops they are building six 18 x 26 8-wheel engines, with driving-wheels 72 inches diameter, for express business, and six others of similar dimensions, but with 4-wheels coupled, for heavy passenger and fast freight traffic. These are equipped with the Westinghouse air-brakes.

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There is intense indignation among many of the parties who exhibited car couplers at the World's Fair with the manner in which they were treated by the judges. The complaint is made that the judges examined only a few of the couplers exhibited, the impression being that the awards were all arranged in advance. It is certain that several of the couplers which are in great favor with practical railroad men received no mention whatever. Novel features of a highly valuable and practical character received no attention. A similar feeling exists about the treatment of other railroad appliances.



Our Line Engravings are made by the wax process, a plan securing accuracy and distinct lines on original copper plates They are made by Bradley & Poates, 251 William Street, New York City.

### OUR ENGRAVINGS.

Of late we have had a great many inquiries as to who made the fine half-tone plates shown each month in Locomotive Engineering. Credit is due the expert anywhere and we are glad to recommend the engravers of our plates to those wanting good work at reasonable prices. All the half-tones and reproductions we use are made by the Star Engraving & Printing Co., 607 & 609 Sansom St., Philadelphia, Pa.

Sinclair & Hill.

### Group of the Foreman Blacksmiths' Association.

At the recent meeting of the above association, in Chicago, the above picture was taken. It is pretty foggy, but the men will feel just as if they were in a blacksmith's shop without ventilation, if the faces are indistinct. Commencing on the left and the first row, the personnel of the group is as follows

A. D. Wilkins, Pittsburg, Pa., Pgh. Loco. Wks., Jno. E. Mick, Chillicothe, O., B. & O. So. West; Jno. Buckley, Chicago, I. C. R R., C. H. Williams, Ludlow, Ky., C S. R'y; S. Uren, Sacramento, Cal., So. P. R R, J J. Thornton, Brainerd, Minn., N. P. R. R, Harry Jeffery, Pittsburg, Pa., Pgh Loco. Wks.; Geo. F. Hiokens, St. Paul, Minn., St. P. & D R R., A. Younger, Sacramento, Cal., So. P.R.R, Jos. Hughes, Bloomington, Ill., C & A R. R; Jas. Walker, Aurora, Ill., C. B. & Q. R. R.

*Second Row.*—Frank Peck, East Toledo, O. W. L. E. R R., Geo. Tulberry, Chicago, C R. I & P.; Jno. Hannagan, Springfield, O., Ohio So. R'y, W. J. Barrett, Lima, O., L. E & W R.; Ralph A Mould, Galion, O., N Y. L. E. & W.; J. C Stewart, Brainerd, Minn., N. P B. R., Thos. Daltry, Huntington, Ind., C & E R. R., Tom Bethume, Chicago Crane Co.; Wm Henderson, Tacoma, Washington, N P R R; Jas. Heron, Chicago, C. R. I. & P.

*Third Row.*—Ed Boyle, Aurora, Ill, C B & Q. R. R., Jno. Kuhn, Chicago, C & W. I. R. R.; Harry Hinkens, St. Paul, Minn., C, St P. M. & O., Horace Pentecost St Paul, Minn., N. P. R. R., Jas. O. Halloran, Pullman, Ill, P. P. C. Co; D. F. Hughes, Franklott, Ind, T., St. L. & K. C.

### The Wabash Report.

The fourth annual report of the Wabash Railroad shows that the condition of this fine property has greatly improved under the able management of Mr. Chas. M Hays. The following extract from the report voices a sentiment well worthy of universal acceptance "In order to show the disposition of surplus earnings, a profit and loss account has been opened, to which the surplus of each year has been credited, and to which extraordinary expenditures for betterments have been debited. This account indicates clearly the disbursements which are not legitimately a part of the operating expenses, and obviates the necessity of adopting the questionable method of debiting and crediting "cost of road" under cover of a construction account, which is too often used as a cloak to conceal charges which should be included in operating expenses. Open construction accounts, although indispensable during the progress of construction of new lines, are always objectionable after a certain period when a road is supposed to be completed, or at least when it has arrived at that stage of completion when its earning capacity is to be tested and the net profits of the traffic are to be given as the basis of its value. Conservative railway management in the United States is understood to imply the maintenance and repair of lines from the yearly earnings, and, although it often becomes necessary to provide for deficient or incomplete construction from other sources than earnings, it is generally considered more in accordance with sound principles of finance to make definite appropriations to meet the required expenditures, either by the issue of bonds or capital stock, when the new construction is authorized."

### Cutting of Wheel Flanges.

An extremely expensive defect to railroad companies is the cutting of wheel flanges, which requires the renewing of the wheel long before it has made the mileage to be expected had the wheel worn evenly. A great many remedies have been tried, but we still see repair yards crowded with cars that are sent in to get wheels changed because some of them have been running to one side. The diamond truck comes in for a good share of the blame for flange cutting. To prevent flange cutting and unnecessary resistance from friction, the wheels ought to be held so that the axles are parallel and the wheels on each side made to revolve in parallel planes at right angles to the axles. The diamond truck fails wofully in holding the wheels in this desirable manner, and so long as it is generally used the railroad companies will have to put up with the expense of removing wheels prematurely because the flanges are cut. A crying need of the day is a freight car truck that will keep the wheels running straight on the track.

At the last meeting of the New England Railroad Club Mr N. Lauder gave a very lucid explanation of how many flanges get cut. It is rather novel to be told that cut flanges are more common on straight than on curved roads, but we believe the statement to be true. Mr. Lauder said

"The Western roads have long tangents and few curves compared to the Eastern roads, and, although the statement may seem strange, I think there is a much greater tendency to sharp flanges on those straight Western roads than on our crooked New England ones. The ordinary freight car is called center-bearing, but it soon gets down on side bearings. Most cars are built of green wood, by contract, with the wheels perhaps ¼ to ½ in out of gauge, and it cannot be expected they will remain center-bearing very long; they become side-bearing. The side bearings are put in there to keep the cars from tipping over. When the car gets down on side bearings it takes an enormous force to swivel the truck under that car When that car rounds a curve it takes a jump and swings to one side, and when it leaves the curve it comes back only far enough to allow it to run on the rail, it runs on that tangent for miles and miles, and there not being swing enough to bring it back, it grinds on the flange all the way until it comes to another curve and takes a swing the other way. I think a center-bearing car is a humbug, and that the car should have side bearings, and such bearings that the tendency of the load will be to bring the truck back straight with the sills of the car, straight with the track it is to run on."

### Balanced Slide-Valves.

At a meeting of the Southwestern Railway Club, Mr. Sanderson, of the Norfolk & Western, read a paper on Balancing Slide-Valves, which represented the results of very careful investigation and calculation. The author of the paper gave figures showing the pressure on the valves during the whole stroke, the relative positions of valve and piston being shown graphically An engine carrying 140 pounds boiler pressure had a maximum valve pressure of 26,300 pounds.

The conclusions arrived at by Mr. Sanderson were that balanced valves, as a rule, do not have sufficient of the area exposed for downward pressure balanced. In view of the large valves and intense pressures coming into use, these conclusions are deserving of serious attention. We would suggest to the roads that are using valves with circular balancing devices to calculate how much of the surface there is left without anything to relieve the downward pressure of the steam.

### The Locomotive Yields to the Trolley.

The success of trolley electric railroads in many cities is forcing the managers of different elevated and suburban railroads to investigate the relative expense of steam locomotives and of electricity in the operating of cars. It is difficult obtaining the data necessary for accurate comparison, but those who are most familiar with the subject say that the car ton can be moved by steam locomotives at about half the cost for fuel entailed by the use of electric motors. The mere cost of fuel is, however, a small part of the considerations involved. If a more convenient service can be provided by running electric cars than what is practicable with trains pulled by locomotives it may be found the best paying plan to run electric cars, even when the expenses for fuel are largely increased The case of the Brooklyn, Bath & West End Railroad, N. Y, is representative of many others. This road has been operated by steam for years, but lately part of the line came in competition with trolley electric cars, and the latter cars were securing a great part of the business because they ran oftener than the steam trains. It did not pay to run a steam train as frequently as electric cars were run on account of the high wages account, and so the railroad company abandoned locomotives and put electric cars upon their line The Kings County Elevated Railroad Company is considering the propriety of making a similar change.

The business men of Memphis, Tenn., are striving to bring manufacturing concerns to their city In pursuing this policy they made an offer some time ago to the Letchworth Car Co., now located at Letchworth, Ill., to remove their plant to Memphis. The offer has been accepted, and the car plant will soon be removed.


Group of Members of Foreman Blacksmiths' Association at Their First Annual Meeting, Chicago, 1893.

## *Railroad Coppersmithing—IV.

By John Fuller, Sr

BRAZING AND SOLDERING THE JOINT

We shall now proceed to make use of the firepot, and describe the process of hard soldering by its aid. The pipe having been placed in position, care should be taken that the socket is level across the brim, perhaps it is better secured in the pit, or fastened to the forge or some other suitable and convenient place, so that the roller and chain overhead is handy, if necessary to the job. By referring to the engraving, Fig. 37, the clamp to hold up the pot is seen, which is made of $2\frac{1}{2}$x$\frac{3}{8}$-inch iron, the arms being formed so that they will clasp the pipe, and are held there by two bolts, as shown. There should be enough space between them so that they could be used for different sized pipes. These clamps are fastened close up under the bottom of the socket, then the iron plates which form the bottom of the firepot are laid on, as shown in Fig 38. Now spread a thin coat of moist clay over the plates and around the pipe, and hollow it up the socket from 1 inch to $1\frac{1}{2}$ inches. This is to keep the joint cool at the bottom, so that as the spelter melts it will not run through—that is, not lower than the clay. Now place the pot in position with the pipe in the center, as shown in Fig. 39. This is the most critical and important feature of the work. Care must be taken to have the flange of the socket, which is to hold the solder level, and the brim of the pot level with the socket flange. The pot would be better rather below than above, for if the spelter be too far out of the pot the blast is too low down, and if it is too low down in the pot there is danger of running out the seam in the upper pipe. Then, again, the joint cannot be skimmed off handily or so well attended. When the pot has been placed in proper position, draw the clay around the bottom of it outside so that the flame will not escape between the pot and bottom plates, then apply the blast-pipes. If the joint be less than 5 or 6 inches in diameter one blast-pipe will be enough, if the blast be of sufficient strength, but if the pipe to be joined is larger than 6 or 7 inches, then there should be two entries of the blast, as shown in Fig. 39. The socket-flange about the joint is now filled with clean mixed spelter and borax. If the joint to be made is on brazed pipe, then spread a little moist fire-clay over the seam up to the rim of the socket. Fasten the two screw-clamps, Fig. 40, opposite each other at the top of the pipe, and pass the traveler-chain through them and hook in a link or hook around the chain. On the other end of the chain a counter-balance weight is attached, nearly equal in weight to the male part of the job, or upper piece, or the chain may be fastened to the cleat or hitching-hook on the wall in such a way that it will take the weight of the top piece of pipe while the joint is hot.

We are now ready for the fire. First, place a little dead charcoal on the wet clay, then put a layer of live hot pieces, and cover them with a few more dead ones, and fill up the pot with nice clean coke of about the size of a walnut, covering the solder some two inches, that is, pile the coke up around the pipe in a conical form from the edge of the pot. Then let the blast in slowly, and be patient until the joint is red hot right through. While this is going on slowly, touch down the coke into a compact mass. When the joint is thoroughly red hot take the coke back a little from the pipe and dust some freshly powdered borax on the spelter, by this time the fire should be in good condition. Draw the coke up around the pipe again and replenish the fire, and let in the blast at a brisk rate, keeping a watchful eye on the solder and the blast slide. When the solder has run and the joint is full and well fluxed, skim it off with a red-hot poker or rod, Fig. 41, flattened at the end, and stop the blast, take off the blast-pipes and lift the pot, then throw a little common salt on the joint to kill the borax, which is hard on a good file. In all cases the draft through the pipe should be stopped, because the cold air going through tends to keep the joint cold, and, in case of larger pipes greatly retards the progress of the work. The directions above given are intended especially for learners, although old hands would save themselves some time and often much trouble, were they in a majority of cases to follow them out. The practice in many, perhaps most shops, is to make a large fire on the brick forge, and then take a shovelful of live hot coke and fill the pot with it, and a failure is sometimes the result. But practice will partly balance the chances, because a man *must* make himself acquainted with the "ropes" (customs) of the shop in which he gets employment, no matter how absurd they are they must be continued. Advance or innovation is seldom countenanced by workingmen without trouble. I never had any trouble, or a single failure, when the fire was started with charcoal as above directed.



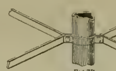


Fig 37.

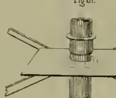


Fig 38

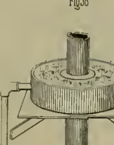


Fig 39.

Fig 48.

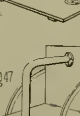


Fig 47

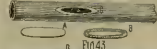




Fig 43

Fig 44

Fig 40

Fig 41

Fig 42



Fig 53.

Fig 49



Fig 52



Fig 50



Fig 46

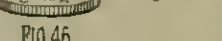


Fig 45.

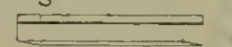




Fig.51.

SOFT SOLDERING THE JOINTS

To make a soft solder joint the firepot is placed in position in the same manner as for brazing, and charcoal is used in preference to coke entirely in this operation. The solder may be run from a suitable stick or from a ladle. Joints in small pipes can be made with the aid of a pair of round tongs made hot. Joints in large pipes are sometimes more conveniently made and a better job done, by using a pot of burning charcoal, Fig. 42, applied on the inside, held and lowered into the pipe with the chain, care being taken to keep the lower end of the joint cool, and sizing the male end with size made of ivory-black or lamp-black and gold size, or any other pigment that will answer the purpose of preventing the solder from running through the joint. The firepot for large soft solder joints is made to fit the pipe easily, and to hold a sufficient quantity of charcoal to do the work required. The bottom end of the pipe in this case is left open, if possible, so as to permit the draft, which in the other case is necessary to stop. It will be seen that the bottom of the socket must be kept cool enough to stop the solder from running through, or the possibility of a leak may be prevented by rubbing some moist clay into the end of the joint on the inside, if one can get to do it conveniently.

PATCHING PIPES

Patching copper pipes, like most of the other branches of coppersmith's work, requires perception first, and then skill, with patient persevering ingenuity. Pipes are liable to so many different kinds of fractures and breakages that one can hardly prescribe beforehand a remedy for all the many contingencies that may arise. We will, therefore, mention a few occurrences that are happening frequently, and let them serve as stepping-stones to the performance of others that may call for the attention and skill of the operator. It often happens that pipes burst at the seam, this may arise from one of several causes, namely From imperfect brazing, such as overheating while at the fire, or not enough heat to properly fuse the spelter so that it adhere firmly, or from freezing, continual jar, over-pressure from force pumps or flaws in the metal

If a fracture should occur from overheating, that is the part is burnt, it is best to cut it out, it can never be successfully repaired. If ever so good a job be done, it is all to no purpose, seeing the foundation of the work has been made rotten. Again, there is no satisfaction for the labor spent, and it is therefore useless, except in cases of extreme emergency, to waste time and material on it. If the fracture arises from the want of heat, or the spelter has not been run enough to adhere to or fill the joint, then open the joint and properly clean it, then close it down and give it a coat of warm borax and water, the borax having been previously dissolved in hot water, jar this through the seam, and charge it again with spelter either inside or outside, as seems best. If outside, the addition of a little fresh spelter will do no harm, if care is taken to see that it is all completely run. If from freezing, the fracture may be anywhere as well as at the seam, then the metal will be parted as if cut through with a knife. If this should be the case, file it down at the fracture, as shown at *C*, Fig 43, so that where the split is the edge is thin, making the scarf similar to those at the seam, and clean the split carefully on the edges. Now make the patch *A*, thinning the edges down to a suitable thickness, *B*, so that the edge of the patch will just cover the outside edge of the scarf on the pipe at *C*, and let the patch be thick enough to make the part of the pipe repaired the same thickness as any other part of the pipe

When the patch is properly fitted, anneal it with some wet salt previously smeared over it, then scour it clean and cover it with a thin coat of fine spelter and borax, and run it smooth over the patch at the fire, throwing off all that will leave it with one jerk while it is hot (this is to answer the same purpose as tinning). Now wire the patch fast to the pipe as shown in Fig. 44, and place the wires sufficiently close to keep it from bagging when hot, charge it with fine spelter, one half on the pipe the other on the patch, and put a little inside along the crack, when the solder has dried enough, make the pipe red hot slowly all around the back of the patch and along the whole length of it, preventing oxidation of the spelter by a supply of borax kept always at hand. When sufficiently hot, gradually turn it over, and offer the spelter to a moderately brisk fire. It should run and flow easily, and if carefully performed, a good, sound and durable job will be insured. The cleaning off or finishing the patch is next in order, which may be done as tastily as the job will admit, to make it look as if the work had been performed by a competent mechanic. If a fracture is caused by a continual jar or over-pressure by a force pump, it will in all probability be like that caused by freezing, and may be treated in the same way. Flaws in the metal arise from many causes, and their particular condition when discovered must govern what are the best measures to be taken to remedy the defects. If the flaws occur in large work they may be cut out and the patch cramped in or riveted in and then brazed.

It often happens that continual jar produces a lateral fracture at right angles with the length of the pipe or around the flange immediately above the solder. To repair this kind of fracture, a copper collar, *E*, Fig. 45, from $\frac{1}{2}$ to $\frac{3}{4}$ inch wide, is prepared, of about the same thickness as the pipe. The pipe is now taken to the fire, and the old solder run with a little fresh borax, and, when in a thoroughly liquid state, the solder is thrown off the flange with a sharp jerk, when cool, the pipe is cleaned as far up as necessary, then the collar is prepared to suit, and covered with fine solder as before directed, then coiled around the pipe and wired close, as at *D*, Fig. 46, the wire being placed close to the upper edge of the collar, to form additional room on which to lay the

solder. Care must be taken that the collar fits tight up to the pipe. If the work is done on a small pipe, it is left open, so that the heat may readily run up through the pipe to assist in running the solder laid about the upper edge of the collar *D*. If it is a large pipe on which the work is being performed, then the end is stopped with a piece of sheet-iron, clipped around the edges and bent up to fit, which is placed up the pipe at the lower end about a foot, instead of 3 or 4 inches, as is done when brazing on flanges.

TEMPLATE BOARDS.

The template boards are a very useful and convenient contrivance, made for the purpose of substituting the position in which pipes are to be coupled or occupy on an engine or tender or in a ship's hold. The single board is shown in Fig. 47.

This board, or rather two boards, are hinged together at *A*, and provided with two wings, *B*, about an inch wide, similar to that of a pair of compasses. These wings are fastened to the bottom leaf of the board, and slide through a loop which is fastened to the side of the other leaf.

The loop is provided with a thumb-screw, which being tightened on the wing holds the upright leaf of the board in any position the flanges may require. The double board, Fig. 48, is similar to the single board, but has two leaves. This board is to take the set of S-bends from templates when they are required to be set at right angles to each other, as shown by the pipe standing on the board, Fig. 48.

Here is an example, given to show its practical use

It often happens from continual jar or improper adjustment to allow for expansion and contraction, as in the case of steam pipes, feed pipes and suction pipes, that the pipe breaks off close up at the back of the flange, *A*, Fig. 49, and the flange is not damaged, or the pipe either, further than the flange being broken off, and it is necessary to put the flange back on the pipe again without piecing, and to have the bolt holes in the exact position after the pipe has been repaired as they were before the pipe was broken.

Suppose the pipe to be broken off at the bottom flange *C*, Fig. 47 First match the fracture, and take a template of it on the board by making the board fit the position of the flanges, as shown. When they are in their true position, as they were before the pipe was broken, mark the flanges around with a pencil on the board and all the bolt holes; then make a chisel mark on the edge of the flange, and at this point mark it on the board. Now all is prepared ready, and we can proceed with the repairing. Anneal and clean the end of the pipe inside and outside, and make a short thimble 2 inches long, *D*, Fig. 50, of light copper, and fit it tight into the end of the pipe, and place it so that when the flange is put on over it the thimble will come through the flange, *E*, Fig. 49, ¼ inch. Braze the ferrule in the pipe on two sides inside, and then run off all the old solder from the flange *A*, and when cool fit it to its place again, being careful to match the fracture and the holes and chisel mark on the board, then turn the end of the ferrule over the flange, forming a rivet to hold it on and to draw the flange close up to its place. Now make a collar of a strip of copper, *B*, Fig. 51, and scarf the ends, and after bending, as in *C*, Fig. 52, put it around the fracture, *F*, Fig. 53, making it wide enough to cover the break ¼ inch. Then wire it on tight, and after carefully charging it with fine solder around the top edge of the collar and coarse around the bottom, sling it over the fire, with the upper end of the pipe open, and run the solder. When the solder is set the wire may be taken off while it is hot quite easily. If the instruction here given be carefully followed, a strong, substantial job will always be the result.

## Wm. Baxter's Compound Locomotive, Built in 1870.

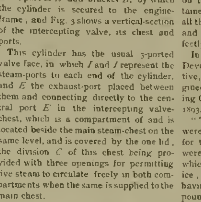
BY JOHN H. COOPER

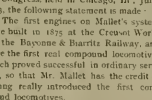
The writer is indebted to Mr. H F Colvin, of this city, who has discovered, identified and sketched Mr. Baxter's high-pressure cylinder (5 in. diameter x 12 in. stroke), as used by him on the Worcester & Shrewsbury R. R. early in the seventies. From these sketches I have made drawings, which are reproduced in the cuts accompanying this article.

Fig. 1 shows a plan of the cylinder, with valve faces and ports; Fig 2 shows a cross-section of Fig. 1, through the exhaust port *E E* and bracket *B*, by which the cylinder is secured to the engine-frame; and Fig. 3 shows a vertical-section of the intercepting valve, its chest and ports.

This cylinder has the usual 3-ported valve face, in which *I* and *I* represent the steam-ports to each end of the cylinder, and *E* the exhaust-port placed between them and connecting directly to the central port *E* in the intercepting valve-chest, which is a compartment of and is located beside the main steam-chest on the same level, and is covered by the one lid, the division *C* of this chest being provided with three openings for permitting live steam to circulate freely in both compartments when the same is supplied to the main chest.

When the intercepting valve *D* is placed




in the full line position shown, the exhaust steam from the high-pressure cylinder would flow freely through the *D* opening under the valve from the port *E* through *E*, and by the way of the port *F* to the low-pressure steam-chest, in which case the engine would work compound. When this valve was moved to the position shown by dotted lines, the exhaust from the high-pressure cylinder would flow from the port *E* through the connected port *H* to the atmosphere, at the same time live steam would flow from the steam-chest through the uncovered port *F* to the low-pressure steam-chest, in which case the engine would work as a simple one.

The pistons of both the steam cylinders were connected to crank-pins at right angles in the usual way, and the main slide-valves were worked by Stephenson's link motion, such as are in common use on the locomotives of to-day. The four driving-wheels were each 2 feet in diameter, and were coupled by solid end side-rods.

The low-pressure cylinder was 8 inches in diameter by 12-inch stroke, and was in every particular like the cylinder of the ordinary locomotive designed for simple running, its steam-chest being supplied with either the exhaust steam from the smaller cylinder, or with live steam directly from the boiler, according to the position of the intercepting valve *D* as already described.

The railway gauge was 3 feet. These locomotives were in regular daily service for ten years and over.

Mr. Wm Baxter, Jr, writes under date of March 25, 1891, in reference to his father's compound locomotive

"This locomotive was made about the year 1870, and the compound type of machine was used not only to insure greater economy, but also to meet the requirements of street railway service. The cylinders were so arranged that when the car was running on a level, it would work compound, but when it was desired to obtain more power to ascend the grade, both cylinders worked with live steam. In this way the power of the machine could be varied all the way from five to twenty H P. The first machine made, in addition to having a compound engine, had a compound boiler. The high-pressure boiler was surrounded by an annular low-pressure boiler, or regenerator, and into this latter the high-pressure cylinder exhausted. In this way, the back-pressure on the high-pressure cylinder was maintained uniform, and at the same time, all the condensed steam was regenerated and entered the second cylinder perfectly dry."

In Mr. A. von Borries' paper on "The Development of the Compound Locomotive," presented at the mechanical engineering section of the World's Engineering Congress, held in Chicago, Ill, July, 1893, the following statement is made

"The first engines on Mallet's system were built in 1875 at the Creusot Works for the Bayonne & Biarritz Railway, and were the first real compound locomotives which proved successful in ordinary service, so that Mr. Mallet has the credit of having really introduced the first compound locomotives.

"In these locomotives, the low-pressure piston received the full steam pressure when working non-compound, thus giving very unequal tractive force, and causing the train to shake at slow speeds

"Mr. Mallet has been engaged since 1874 in adapting the compound system to locomotives.

"The original Mallet system, as described, is to be classed as a two-cylinder locomotive, which may be worked either as a compound or as an ordinary engine."

Without disparaging the labors and inventions of other engineers, who are making noteworthy efforts in the right direction with much good result, this early contribution to the development of the compound locomotive by Mr Baxter must be regarded as not only an invention of supreme simplicity, but as one which solves most directly the problem of the two-cylinder compound locomotive.

With these dates and data before us, the case is clear that to Mr Baxter belongs the credit of making and using continuously on the road the first two-cylinder compound locomotive that may be run for any length of time, either simple or compound, at the will of the engineer.

## If He Had Kept His Hands Off, the Boiler Might Not Have Blown Up.

"Died with his hand on the safety-valve." What better epitaph could any man have than this which is written of John Armstrong, the engineer of the Dry Dock stables on East Fourteenth street?—*N. Y. Evening Telegram, Nov. 6.*

Paul Synnestvedt's article on "Disease and Cure of Air-Brakes" commences next month.

## Train Running for the Confederacy.

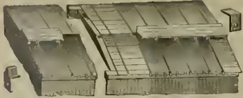
BY CARTER S. ANDERSON.

Owing to my feeling of utter incompetency to write for such a journal and to increased duties, I expected never to write again for your paper, and probably never would have attempted to do so had I not received several encouraging letters from young men of the North who read your paper, especially from one in Auburn, N.Y. I cannot imagine why young mechanical folks of to-day should take so much interest in the build of our little old scrappy engines. I should think they'd rather hear those touches of war history which I am compelled to bring in as I tell of the difficulties under which we railroaded in 1861-5.

Well, boys, here is one of my trips in the early fall of '61. Being promoted from baggage-car to conductor of troop train, I got orders to take a load of provisions from Richmond to Jackson River, the then terminus of the Virginia Central Railroad, for the Western army, which was as well as I remember under the command of General H. H. Wise. The train consisted of about twenty freight cars of provisions—no caboose. I rode sometimes on the engine and sometimes on the rear freight car loaded with hogsheads of sugar, bacon, etc. We had the engine "Staunton," and John Harton, engineer. The "Staunton" was built about 1858 or '60 by the New Jersey Locomotive Works. She was bought for a fast passenger engine. Her drivers were 5 feet 6 inches high. She set up high on her bearings. On account of our Blue Ridge and North Mountain grades, the "Staunton" did not prove satisfactory. She had a most powerful whistle, and that is the most you could say of her. She would slip her wheels on every occasion of a tight pull, and had acquired the name of "Old Spinner." But on moderate grades she could fly. The "Staunton" was, therefore, put into extra freight use. In other words she had to step down and give place to those of better build.

About the time that we left Richmond at this period of which I tell, two double-headed trains left Jackson River for Richmond heavily loaded with sick and wounded soldiers from West Virginia going to the hospitals. We got orders at Richmond to go to Gordonsville and report for orders. Gordonsville was at that time the most important military point in Virginia or the South. About noon each day there stood at Gordonsville long and crowded trains from four different and very important military points. It was a busy scene, and about the depots, for an hour or so, there was a dense crowd of officers, couriers, soldiers and sutlers going to and coming from the battle-fields.

Being an extra we had to remain there that day four hours before we could get orders to go West. The old "Staunton" had become so hot that she was blowing off loudly, and John Harton, himself, had on more steam than his boiler plates justified. We got orders, though, about 4 or 5 P. M., to go to Greenwood and "meet two troop trains, and then to go to Staunton and report for orders." When John Harton pulled up on old "Staunton," I was closely following, and—well, I was seeing how he rolled those twenty cars along the light grades and very rough track to Charlottesville. But when the "Staunton" struck the 75-foot to-the-mile-grade, she soon told Mr. Harton that she had on too many cars. So he left enough at Mechum's River to enable her to pull the train, and we soon reached Greenwood, and took the siding to await the arrival and passing of the two troop trains mentioned in the order The first train soon came through Greenwood tunnel and stopped for water. "Where's the other train?" I asked of the men. "Left it at Staunton, it is closely following and will be here soon," they answered. Sure enough, not long after the first train



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HAS no surface nail or screw holes. It has no joints where cinders, rain or fine snow can get through. It allows for contraction and expansion, and has ample elasticity to provide for sagging, twisting, buckling and cornering of the car body. It 's as solid as the car frame itself. It has no soldered joints. It can be repaired readily, and without taking off more of the roof than is damaged. It is much cheaper than any other metallic roof now in use, and is cheaper than the double board roof, made of good lumber. It is unlike any other metallic roof for the reason that **everything is furnished to make it complete**; so that the parties buying it have no expense other than to apply it.

**This ROOF can be applied on OLD LEAKY BOARD-ROOF CARS without making any changes in the board roof; thereby saving the expense of replacing the old boards with new, and thus utilizing material that must otherwise be thrown away.**

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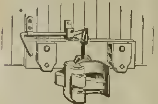

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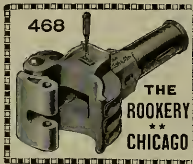

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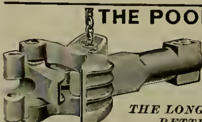

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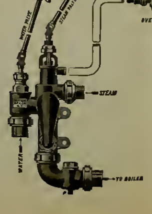

had left, I heard number two, as I thought it was, coming. It soon pulled down out of Greenwood tunnel and stopped also for water. "Hello George, where's your train?" I asked of George Pelter, the engineer, who was greasing his engine, "John Timberlake," while his fireman took water.

"I could not pull my train, and left my cars at Waynesboro'. I am on my way to Richmond to get another engine," was his reply.

I, of course, considered then that the road was clear, and that my orders justified me in going ahead, having met *one* train, and the engineer of the second engine telling me that he had left his cars, which of course I concluded were those of the second troop train, at Waynesboro'. Thinking there was nothing else to come, I ordered my brakeman to change switch and told Mr. Harton to go ahead. "Why, Carter," said Mr. Harton, "that was only an empty en ine that passed. How is that?" I explained to him that George Pelter had had to leave his cars at Waynesboro' on account of his engine giving out. "Ah! All right, then," said John, and so we pulled out. As I had to see the switch locked, I pulled up on the last freight car and waved him (Mr. Harton) to go ahead.

Now, before I relate the accident—awful as it was, which soon followed—I will show your readers how we misapprehended the orders. The engine, which we met at Greenwood and whose cars had been left at Waynesboro', was *not* the train number two in our orders. There was a train at Waynesboro', which had no orders from the dispatcher to move, but as the engine was out of order, the engineer concluded himself to run under flag behind the first section of troop train and ahead of second section, thus making three trains, or at least three engines, which we would have had to meet at Greenwood had the dispatcher known that Pelter was coming in with his engine.

So tugged away the old "Staunton," and on came from Staunton, facing us, the double-headed troop train full of wounded and sick soldiers. Seth Mack, the oldest engine runner in America, now hostler in the Richmond yard, ran the front engine, "Albemarle," a fine Rogers engine. Coupled behind him was the Norris engine, "Monticello," run by John M. Kraft. When the "Staunton" turned the summit at Afton, and pitched into the dip and very severe curve, just before entering the eastern portal of Blue Ridge tunnel, the fated troop train was cautiously—thank God!—rolling down through Blue Ridge tunnel. The tunnel is straight, but curves so suddenly at eastern portal that it is impossible to see scarcely any track ahead until you are out of the tunnel. So when Seth Mack popped out of the tunnel, "Staunton's" great headlight met him full face to face, and not a hundred yards away. "Uncle Seth" says he whistled for brakes and drew her back. Mr. Kraft also reversed his engine, thus somewhat checking the very heavy train, so that when the "Staunton" dashed *her* brains out against the "Albemarle," it very slightly disabled the latter; but the old "Monticello" caught the blow as the train in her rear bursted into her tender and otherwise damaged her. What saved us from a more fearful accident was the caution which the east-bound double-headed train was taking before entering the very heavy curve on the hill overlooking the lovely Rock Fish Valley.

The curve there is so heavy that the guard rail is used there as a safety.

Although badly bruised, I was able to go to the front, and I found Mr. Harton not only not killed, as I had feared, but at work on his engine getting her in a condition to handle. The smoke from all three locomotives rolled into the tunnel as it would have been drawn up a chimney, and soon there arose howls and curses from the poor suffering soldiers who were stifling from the smoke, which had now gotten so thick that it was impossible to breathe. Fortunately no one was hurt by the collision. Only the smoke was killing them.

"Get down out of the cars, boys, and put your noses near the ground," cried out the voice of Conductor Joshua Finks, as he came along the side of his train to see what had happened to the front. The sick and suffering soldiers actually got down into the water which continually runs through this tunnel, and thus managed to get breath and get out alive. The smoke was stopped just as soon as we could put out the fires.

The crowd soon gathered. Some officers, the attendants on the sick, and some furloughed soldiers came to where we were working on the wrecked engines.

"Whose fault is this?" loudly called out an officer in a commanding voice.

"Major, here are my orders," answered Conductor Finks "'Go to Greenwood and meet one troop train; go to Charlottesville and report for orders.' This is the train I should have met at Greenwood," concluded he. Truth.

John Harton had in one hand an old-fashioned torch—black smoke and big blaze—and in the other his monkey-wrench. He realized the situation, and turning around said, with a firm and manly voice "Major, I pulled out of Greenwood side track, where my conductor had the switch changed, and gave me orders to do so. But though I am innocent, I am as well prepared to die now as I ever will be, and if you will only allow me time to get my engine back to Afton side track, so that these poor suffering soldiers can get to the hospital, you can dispose of my old body as you please, for I am nearly dead, anyway," and turning away his smutty face he went to hammering again.

"Where's the conductor of this train?" boldly asked the major.

I was about to put my nerveless fingers into my vest pocket for my orders and explain, when good and witty old Conductor Finks answered "*Dead*, sir! Mashed to death in the rear car among a lot of government supplies!"

"Yes," said John Harton. "And in hell, I hope" But John knew I was within ten feet of him as he spoke. Then, Captain Finks, turning quickly to me, said, "Henry, by the way, you must take a telegram at once to the Greenwood office. We must have two engines here at once, and the wrecking force to clear the track. These poor soldiers must be carried to the hospital, if we have to roll 'Old Spinner' down the mountain to do it." At the same time walking me off and giving me his lantern, while he pretended to be writing a telegram. As soon as he got me far enough off he gave me a sure enough message, and told me to go to Greenwood, report the accident and then keep out of sight until the soldiers' train had passed. For once in my life, I can truthfully say I took advice.

I joined my crippled train next day at Afton, but had to go to bed on account of injuries received from being caught between a hogshead and side of the car when the accident occurred. In about a week I reported to Superintendent H. D. Whitcomb, at Richmond, who said to me, "Carter, had I seen you immediately after the accident occurred I would have discharged you at once. But your absence, on account of your being hurt, has given me time for reflection, and I confess that my system of giving train orders was imperfect. I have now adopted a rule of giving in every train order the names of conductor, engineer and engine of both trains"—a rule which worked well and continued in use for twenty years Continued my honest superintendent, "You can go back on your baggage-car with Conductor Jones. I would rather not put you to running conductor now. This thing of wrecking trains crowded with soldiers is rather serious"

There happened to the troop train in the tunnel that night what may seem impossible; but I can prove it, if necessary, just by way of argument. From some cause there was in the troop train a flat. The flat was lower in body than the freight box car in rear of it, and when the collision occurred the box car jumped entirely off its truck on to the flat, and was carried, with soldiers in it, to Richmond, so nicely did it fit itself on to the flat. Of course, it just happened so.

One of your readers writes. "My old father wants to know what became of the 'Fred Harris.'" The "Fred Harris" was the smallest and oldest engine that I remember our using. Jug boiler and her steam-gauge made like a spring balance. In 1862, Superintendent Whitcomb took her to Lindsay's Station, where he had her uncoupled and swung so that he had a saw-mill attached, and John Parrott cut many thousand feet of car lumber with it. The mill and engine sat near the track. At a glance one would take it to be a short train, taking in the engine with her cab, and John, just for mischief in it, as though he were going to move. One day some one on the west-bound P. M. passenger train called out "Parrott, what time do you leave?" "Just as soon as I get 'all aboard,'" said he. When the old "Fred Harris" did get "all aboard" she was scrapped, and her cab set up on Seventeenth Street yard as a watch-house for crossing-watchmen.

SWISS RACK-RAIL ENGINE, RUNNING BETWEEN LAUTERBRUNNEN AND GRINDELWALD.

## Wants to Run 200 Miles an Hour.

One of the commonest cranks of the day is the high speed for railroad trains crank. The latest specimen hails from Buffalo and he has been making his views public in the Buffalo *Express*. His name is Kelly. He promises to be as famous as Keeley. A speed of 112 miles an hour is too slow for him, and by means of cars offering diminished resistance to the air and a wonderful locomotive, he means to make 200 miles an hour common speed. Here is his description of his locomotive

"In the common locomotive the boiler used is 56 inches in diameter by 27 inches over all, having 230 2-inch flues 12 inches long, supplying the cylinders with wet steam taken directly from top of water. Steam travels 24 inches through pipe to cylinder-head, thus wasting 40 per cent of pressure in pipe friction and turning five corners. The boiler in 'Thunderbolt' is the same length, elliptic instead of circular in form; has 502 flues instead of 231 It has a horizontal partition with super heating steam chamber, larger than a common boiler; the steam travels only 4 inches to get from boiler to cylinder instead of 24 inches, thus saving the entire 40 per cent. lost by the old boiler. All steam is super-heated, also a great advantage A common engine exhausts perpendicular up against the air at its gravity weight of 15 pounds per square inch, which is equal to a downward stroke of a 3,800-pound hammer on top of the engine every time the engine puffs at the open throttle. In the new engine the exhaust is directly back, sending the smoke and cinders out of the rear end of the train and thus forcing the train forward by a pressure of 3,800 pounds, a clear saving of nearly two tons of power.

"The engineer has a cab at the front of the boiler instead of the rear. The pilot is in the roof to his cab, he has a clear, unobstructed view on both sides and front The fireman occupies his old stand."

## Arbitration Should Prevent Strikes.

In an article on arbitration as applied to railroad corporations and their employés, contributed by Mr Edward A. Mosely to *Transportation*, the following paragraph is found

"Without venturing upon a statement in relation to the railway strikes which have occurred in our country, it is sufficient to give the result of the Scottish railway strike of 1890, when there was a complete paralysis of all industry Over 100,000 persons, other than strikers, were thrown out of employment as a consequence of the railway strike Steel works, engineering works, ship-building works and cotton mills shut down for want of coal and material. The scarcity of coal affected most seriously and bore most heavily upon the poorer people. The public loss and inconvenience was incalculable, the retail price of coal doubled. Trade left Scottish ports and merchants bought their goods elsewhere. Such a calamity might overtake our own country Can the efforts of the legislator be better directed than towards a solution of this question, towards devising some method of treating in a just, amicable and satisfactory manner these disputes so liable at any time to arise? It is for the common good, 'the general welfare,' of all interests that arbitration in matters of railway employment may be provided. May we not look forward to the time when the almost waste product of the higher abilities that are latent among railroad employés will be availed of in the directories of the corporation"

Some extraordinary ridiculous claims have been made for a smokeless coal found in the Ouchita River district of Arkansas. A daily newspaper account says that the coal is found in a large deposit, the vein being 42 inches wide. It contains 20 per cent. of oil, which has been found to be very valuable in making paint A bar of iron painted with it has been placed in a fire and submitted to an intense heat without disturbing the paint It is also claimed that one ton of this coal will produce as much steam as ten tons of ordinary coal. It is also claimed that it is much better for gas than Pittsburg coal.

The agents of the Chicago, Milwaukee & St Paul have been invited by Mr. George H Heafford, the general passenger agent, to engage in a curious competition. He wants a motto for advertising purposes that shall be striking, as catching as "You press the button and I do the rest." He offers a $25 prize for the best one, and warns all concerned to avoid sending in chestnuts. A striking, original catch phrase is worth ten times the money offered.

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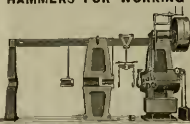
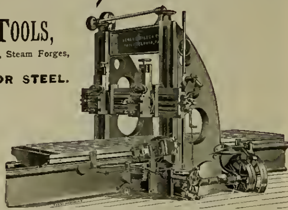
For Railroad Shops, Locomotive and Car Builders, Machine Shops, Steam Forges, Ship Yards, Boiler Shops, Bridge Works.

**STEAM HAMMERS FOR WORKING IRON OR STEEL.**





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Lathes, Planers, Drill Presses, Steam Hammers, Steam and Hydraulic Riveters, Punches and Shears, Bolt Cutters, Wheel Presses, Car-Wheel Borers, etc. High Speed Power Traveling and Swing Cranes. Testing Machines, etc. Turn Tables for Locomotives. Shafting, Pulleys, Couplings, Hangers. Self-Adjusting Injector of 1876. Self-Acting Injector of 1887.

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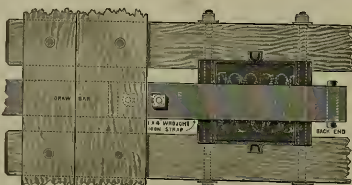
The Yoke Device is becoming a general favorite with users of AUTOMATIC COUPLERS. ☞ Try it and be convinced.




The number in use constantly increasing, and the new strengthened castings are giving entire satisfaction.

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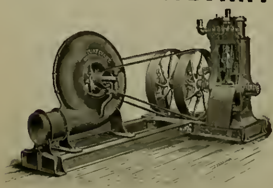

Blower on Adj. Bed, with Double Inclosed Engine.

FOR CUPOLA FURNACES AND FORGE SHOPS.

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**STEEL PLATE EXHAUSTERS**

FOR REMOVING SMOKE FROM FORGES AND REFUSE FROM WOOD-WORKING MACHINERY.

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### An Attractive Iron Exhibit.

Ewald Iron Company, Tennessee Rolling Mills of St. Louis and Louisville, present a cut herewith of a very handsome hardwood pavilion. their exhibit at the St. Louis Exposition this year. This company displays, in a very tasteful manner, their well-known Tennessee bloom charcoal iron for stay-bolts. In their variety of tests will be found stay-bolts turned, polished and threads cut, cold and hot bent and twisted shapes, nicked tests, showing the character of the fiber, pieces of round iron tied in knots. It is a very creditable display of the Tennessee bloom iron.

### To Those Ambitious to Sail Round the Moon.

Mr. M. N. Forney writes us "In your very kind notice of *Aeronautics* in the last number of your paper, you mention the fact that the subscription price is $3.50 per year. As we are supplying it to subscribers to the *American Engineer* at 50 cents and are charging other persons $1, would it be asking too much for you to make a very brief correction in your next number? As compensation for this favor, we will promise that in the first balloon ascension which we conduct ourselves, we will send you an invitation to accompany us 'up above the little stars and all around the moon.' All prepaid subscribers will be entitled to the same privilege."

### Curious Origin of Important Inventions.

We often hear surprise expressed that invention progressed so slowly in the first years of what might be called the engineering era. Many inventions that have exercised the very greatest influence in mechanics are so simple, that it is natural to ask, why did not somebody think of that before? The application of the piston to a cylinder, was the first thing that made the steam engine a success. Yet for hundreds of years, philosophers, inventors and other wise men struggled in vain to design harness that would convert the power of steam into doing work When the piston was tried, and found successful, hundreds wondered why they had never thought of such a device.

It appears that the inventive faculty grows both among individuals and communities; and it is likely that future generations will invent appliances that will exert us much influence on industries, as anything that has been invented up to this time. They in turn will wonder that the people of the nineteenth century failed to invent things that seemed so simple. Most inventions appear simple after they have been worked out, but it requires genius to devise them. The carrying of air through a train in pipes to operate brakes is now thought a very commonplace invention, but the thought of such a plan was a stroke of genius.

It is curious the way that some of our most useful appliances were invented or discovered. We are told that some Venetian mariners built a fire on a beach, where there was sand mixed with soda, and that they were surprised to find that the sand melted and formed a transparent composition. Some reflecting man was in the party, and by this accidental melting of the sand, discovered how to make glass. Years after this, the children belonging to a Dutch spectacle-maker were playing with the glasses which their father used, and they made the discovery that, by putting one glass in front of the other, they could make the steeple of a neighboring church appear nearer. Their father had sharpness enough to use this accidental discovery in making the first telescope.

Most engineers are familiar with the story of how the steam-engine was first made automatic. In the early rude forms of the Newcommen engine, a boy was employed to open and shut the cocks which admitted steam and the condensing water. A boy named Humphrey Potter who was engaged on this work, was anxious to play, and the movement of the engine gave him very little opportunity. To increase his leisure, he devised an arrangement of strings connected with the walking-beam, which opened and shut the cocks. This was the first move towards making the engine's mechanism to perform the operations of admitting and releasing steam.

The moving of a distant signal by means of a wire, seems a very simple operation, and one which called for little ingenuity to invent. Still the earlier railroad engineers could not devise satisfactory means of operating a distant signal until a working signal man showed them the way. It is told that in 1846, an English signal man had to attend to two signals, placed some distance apart at a station. To save himself the trouble of walking to and fro between them, he procured some wire and pulleys, and made a crude arrangement, by which he was able while in his box to operate both signals An official who had been trying to devise some means of protecting trains standing at stations, happened to see this primitive arrangement, and applied it to the working of distant signals.

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The January edition of Locomotive Engineering will be 30,000 copies. Subscriptions for 1894 can commence with that number until the over-stock is exhausted (this happened in April last year). *No back numbers beyond the current year.*

### Consolidated Car Heating Co.

A special meeting of the directors of the Consolidated Car Heating Company of Albany, N. Y., was held on Tuesday, October 31st, and the final papers were signed transferring to an English syndicate the English steam and hot water heating patents of the Consolidated Car-Heating Co. The English electric heating patents have not yet been taken by the English syndicate, although it has an option thereon until January 1, 1894. The option on the heating patents which it bought would have expired November 1st

The total sales of the Consolidated Car-Heating Co., including October complete, are slightly in excess of the sales at the same period last year. Within the last week orders for electric heaters have been received from twenty-one additional roads, making a total of fifty-one street railways in the United States and Canada which are using or are about to use the Consolidated Co.'s electric heaters.

### Meadville Shops.

One of the best managed shops we have looked through lately are those of the Erie, at Meadville, Pa., under the charge of Master Mechanic F. B. Smith, with Willard Kells as general foreman A clean, neat shop, with everything in its place and a place for everything conveys to me the information that the men in charge are looking closely after the details of their business. In going through the shop I was struck with the absence of fittings belonging to the engines undergoing repairs. They are generally to be found littering the floor or piled up in racks. There was no traces of them to be seen. On mentioning to Mr Smith the matter that was puzzling me, he led me to a large trap door, turned a valve handle and the door rose up as if by magic. It was moved by a pneumatic cylinder placed beneath The door covered recesses under the floor, where all the engine fittings where stored ready to be taken out when needed

The shop has not been well provided originally with lifting appliances, but this source of inconvenience, delay and extra labor has been successfully overcome by the use of simple air-lifts placed beside every tool that does work on heavy pieces.

They have in one end of the shop an excellent tool room, fairly supplied with small tools. Beside it there is a wall fitted up with all the appliances necessary to test brakes and gauges. In the absence of a brake instruction car, this place is used for demonstrating how the brakes operate. At the same place there is a remarkably good apparatus for applying the fittings to air and heater pipe hose. All the work is done by a simple arrangement of air-cylinders. By the aid of this device one man can fit up 250 sets of couplings in one day. When all the work had to be done by hand 35 sets was a good day's work. A. S.

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One of the first concerns in Newark, N J., to give their employés a practical reminder that hard times had come was the Consolidated Traction Company This company has a practical monopoly of street railway transportation over about 100 square miles of valuable territory and enjoys public privileges of a most money-making character which ought to be accorded to no private corporation. Yet they quickly availed themselves of the talk of hard times to cut the wages of their employés to an unscrupulous extent. There was no falling-off of passengers riding on the cars passing over railroads costing nothing for right of way, there was no reduction of fares and ready cash continues to be the terms on which people can ride, yet the officers of the company have the effrontery to announce that the hard times make it necessary to reduce expenses.

### The Galena Oil Works.

[EDITORIAL CORRESPONDENCE.]

In the interval between the meeting of the mechanical conventions at Lakewood, last June, many of the members and their friends enjoyed a rare treat in visiting Franklin, Pa., a name familiar to most railroad men as being the location of the Galena Oil Works. It is too late now to


Galena Oil Works, Franklin, Pa.

repeat the attractions which Messrs. Miller & Sibley, of the Galena Oil Works, provided for the visiting railroad men and their friends. A magnificent display of blooded horses and prize animals of rare breeds monopolized the time of the visitors and there was no opportunity to examine the manufacture of oils, although some of us were rather more interested in that than in animals, even of highest degree. The place was attractive enough to draw the writer back a few days ago.

To many people whom I have met, "the oil regions of Pennsylvania" are sterile wastes, where all the beauties of nature are smeared with petroleum and the air is made offensive with the smells that oil sends forth. Nothing could be farther from the truth. The reality reveals a succession of verdant valleys intersected by clear running streams, and bordered by wood-clad hills where every hue of nature seems reflected in the clothing verdure. The only sign of oil is the derricks, which are dotted over the country thicker than windmills in the land of Don Quixote. Franklin is a finely situated little town, notable principally for cleanliness and well-paved streets, two characteristics by no means common to towns of less than 10,000 inhabitants. In the Galena Oil Company's office I met many familiar faces—faces that I have seen on locomotives and in other railroad positions in widely separated places. This company has followed the sagacious policy of securing railroad men as agents, and they nearly always choose the smartest men on the roads they draw from. Few railroad men visiting here would fail to meet familiar acquaintances.

Social intercourse is not, however, the object of my visit. After an hour spent in the fine offices, accompanied by Mr. Hill, one of the agents, I proceed to the works shown in the upper engraving, the place where crude petroleum oil is converted into the lubricating and signal oils so well known to our readers. The works, as will be seen, occupy a large space of ground on the bank of a creek, that in most places would be called a river. The most conspicuous things about the works are large oil tanks, where crude and refined oils are stored. Crude oil does not differ in appearance from the ordinary lubricating oils, but it proves a very poor mixture when used without the treatment which gives lubricating qualities. The operations through which the oil passes are not easily understood by a visitor. The first operation appears to be the removing of water and gritty impurities. Water is taken out by heat and solids by straining. The succeeding operations are trade secrets. Red lead and whale oil appear to be the principal ingredients mixed with the petroleum. They are put in while the oil is kept at a certain temperature, but how they succeed in putting the lead in suspension, so that it does not settle when the oil is kept quiet for years is one of the secret arts of the business.

All the valleys and hills in this region are studded with the derricks that indicate the presence of an oil well. There is a constant flow from these wells to the refining works, and from thence to the oil houses of nearly all the railroads on this continent. The output of the works is about 22,000 barrels a month. As a barrel contains about 34 gallons, it means about 750,000 gallons sent out monthly. Mr. Charles Miller, the President of the Galena


Shooting an Oil Well.—Responding to the Shot. From an Instantaneous Photograph.

Oil Company, is said to be the ablest expert in oil making in the country, and the high character of the product is due in a great measure to his skill and knowledge.

The scene shown above is the reproduction of an instantaneous photograph, and pictures a striking operation in oil production. When an oil well has been bored for a certain distance and does not produce the expected supply, or when a well begins to run dry, it is the practice to introduce a heavy charge of dynamite to the bottom and explode it for the purpose of shattering the rocks which may be preventing the oil from reaching the well. The photograph was taken when oil belched upwards after a heavy charge of dynamite was exploded. The volume of oil that responded to the charge would indicate that a good supply was still in the fountain.

These oil regions are within easy reach for any one having business in Western Pennsylvania or New York, and will well repay a visit. Here was first discovered in considerable quantities the petroleum which has become one of the greatest of the world's industries, and in this region was first solved the problem of making the product suitable for the numerous uses that it now serves. The product appeared to come when the need for it was becoming urgent, when the world could get along no longer without it. It is curious to reflect on how the myriad wheels of modern machinery could be kept running cool had petroleum oil not been found. Even more attractive to some of us is the reflection how much darkness has been dispelled by the products of petroleum. I remember when the light of the workman's house was a rush wick burning in whale oil. A good crusie, as the lamp was called in Scotland, would give light of about half a candle power, and yet this feeble glimmer had to light the family room, and by it many a student wasted his eyesight. At smaller expense, similar families now enjoy the light of a good kerosene lamp. A. S.

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Locomotive Engineering will issue a handsome calendar next year. It will be sent to those who are subscribers to the paper for 1894 only.

### Awakening of Desire for Engineering Knowledge.

In the course of some interesting railroad shop reminiscences, written some years ago by Mr. E. P. Watson, proprietor of *The Engineer*, facts of experience are told which will be familiar to every old mechanic who has studied the science of his business. The ambitious shopman of this generation has so many well-known engineering books and publications to help him, that nothing but will is needed to obtain a knowledge of the technical part of his business. It was very different forty years ago. Writing of shop life in the early fifties, Mr. Watson says:

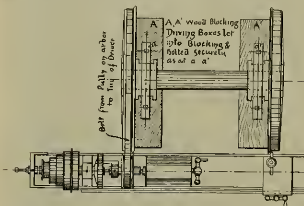
"Books and papers treating of steam and machinery were both scarce and expensive. I remember well the first technical work I ever saw. It was named 'The Mechanic's Calculator,' and belonged to the foreman of the shop. He kept it locked up in his desk, and seemingly prized it as much as though it were a precious jewel. In those days, a shop hand who was fortunate enough to know something of the theory of the trade, or if he could work out problems in screw-cutting, gearing, valve motion, and suchlike, he jealously guarded his knowledge of these things or would sell it to others at fancy prices. One dinner hour, while sauntering round the shop, I espied the foreman's treasured volume lying on the top of his desk. I glanced round to see if any one was looking, and finding the coast clear, opened the book. Glancing through it hurriedly, I found a chapter devoted to the steam-engine. Here I paused, read and re-read the rules, problems and explanations, but they were all Greek to me. I felt for the first time that I was merely an animated machine, since I was drawing lines, describing circles, and doing many other things daily without being able to give a reason why they were done. I felt abashed and humiliated, and during the remainder of the afternoon my mind was preoccupied with matters entirely foreign to the job I was working on. When I left school, I had but a very crude knowledge of arithmetic. Greater knowledge of it I felt would unlock the mystery of the signs in 'The Mechanic's Calculator' which I could not understand.

"There was an old Scotchman working in the shop at the time, an excellent machinist, who made no mystery of what he knew about the technical part of the machinist art. I spoke to this man about the foreman's book, and about my own ignorance and desire to learn all I could about the theory of the business. He advised me to go to a night school and study arithmetic and geometry. The end of it was

that I took his advice. But it was not the night school alone that helped me. That helped to impress upon me the need for more knowledge, and my daily occupation became a school. When I saw anything done which I did not understand I did not rest until I knew the why and wherefore of the operation. When a man once gets the thirst for knowledge he acquires what he wants from all quarters."

### Turning Driving-Wheel Tires on an Engine Lathe.

The annexed engraving shows a very ingenious arrangement made by Mr. Chas. H. Burgiss, master mechanic of the New Orleans, Fort Jackson & Grand Isle for turning driving-wheel tires by means of a common engine lathe. This is a case where necessity was the mother of invention. The railroad company has only got a few engines and is too poor to buy a wheel lathe, but yet the wheels had to be turned when they became worn. It was expensive sending them to a distant contract shop to have the work done, and the master mechanic in charge fell upon the arrangement shown, which has enabled him to turn his own tires although it was a slow proceeding. Two heavy blocks of wood are secured into the floor and recesses are cut in them for holding the driving-boxes. The boxes are set upside down and the wheels are placed in the boxes and are held in position by their own weight. A belt is extended from the lathe round one of the wheels which keeps it in motion while the other is being turned.




Turning Tire Without a Wheel Lathe.

### Against Overtime.

In an answer made to the Railway Commissioners of New South Wales by the president of the Locomotive Engine Drivers, Firemen and Cleaners' Association, on a charge of insubordination raised because they had agitated for redress of grievances, the following points are made:

"Overtime is being worked which the men do not desire, and consequently is keeping starving men from employment. Under all circumstances overtime is an evil, but under conditions like those at present prevailing it is materially intensified.

"The average rate of wages which you give cannot but show an increase, but it is not a real one to the men, considering that the general rule is carried out of the oldest hands retaining their positions in preference to the junior, and were it otherwise it would be decidedly unjust; but it must not be forgotten that there are now considerably less drivers than there were in 1888, although there is an increase both in the weight carried and in the mileage rate, and stronger evidence of the present sweating system, with its utter disregard of health or home comforts, cannot be given than in your own figures.

"A word as to the lodging allowances, the only alteration in this matter since you assumed office being one which was by mutual agreement shown to be in favor of the department. You quote the rule from old rule book as to preparation of engines. As you well know, this rule was not in operation, but a fair system prevailed—according to the circumstances of the depots. The rule itself, except on the Northern line, was inoperative and the whole conditions were altogether different from those of to-day. The great majority of the men ran their own engines and enjoyed the privilege of a shed day, in which they could see their engines were properly prepared. In that day engines were cleaned regularly; to-day it is very questionable whether in the whole world there are such dirty, neglected engines as in New South Wales."

### Grease for Locomotive Lubrication.

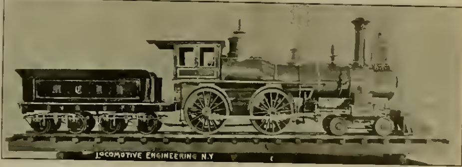
"A penny saved is a penny gained, and every penny gained helps to make both ends meet," remarked a well-known motive power man lately to the writer. The proverb was employed to justify a change to cheap lubricants, which was done to save money. The impression we received was that pressure from above had been used to induce the mechanical department to adopt the cheap material, and the head of the department was pretending to like the change. Part of the change was the introduction of grease for locomotive use. Some remarks made by Professor Denton in an address on lubricants may be edifying to those who think that pennies may be saved by the use of inferior lubricants.

The locomotive engineer, said the speaker, learning of the economy due to grease in marine work, tries it as a lubricant on the crank pins of his engine where oil-cups are available. He uses the spring-piston feed-cup, and finds the grease runs the engine fairly well. He notices that the bearing is a little warmer than with oil, but that the temperature does not increase as it does when something is wrong with the bearing surfaces and a hot pin is breeding. This fact is explained to him by the grease agent to be friction due to a little viscosity, but the viscosity is called "body," and a lubricant possessing more body than lard oil or engine oil common to locomotives is an idea which seems to the engineer an improvement, especially if the grease is going to save on the quantity of lubricant used. So he makes a faithful trial of the grease without any overheating occurrences. But he finds little or no saving over oil in the consumption.

When he used oil with a needle-feed oil-cup adjusted carefully, as he has long since learned to regulate it, he could run a thousand miles without exhausting the small-sized oil-cup used on the crank-pins. He finds that he cannot do sensibly better with the grease. Also, that in the long run about as many cases of overheating occur. Again, when the overheating occurs, although the grease flows from the cup with a sudden abundance, it is too late to save the overheating, while the increase of consumption over the oil is then unquestionable, especially if he must smooth the journal by a temporary use of oil.

### The Very Smallest Locomotive.

We have several times within the last few years given illustrations of extremely small locomotives that were complete in all parts, but that shown in the annexed engraving is the very smallest working locomotive that we have heard about. It was built by a jeweler, and is the property of




The Very Smallest Yet.

Mr. W. E. Gallant, Chicago. This elaborate toy is built to run on a track ⅞ inch wide and has a total length of 9½ inches with tender included. The cylinders are ¼ x ⅜ inch, the driving-wheels are 11/16-inch diameter. The boiler is ¾ x 3 inches. The total weight of engine and tender is 9½ ounces. Gold, brass, steel and nickel are the materials of which the engine is made and the pilot is of wood. It is a real working model and spins along in good shape with its own steam, a spirit lamp supplying the required heat.

### 16-Spindle Drill.

The annexed engraving is made from the photograph of a novel form of drill which was in the Pratt & Whitney exhibit at the World's Fair. Beside it is a specimen of the work done by this drill. The machine is so made that it will drill holes arranged in any form, regular or irregular. This is the first tool of the kind, but it has been so useful and popular that


A New Multiple Spindle Drill.

there is likely to be a lively demand for it. The company have also decided to make similar drills with the shafts set vertically. In this form the tool will be very useful for drilling flue sheets and other articles where many holes can be drilled at the same time. This tool can drill one to sixteen holes of ½ to 1¼ in. diameter, 2½ in. or more apart in circles, or arranged in any shape. The power feed is 1 to 3 in. per minute. The tool is made exclusively by the Pratt & Whitney Co., Hartford, Conn.

Firms that deal with railroad companies would do well to have their catalogues made of the standard size recommended by a committee of the M. C. B. Association. Nearly all railroad officers who require to consult catalogues are having cases made specially adapted to the holding of standard sizes, and the likelihood is that odd sizes will find their way into the waste-basket.

The following is an extract from a Detroit paper: "The gold medal awarded as evidence of the highest merit in lubricator cups was very appropriately given to the Detroit Lubricator Co.'s line of goods known as 'The Detroit.' We are pleased at this, not because it was essential to the success of these particular lubricators—for they certainly are already known as well, or even better, than any similar line in the market—but because it confirms the verdict previously given by the most practical and reliable engineers all over the country, and furthermore, because it will undoubtedly settle the question in the minds of doubters and be a reliable guide to others not conversant with the comparative merits of the goods hitherto presented."

The legislature of Ohio passed a law some time ago making ten hours a legal working day. Most people thought the law was one of those ornamental enactments designed as a sop to labor interests without hurting exacting employers of labor, or benefiting the unfortunates whose hours of work are scarcely kept within the bounds of physical endurance. A telegraph operator who worked for the Bridge & Terminal Railroad Co., at Martin's Ferry, and a jury have reduced the terms of the law to practice. He had been kept at work from fourteen to eighteen hours a day and sued the company for $523 overtime and a verdict was returned in his favor.

The Great Northern people are erecting very fine shops at Hillyard, on the Pacific division. It is intended that all repairs of locomotives and cars running west of the mountains shall be done in these shops. First-class machinery will be provided for doing the work, and the most approved methods will be followed.

# Car Shops and Car Builders.

## Reduce the Shocks of Passenger Trains.

The hydrostatic buffers used on the cars composing the trains that formed the New York and Chicago Exposition Flyer did a great deal to make the train popular, for nearly every passenger who traveled on the train testified to its remarkable steadiness. We hope to see the buffer applied to all the passenger equipment of the country. It is an improvement greatly needed, and will rank in the line of progress with the Miller platform and coupler, which was the first great step towards making a train run steady. The traveling public have the right to demand the introduction of every practical improvement that will increase the comfort and secure greater safety to those who ride in trains. It is not so very long ago that railroad men objected to close coupled cars because they made a train hard to start. The putting of wedges into the links to hold the slack was considered an important improvement before the Miller coupler made people aware that wedged couplers were not all that could be desired.

The wedged coupler was as good, comparatively, as the common vertical plane coupler with springs is compared to a car that is bound to the next one by the hydrostatic buffers. The beauty of this device is that it never lets the springs get loose. In ordinary passenger car draft gear, the springs are constantly losing their resisting power, and the cars get jammed together in a way that is extremely uncomfortable and in some cases dangerous. The road that first adopts for all its through passenger cars a buffer that prevents the common shocks due to sudden braking and to quick starting, will gain in popularity much more than will pay for the expense of applying this much needed improvement.

## Redwood as Car Building Material.

Nearly every person acquainted with American products is familiar with the fact that in California there grows immense trees which are called "redwood," from the color of the wood, and that the trees sometime attain an altitude of 300 feet, with a diameter on which could be built a large house. Interesting particulars about this wood were given by Mr. Benjamin Welch, the well-known master car builder of the Southern Pacific, in an article contributed to the *Railroad Car Journal*. We abstract the following points.

"Redwood is extremely light in weight, but durable. It is of a handsome red hue, very closely grained and straight, and may be split with remarkable facility, it may also be very readily and beautifully polished.

"From a tree 35 ft. in diameter and 300 ft. high, was taken a plank 16 ft. 3 in. wide, 12 ft. 9 in. long and 5 in. thick, and was about 20 per cent. clear. According to its rings the tree must have been at least 1,500 years old. The tree was cut 28 ft. from the ground, and the plank was hewed out of the stump, representing a section taken from near the heart to the bark. After it was displaced, it was lowered by block and tackle, with a locomotive for power. In the way of labor, its cost represented the time of two men for a month, simply to prepare it in the rough for shipment.

"Redwood is unquestionably the most durable wood of its kind grown in California for car and house building, it being much preferred to pine or other soft woods, though the cost is of no material difference. Redwood will shrink a little in length but in width this is scarcely perceptible, and when seasoned is not affected by climatic changes. It has also been demonstrated by actual occurrences that redwood has wonderful fire-resisting qualities.

"The uses of redwood are varied. It is adopted in California almost exclusively for railroad ties, car sheathing, roofing, lining, inside finishing, pickets, rustic shingles, and other classes of work subject to dampness and where strength is not required. Rock redwood is used for underground work, is harder and darker than that used for purposes above named, and on account of the greater amount of pyroligneous acid therein contained, is not so easily subject to decay.

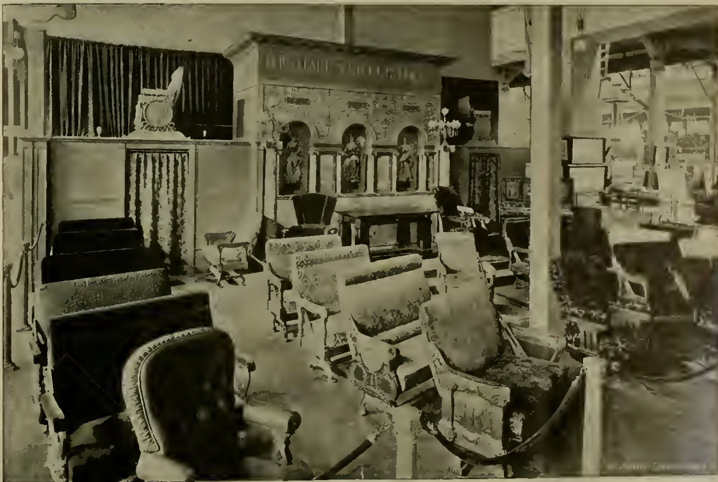
"The adoption of redwood for car building was brought on wholly through practical tests, and we have yet to discover the first species of another similar variety which could be successfully used as an auxiliary to it.

"This has been fully demonstrated on some cars built by the Central Pacific Railroad in 1875, which were finished inside with redwood. Some of the panels were oiled in part, leaving the other part to be shellaced and varnished without oil. To-day the parts of the panels not oiled are of a dull reddish yellow, while the parts oiled present a strikingly rich red.

"Redwood should be perfectly dry before painting, if not, it is quite impossible to keep the paint from blistering on it. In its natural state it contains much more sap and acid than white wood, ash or poplar, and if it is wet to any great extent the paint will not dry, no matter how much Japan dryer it contains. There is but one dryer that I know of that will dry paint on wet redwood, and that is 'litharge.' This will dry the paint no matter how wet the wood may be. This will do very well for freight cars and other rough painting, where but two or three coats are applied and not varnished, but if sealed with varnish it will invariably blister. Absolute dryness of the wood in passenger car painting is very essential, and especially so if the paint to be used is of a dark color."

## Exhibit of the Hale & Kilburn Mfg. Co.

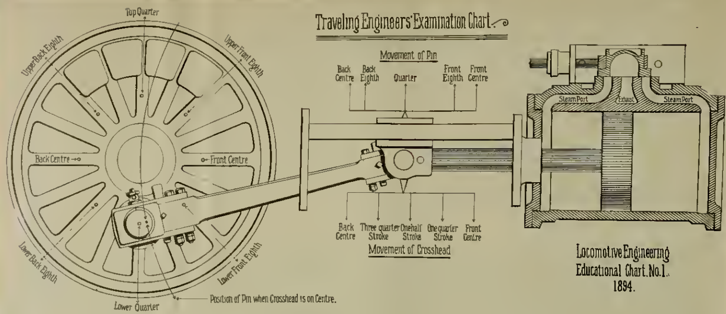
One of the most attractive exhibits witnessed in the Transportation Building of the World's Fair was the fine display of car seats made by the Hale & Kilburn Mfg. Co., of Philadelphia, an illustration of which is here shown. A great variety of car seats was exhibited, all being remarkable for artistic design and perfect workmanship. To those who were not fortunate enough to have the opportunity of examining the exhibit in person, the picture will convey a good idea of how the exhibit looked, and what kind of seats were shown. But we cannot reproduce the rich hues of the silk and the plush and the embossed leather. The exhibit attracted the attention of so many railroad men that the company, no doubt, see a future return for the great expense involved in adding that very interesting display to the beauties of transportation comforts. An examination of the car seats, some form of which is used by nearly all railroad travelers, was sufficient to rob a long journey of the terrors of prospective fatigue.



Car Seat Exhibit of Hale & Kilburn Manufacturing Co. at World's Fair.

## New Form of Sleeping-Car.

There was exhibited at the World's Fair by the Krabel Palace Car Company three cars of a very peculiar arrangement of seating, and the means of converting the cars from day coaches to sleepers. The seats, which are noted for their splendid cushions and fine upholstery, look like very wide arm chairs that are capable of being turned in any direction. The seats are so constructed that they form an excellent seat during the day, and have all the parts necessary to make up both upper and lower sleeping berths at night. Each seat or chair rests on four double casters, in the center it is securely fastened to the floor with 1-inch steel king-bolt, the head of which moves in a slot in the floor, which slot extends across the car. The bolt passes through the bottom of the




# The Angularity of the Main Rod

Is one of the things few men fully understand. Our **Educational Chart No. 1** explains it better than anything else. The above picture gives some idea of this Chart. The piston, piston-rod and cross-head, as well as the valve are made of celluloid and move back and forth in slots. On the back of this Chart there is a short, plain explanation of the angularity of the rod and its effect on the piston and the valve. Then there are thirty-six questions to be answered, by placing the valve and piston in the proper positions—if a man can answer all these questions in this way he must know something about the **subject.** The answers to these questions cannot be learned parrot fashion, the student must know **why.**

# The Names of All Parts.

**Educational Chart No. 2** will be a fine, transparent picture of a modern locomotive, with the name of every part given. This will be as fine as steel and worthy of a frame in the home of any man who knows a locomotive from a sausage mill.

# The Triple Valve

Is another **Educational Model, No. 3,** with moving celluloid parts, on the same plan as the first one. This will show just what takes place in the triple valve when re-charging in service application and in emergency, and with the "few well chosen words" on the back will make this subject clearer to any train man than fourteen pages of explanation in type.

These three models will be sent free to every subscriber to **Locomotive Engineering** for 1894. The paper will come out in a new dress and a cover on January 1st, and we are spending a lot of money for articles from the best writers on mechanical subjects in this country. Some special articles on Block Signals will be very interesting.

# The Prize Designs.

In the past ten years there have been 796 engineers and firemen cooked to death under engines! This year we are offering prizes of $350 cash for the best designed cab fittings for an eight-wheeler and a consolidation engine. We furnish drawings of the engine and boiler, all the designing we want is the arrangement of throttle, lever, all the gauges, injectors, lubricators, pipes, cocks, hose, draft-rig, etc. The design must aim at: 1st. The safety of the engineer and fireman; 2d. Convenience in handling; 3d. Accessibility and economy in keeping up running repairs. $100 for first prize for each class of engine; $50 for second prize, and $25 for third. We will also pay $5 each for all designs not winning prizes which we consider worth publishing. This contest is open to the world. Readers of Locomotive Engineering get the benefit of it. A competent board of railroad men and locomotive builders will award the prizes in June, 1894, and we will pay them by July 4th. See other posters for particulars. Here is a chance for engineers, firemen and shop men.

# The Dull Times

Are not worrying us—we have spent over $3,000 per month on the paper in the last year, and will spend more next. New features will be added and the best of everything in our line will be captured at any cost. We don't propose to give our worst enemy the least excuse to say that the words on our seal are not the truth, the whole truth, and nothing but the truth.

Everybody "Most Interesting Railroad Paper Published" Says So!

If there is anybody getting up a club in your district, give him $2.00 and your name if not, send direct to us. We pay a cash commission to club raisers or give watches or other premiums—you can make the price of a $100 gold watch or get yourself a new overcoat by a little overtime. Send for terms to club raisers.

ANGUS SINCLAIR, JOHN A. HILL, Editors.

**LOCOMOTIVE ENGINEERING,**
NEW YORK.

seat, which is made of 3 inches of oak, there is then a very ingenious device for securely locking the seats when made up in berths for the night. By means of this slot in the floor the chairs can be moved to


End Framing, Pullman Coach

either side of the car and the entire car made up into staterooms, containing upper and lower berths, and two sections, with a 2-foot aisle on one side. In order that the chairs may be moved in the daytime without obstructing the center aisle, the bottom of the seats also has a 6-inch slot, by which means the chairs may be moved.

By this means, when the seats are facing each other, they can be moved back until they strike the next section, and when the front of the seat is opened and locked to the half of the corresponding seat, it makes all the sleeping berths rigid throughout the train. These two seats or parlor chairs contain all the material for upper and lower berths, thus dispensing with the great weight usually carried in the top of the car. This plan makes the cars ride very smoothly, and they do not sway under rapid motion. To make up the berths, the cushions are removed, and each back is hung at the upper edge and locked by a brace; one cushion is then inserted between the ends on a projecting shelf, this forms the upper berth. The front of each seat is divided vertically and hung at the corners; a lift is raised and each half is swung around to meet the corresponding half of the other seat and locked. The second cushion, with two mattresses on the seat, are then drawn together to form the lower berth. By this arrangement, the upper berth is one foot lower than in any other sleeper, and the lower berth, by being lower, gives four inches more between the upper and lower berths than any other sleeper. As these chairs meet at the top, it leaves a sixteen-inch space at the end of each berth for baggage and full depth of the berth. As the chairs revolve on a center, when made up they are six inches from the wall, thus giving a good circulation of air through the car. The berths are one foot and four inches longer than the Pullman, and the upper berth is six inches wider. Although each berth is one foot and four inches longer than the Pullman, the same number of berths can be put in a Krabel car of the same length, on account of the smoking-room in the latter being on the platform.

### The Krabel Vestibule.

A train of cars which was exhibited at the World's Fair by the Krabel Car Co., presented a decided novelty in the platform being covered in, making the train look like a continuous car.

All vestibules heretofore used have been an integral part of the car, and rigid to it. The construction of the Krabel vestibule differs from all others; the two halves of the vestibule are locked solidly together, forming a room rounded at the opposite ends, and resting on the two platforms, secured by means of a king-bolt in a longitudinal slot in each platform. At this king-bolt the vestibule is slightly convex and there are iron boxes bolted to the corners of the regular car platform, in which are coiled springs with an iron plunger or piston resting on the spring, in which the rounded end of each vestibule floor, covered by an iron plate, rides. By this arrangement the section, or smoking room, can be built the full width of the car, thus overcoming the usual wind friction between the cars, and as it is not rigid to the platforms, but connected to them on the same principle as the coach on the truck, excepting that the king-bolt is in a slot to permit of the cars taking up the slack, otherwise the vestibule would tear in two at the center when making a curve. When in the normal position, the king-bolt stands in the center of the slot and the rounded end of the vestibule is cushioned between the sill of the car with a 6-inch rubber cushion.

On account of the vestibule at the point of contact being slightly rounded, and attached by a king-bolt in a slot, the cars readily move to and fro and all concussion is received by the regular buffer heads and car platforms, the vestibule being six inches from the car sill. A provision is also made to provide against the cars uncoupling. If the cars should uncouple and the safety chains part, the vestibule floor coupler, a secondary coupler which couples the vestibules together, would prevent the train from parting and the entire train could be hauled in this manner. By this arrangement, the opposing motion of the cars is not imparted to the vestibules, and on undulating track no matter how much the cars fall from the level, this vestibule remains level on account of the two springs on each side. To cover the distance between the opposing ends of the vestibule and the car threshold, an iron plate is fitted in the center of one side and the sill of the car, which slides over the vestibule floor as the car moves when making a curve. The steps on these cars also close up when cars are in motion, and when closed the upper edge cannot be pushed out, thus avoiding all danger to passengers. When lowered it is pushed down by the foot by means of the lower step, when it moves out and assumes a level position at the instant of locking. As the steps descend the weight increases the tension on a coiled spring, by which means, when released, its action throws the steps back again.

### Most Advanced Features in Car Design.

It may be taken as a fact that the most advanced ideas in car construction were embraced in the cars exhibited at the World's Fair. Accepting this as true, we must conclude that the freight car used on American railroads has reached a standard form which is susceptible of very little improvement. Invention is still devoted to improving the attachments of the car, such as trucks, draft gear, doors and roof, but the body of the car has reached the form in which it is best adapted to the work intended. This would seem to offer a very strong argument in favor of the Master Car Builders' Association establishing a standard form of body for a box car.

Ordinary day coaches appear, like box cars, to have reached an established form, the only room for improvement being in the arrangement of lavatory apartments and in conveniences for depositing small articles of baggage. The ordinary rack used for the latter purpose is ridiculously inadequate. It is not only too small to be of utility, but most of the racks used are unsightly protuberances, with projections in the way of ornamentation that are dangerous to people thrown against them in case of the car being overturned from any cause. The extended baggage rack used by the New York, New Haven & Hartford is much more convenient than the ordinary short forms, and it makes a more harmonious looking inside. Why this kind of rack is not generally used is one of the mysteries that common-sense people cannot understand.

Side Framing, Pullman Coach

There was apparent among the cars shown at the Fair an inclination to utilize the platform or the open space usually wasted by the platform. Of course the vestibule was a move in this direction,

but that has merely taken possession of a passage-way over the platforms. Some designers have taken a more radical position and taken in the whole platform. We consider this to be a move in the right direction. The original purpose of the platform was to provide a convenient place for the admission of passengers, and after that it was utilized as a good place for the brake-wheel and the coupling levers. When cars have to be coupled and uncoupled frequently, a platform is a necessary convenience. In the case of through trains the platform is no longer needed for brake and coupling devices, and the passengers might as well mount direct into the car. The closing of the openings now made for the platforms would make a much better looking train and it would greatly reduce the resistance due to wind pressure.

Those who are familiar with the increased power necessary to haul a freight train when a few car doors are open will readily appreciate how much harder a passenger train is to haul with the front of every car acting as a huge wind cup, than it would be to haul the same train with a continuous smooth side. With closed platforms the train would be so much lighter to haul and so much easier kept warm in winter that a material saving in fuel would result from the adoption of the improvement.

There may be practical objections against the Krabel car arrangement, which converts the platforms into an articulated section separate from the rest of the car, but it seems to us that a modification of that form could be used successfully on roads that are not very rough. If the car designers of this country will devote their abilities to designing cars that will have the platforms covered, we have no fear but what the problem will be worked out successfully.

### Compressed Air for Car Cleaning.

About a year ago a representative of LOCOMOTIVE ENGINEERING, while on a visit to the Pacific Coast, found several railroad companies in the West using compressed air for cleaning passenger cars. Particulars of the process were published, and we received many private inquiries for detailed particulars as to how the work was done. We now find that the system has been adopted by several of the trunk railroads, and that the Pullman Car Company is introducing the practice wherever they can obtain air pressure conveniently.

In conversation with men engaged cleaning cars by air in the Erie yards, at Jersey City, we learned that a strong jet of air searches out dust and impurities which hand work fails to reach. They say that cushions and upholstery generally can be much better cleaned by air than by caning. Consideration for the health of the people who ride in passenger cars demands that the cars should be thoroughly cleaned. Compressed air is the latest auxiliary to thoroughly doing the work, it makes a better job than hand, and reduces the cost of labor. The use of air for car cleaning ought to become general.

### Excessively Decorated Cars.

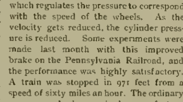
At a recent meeting of the Western Railway Club, Mr. George Gibbs, of the Chicago, Milwaukee & St. Paul, read a paper on the "Passenger Train Equipment at the Columbian Exposition." Mr. Gibbs was one of the judges of train equipment, so that he had peculiarly good opportunities to make himself familiar with the cars exhibited. The greater portion of the paper was devoted to a description of the various cars, but he gives the following opinions, which we consider pungent and well worthy of serious attention

"I have space for but a few of the conclusions which might be profitably drawn from the collection of cars here briefly described. As examples of perfection of the car builders' art, the trains exhibited are truly representative, as examples of the decorators' art, they have never before been equaled, and it is to be hoped will not in this respect prove representative in the near future, this latter refers especially to the Pullman and Wagner trains. These cars should have been entered in the catalogue as two separate classes of exhibits, first, as excellently designed railway equipment: second, as fine examples of the decorators' and house-furnishers' art; but the latter is absurd and execrable taste in connection with the former.

"It has for some time become apparent to railway men that it was time to call a halt upon the expensiveness and over-elaboration of detail found in the equipment of sleeping car companies. I have heard, however, the plea gravely advanced by men who should know better, that the sleeping car companies and not the railways pay for these luxuries. It seems hardly necessary to advance an argument to refute this statement, but it may be asked, who pays for hauling the increased dead weight around the country? In the Wagner compartment car, for instance, but twelve passengers are comfortably accommodated, whereas, in the ordinary twelve section sleeper, with drawing-room, twenty-seven will have a berth apiece. Again, it is the rule to base contracts between car and railway companies upon the net earning power of the equipment to the former, including, of course, interest charges on investment and cost of maintaining, and the higher these latter charges, the less favorable the terms to the railway companies. It is possible, however, that these companies do not intend to put their trains into regular service in exhibition order, and we will rest in that hope.

The Westinghouse Air-Brake Company have been experimenting for some time with an attachment to the air-brake, which enables the brake to exert greatly increased power when the train is running at a high rate of speed. The principal novelty about the improvement is a valve which regulates the pressure to correspond with the speed of the wheels. As the velocity gets reduced, the cylinder pressure is reduced. Some experiments were made last month with this improved brake on the Pennsylvania Railroad, and the performance was highly satisfactory. A train was stopped in 971 feet from a speed of sixty miles an hour. The ordinary emergency brake required 1,235 feet in which to stop the same train. This is a very important gain, and in a great many cases would mean the difference between a safe stop and a collision.

We have received a document in parti-colored ink addressed to the railroad managers throughout the world, and headed "Preamble and Resolution," followed by various whereases and graced in the bottom by a blazing seal. This imposing paper is a circular issued by the Railroad Lighting and Manufacturing Co., Philadelphia. We received the same circular nearly a year ago, but consigned it to the waste-paper basket without notice. From its being sent out a second time, we conclude that it was not found effective enough in the first instance. The purpose of the circular is to tell that the Pennsylvania Railroad Co. have adopted the Frost Carburetor system of car lighting because it is the best lighting system in use. We do not think that in the present state of the art of train lighting the gasoline device has much show. It is well known that the system is used upon the Pennsylvania Railroad, because one of the most influential officers in the company is a stockholder in the lighting company.



WOOD-WORKING ATTACHMENT FOR CAR COUPLER.

## Practical Letters from Practical Men.

Facts Wanted. There's a glut of Opinions.

**Write on one side of the paper, state your point plainly and briefly, and then quit. We supply the generalities. No letters noticed unless name and address accompany.**

### No Spark Arresters Are Best.

*Editors*:

Having read your article in the June number of LOCOMOTIVE ENGINEERING headed, "No Spark Arrester the Best," I wish to add my testimony in the same direction. That is certainly right, provided the engine is properly constructed and proportioned. I have run engines which never threw fire, although they had no spark arresters. I may mention those designed by Mr Fletcher for the North-eastern of England as good examples for they ran the fastest trains of their day without fire throwing, no matter how heavy they might be worked. On the other hand, the engines under the charge of Mr. P. Sterling, of the Great Northern Railway of England, are noted for spark throwing, but this is due in a great measure to the inferior quality of coal used and to the heavy work the engines have to perform. The arrangement of the blast-pipe has much to do with the quantity of sparks sent through the chimney. The last engine I ran in England had the Adams variable blast-pipe. When it was put in right the engine would work without throwing sparks, but it had to be just right. The eight-wheel engines that were engaged working fast freight, fast passenger and cattle trains used from seventeen to twenty-four pounds of coal to the train mile. Before the Adams blast-pipe was put in and when a spark arrester was in use, they used from thirty to forty-seven pounds of coal to the train mile. With one of these engines I have run twenty-one miles in nineteen minutes, and reduced the speed four time.

On this road where I am now the engines were throwing fire when I came, but they do not throw any now, and we have 3½ miles of a grade varying from 1 in 21 to 1 in 30 feet (251 to 179 feet to the mile). The engines are all worked by Chinese engineers and they steamed badly at first but they are all right now. Good steaming and absence of sparks often go together, and the reverse also holds good.

J. FENWICK,
Locomotive Superintendent Formosa Government Railway.

*Formosa, China,*
*September 9, 1893.*

### What a Patent is Worth.

*Editors*:

On page 407 of the November number, you publish a letter from J. B. Michael, asking certain questions about patent law. Instead of answering your correspondent's questions in an intelligent manner, you turn him off with a few sneering remarks about patent attorneys. (?) whom you represent as ignorant and grasping, anxious only to pocket their fees.

Of course, there are rascally patent attorneys, just as there are scamps in every trade and profession; but the great majority of them are honorable men, and it would not hurt you to recognize that fact. I notice that you are quite willing to publish their advertisements and to take their money for such services. Now, since you tacitly confess your inability to answer Mr. Michael's questions, will you permit me to say a word or two to him, because he is perplexed about a matter which troubles a great many intelligent inventors.

His patent was on the face of it, a valid one, and I presume it was actually so. Such being the case, he cannot understand why the Court should have decided that it infringed a prior patent, and why the Commissioner of Patents should not have informed him of that prior patent.

In the first place, nearly every patent that is granted now-a-days—and they are issued at the rate of about 500 a week—is an infringement on one or more prior patents. A patent covers only what its claims point out. Jones invents an improved throttle-valve. It has some new and valuable features but it is an improvement on Smith's old throttle-valve, and contains several of the features of Smith's old valve, which Smith has covered by the claims in his patent Jones cannot make his valve without using the old parts of Smith's valve, and consequently Jones infringes Smith's patent, yet the Patent Office will grant Jones a valid patent for all the new features which he himself has invented, and might not say a word about Smith's patent, because Jones is, in law, presumed to know all about not only Smith's patent but all the other patents which have been granted.

This is a violent presumption, to be sure, because nobody really knows all about the prior patents. But the Patent Office merely says "Here is your patent. The claims are good, so far as we can find out," and leaves the patentee to make his own investigation to determine what prior patents he will infringe if he goes to manufacturing As a matter of fact, no shrewd business man begins to manufacture a patented article without first employing an expert to make a thorough search for all the prior patents which have claims covering any part of that article.

He then either buys those prior patents, or he gets a license from the patentees to use their patents. Such a search takes lots of time and study, and the Patent Office has neither men enough nor time enough to make such a search on every patent issued.

The fact that a patent may be valid, and give full protection for all that is new and patentable in an invention, and yet the invention may infringe prior patents, is one which all patent attorneys find it very hard to explain to inventors.

Suppose a man is put in charge of a locomotive, and is told that she is all in good shape and ready to run on the track that he sees stretching away across the country. Suppose he pulls open the throttle and starts off, and running past danger signals and flagmen he swings round a curve bang into the tail end of another train. You would say he ought to have kept a lookout, and not have run against his signals. In other words, *he must have a regard for the rights of those who are ahead of him on the same track.* The same rule applies to patents.

A patent is good for so much of what it shows and describes as is covered by its claims. The claims, when properly drawn, cover everything in the invention that has not been previously patented or described in some printed publication. Any good patent attorney can ascertain with reasonable certainty what prior patents will be infringed by making the invention. But the search is frequently long and expensive, and the Patent Office has neither the time, money, nor ability to make such a search. Nor does the law require it.

GEO. P WHITTLESEY,
Patent Attorney.

*Washington, D. C.*

### That Defective Engineer's Valve.

*Editors*:

E. P. Bishop, of Birmingham, Ala., has answered my article about engineer's valve very correctly, in fact, almost word for

# Some New Features!!

# LOCOMOTIVE ENGINEERING will have quite a number of entirely NEW FEATURES for 1894. New Dress! New Cover! New Ideas!

## Prize Locomotive Designs.

### $350 CASH IN PRIZES

For the Best Plan of Arranging Cab and Boiler Fittings on a Locomotive for the safety of the crew, comfort in handling the engine, and economy of repairs. The prize-winning designs will be published during the year.

## PROMINENT AMONG THEM WILL BE THE INTERESTING:

**Block Signals.** We have secured from the pen of D. B. McCoy, Signal Engineer of the N. Y. C. & H. R. R. R., a Series of able Articles on Block Signals. The writer tells "What a Block Signal is," "What it Does," and "How it Does it." If you want to post up on block signals, just read these articles.

**Air-Brake Doctors** will be interested in the Series of Articles commencing in the January issue, written by Paul Synnestvedt, and entitled "Diseases of the Air Brake System; their Causes, Symptoms and Cure." These brake articles tell what to expect when any part of the brake acts in a certain way, and then what to do to remedy it. There will be a complete, illustrated chapter on each vital part of the brake mechanism. There will be a chapter each under the following headings: Pumps, Governors, Main Drum, Engineer's Brake Valve, Train Pipe, Auxiliary Reservoir, Brake Cylinder, Triple Valve, Pressure-Retaining Valve, Foundation Brakes, and Miscellaneous. This series of articles will be something new in a new line, and is destined to be of great benefit to all who work with or on air-brakes.

## Profit-Sharing for Railroad Employes.

A Plan of Settlement of the Capital and Labor Controversy, by M. E. Ingalls, President of the C. C. C. & St. L. and the C. & O. Railroads. A live subject by a live man.

## The Injector,

An Ever Interesting and Instructive Subject. A series of articles on Injectors will appear during the year. These are from the pen of an Injector-maker, who has used them on a locomotive as well as made them. They will tell all the flow, when and why about Injectors.

## The Commercial Value of Compound Locomotives.

An Opinion on Compounds from the Financial Side of the House will be contributed by Mr. S. M. Felton, President and Receiver of the Queen & Crescent Road.

## Discipline Without Punishment.

One of the Most Successful General Superintendents in Railroad Work will explain how he keeps up discipline of train and enginemen, and he never lays a man off or fines him.

## Keeping Shop Accounts.

A System of Keeping Accounts of Material and Work in Railroad Repair Shops. These articles are by a well-known railroad officer and describe a system with which he is thoroughly familiar, if not the originator of most of it.

## Railroad Coppersmithing.

By JOHN FULLER, Sr.

Already commenced, will be continued and finished—these articles are a school for sheet-metal workers.

## Economy in Compressing Air for Shop Use.

Will be the Title of a Paper by R. M. Dixon, Engineer of the Safety Car Heating and Lighting Co. No engineer of his country has a more varied experience than Mr. Dixon in pumping air, gas and other vapors.

## Locomotive Tenders.

A Comparison of the Weight, Cost, Repairs and Capacities of the American Eight-Wheeled and the European Six-Wheeled Designs. An interesting subject by a man who knows something about both kinds.—Mr. W. F. Dixon, Chief Draftsman of the Rogers Locomotive Company.

## Sampson Fox,

the Great English Steel-maker, the father of the Pressed Steel Industry, has promised us an article on Boiler Steel, its Manufacture, Inspection, Test and Care. Mr. Fox writes and talks on steel in the most entertaining way—because he is the master of the business.

THESE ARE A FEW OF THE MANY INTERESTING ARTICLES WE HAVE LAID PIPES TO.

WATCH THE PAPER.

1894

DON'T FORGET that we send **THREE EDUCATIONAL CHARTS** to every subscriber whose name is on the list to December, 1894—and to no one else.

YOU DON'T want to miss a chance at those Prize Designs. If you don't compete you want to see what schemes are proposed.

LOCOMOTIVE ENGINEERING will be made so interesting for 1894 that every subscriber will be ashamed that he took so much for the money.

**Blessings are scarce this year! Are you one of the Anointed?**

word as I had intended to have answered it myself. The gasket was burned and cracked between supply port and chamber *D*, as he said. This same thing has occurred several times on some of our engines, because the valves are too near the boiler-head.

I had occasion to examine an engineer's valve a short time ago, that had but recently been overhauled in the shop. The engineer said that an unusual amount of air would escape through preliminary exhaust port before brakes would take hold. On examination I found that a new ring had been put in piston 17, and it was so tight that I could hardly pull it out. The ring was made in the shop and was much heavier than the rings put in by the Westinghouse people. Now, this is wrong, and ought not to be allowed to be done; because it is liable to get some one into trouble. Piston 17 ought to move with as little friction as possible to do good braking. I don't approve of making anything pertaining to the Westinghouse air-brake, because several years' of experience has convinced me that it is cheaper to buy than to make the different parts needed for repairs.

*Syracuse, N. Y.* W. F. RELYEA

### Why Do We Lag Air End of Pump or Driver-Brake Cylinders?

*Editors*:

There seems to be a great complaint about the packing leather in the driver-brake cylinder drying or burning up, also about air cylinders heating, and yet in the face of all this we go right along lagging these cylinders—acting on the supposition that there is condensation to guard against—in fact, keeping them hot when we want them cool. What is the matter with drilling holes through the bottom flange and head between each bolt, and then, instead of lagging for driver-brake cylinder, put on a perforated sheet-iron casing to allow the air to circulate. For the air cylinder, put on a backing of wire netting covered with perforated Russia iron; or for the air cylinder, instead of a perforated casing, make it tight, and connect the air inlet with the space, but drilling the holes mentioned, thereby pulling a current of cold air in about the cylinder.

*Indianapolis, Ind.* W. DE SANNO.

### A Few Suggestions to Those Interested in Learning Mechanical Drawing.

*Editors*:

No doubt there are many of the readers of your paper who have a desire to study some of the "technicals," and mechanical drawing especially. I have had the pleasure of giving lessons in that branch in the last few years, and feel competent to give a little advice. The first question generally asked by the would-be student is "What instruments must I buy, and what will they cost?" An answer has been given to the latter clause of the above by saying buy the best you can afford, which, to say the least, is rather confusing when dealers in such advertise "sets" from one dollar to ninety. It is not my intention to advocate one maker's goods more than another, but would say, first, the list is as follows:

One pair of plain dividers 5 inches long.

One pair of dividers 5 inches long with changeable points.

One spring-bow pen for very small circles.

One drawing or lining pen.

One No. 6 B, or H H H H H H drawing pencil.

Half dozen of fastening tacks.

One drawing board of pine, size 14 x 20 inches.

One T square "blade," 20 inches long, plus the width of "stock."

One triangle of 30, 60 and 90, or equilateral triangle cut in half.

One triangle of 45, 45 and 90, or one half square cut across corners.

A piece of velvet india rubber, for erasing individual lines.

A piece of sponge rubber, for cleaning drawing.

Use a common 2-ft. rule for scale to commence with.

In purchasing, see that the joints of dividers are stiff and do not move with a jerk, choose those with round points and see that the pencil leg is made to receive the small leads that are sold without wood on them. Also have a needle-point attachment to the same dividers.

The triangles should be of hard rubber, and the T-square of any close-grained hard wood, that will keep straight and a smooth edge. For paper I advise printers' blank, 17 x 22 inches, of such quality as this paper is printed on. The cost of the above set should be from seven to ten dollars, and if bought from a reliable firm they should give good satisfaction, generally the pens are sharpened ready to use, which is not the case with the poorer grades.

In addition to the above, I should advise the student to purchase a protractor for laying off angles, but not until he is somewhat advanced. I believe it is much the best to take lessons of some one competent to teach, but if a boy is "too poor" to do that, let him buy some reliable book to learn the rudiments from, and study the different illustrations that appear in LOCOMOTIVE ENGINEERING or other mechanical papers, and don't be afraid to ask all the questions you want to of any one that you see knows something you want to know, never mind being stared at. Of course, it is necessary to know something of geometry and other kindred studies to become an expert, but don't try too much, remembering the maxim, "One thing at a time, and that done well." Would say in closing, that it is better to school the hand to make proper lines and curves rather than close measurements at first.

*Oneonta, N. Y.* WM. NEWTON.

### Defective Piston Attachments.

*Editors*:

The practice of leaving a shoulder on piston-rod crosshead fits is a relic of the barbarous era of mechanics, and should go the way of all barbarism and relics. Without grinding the crosshead on, it is extremely difficult to tell when the rod is drawn solidly into the fit, and unless it is solid, there is no certainty of its staying there. Then, too, the man in a hurry is liable to say, "That ain't very good, but she will go another trip," and sometimes with disastrous results. On the other hand only the worst ignoramus could drive a crosshead key without knowing when the rod was home, when there was no shoulder; and if from any cause the rod should get to working in the fit, the engineer would have a chance to see it.

We used to think the cracks that started in the corners of the shouldered rod, were because of the sharp corner; but I have noticed that rods without a shoulder crack in relatively the same place, *i. e.*, just outside the crosshead. Can some one explain?

While seeking an explanation for that let him think a little on these also. Why are spiders keyed on when nuts are cheaper and better? Why do we take so much pains to keep guides closed when the business end of the piston-rod is often a quarter of an inch too small for the cylinder? Why is not the solid piston-head and snap ring in more general use when it is both lighter and cheaper and just as effective?

*Boone, Ia.* F. W. PETERSON.

### How to Make a Good Rod-Strap.

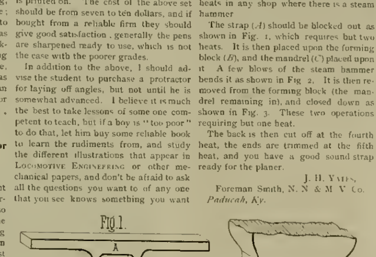
*Editors*:

The inclosed sketch illustrates how a locomotive rod-strap can be made in five heats in any shop where there is a steam hammer.

The strap (*A*) should be blocked out as shown in Fig. 1, which requires but two heats. It is then placed upon the forming block (*B*), and the mandrel (*C*) placed upon it. A few blows of the steam hammer bends it as shown in Fig. 2. It is then removed from the forming block (the mandrel remaining in), and closed down as shown in Fig. 3. These two operations requiring but one heat.

The back is then cut off at the fourth heat, the ends are trimmed at the fifth heat, and you have a good sound strap ready for the planer.

J. H. YATES,
Foreman Smith, N. N. & M. V. Co.
*Paducah, Ky.*




### Has Faith in the Engineer's Valve.

*Editors*:

Was pleased with Mr. W. R. Scott's article in regard to the equalizing discharge valve. I fully coincide with Mr. Scott, and think that the only thing wrong with the valve in most cases is a lack of confidence in it on the part of the engineer. Having had considerable experience with valve and maintenance of same, I find that when valve is in proper condition, 20 pounds excess can be maintained, no matter how leaky your train-pipe. For example, have met with train, that, owing to leaks in train-pipe, pump would not supply more than 40 pounds train-pipe pressure, with this train and equalizing discharge-valve in proper condition have maintained 60 pounds reservoir pressure.

I find the greatest trouble arises from engineers having been used to old style brake-valve. Through force of habit they allow handle of valve to remain in release position after releasing brake, which causes valve to become seated to that one particular position, then after having used the valve in that position for some time, should you endeavor to carry valve in running position, you will find it cannot be done, on account of air escaping between valve and seat, causing the gradual application or sticking of brakes. But could engineers be made to see this, and carry valve in running position at all times, it would naturally seat there, and excess might easily be maintained.

*Wellington, Kan.* J. D. MCKEWN

### Air-Brake Questions.

Grief with Driver Brake-Cylinder Packing. Quick-Action on Engines and Tenders. Gable's Leaky Engineer's Valve. Sweeney's Automatic Pressure Rotary-Valve. A Hardened Scraper for Valve Work. The Other Air-Brake Puzzles. A Remedy for Self-Closing Angle Cocks.

*Editors*:

Some time before the question of pistons on driving-brake cylinders came up in the August number, I heard that the R. & D. men were using water as a remedy, and we proceeded to try it on a particularly bad case—one in which the packing would be ruined in a couple of trips. It was a complete cure in this case, but in a few weeks one of them dried out, and immediately burned so as to be useless. Since this leather was renewed it has given no trouble, there is reason to believe that in the last three months, where this practice has been followed on our mountain divisions, the driving-brakes have been made more reliable, and not only has the life of the packing leathers been increased, but less than half as much time per trip is required to keep these brakes in order than formerly. We are now trying water from the steam lubricator in them, on a hint from an old runner. I am still of the opinion, however, that, if whoever was at fault in placing these cylinders where the leather was so readily burned or overheated, was required to do the repair work on them for a couple of months, there would be no more trouble with that kind of brakes. or if some one who is looking for a place to save money in little things could be brought to realize the amount of labor and air that is wasted in trying to keep up what may be a brake in name, but frequently is not so in fact, perhaps things might work a little better than they do now.

In the September number Brother Synnestvedt wishes to learn what is the opinion of air men as to using a quick-action triple on engines and tender. There may be something that would perhaps interfere with such practice, but if so I have been unable to find it, and believe it should be given a trial on some road that is prepared for such things. It looks as though the Plate D 20 triple-valve has been left on when engines were not so heavy as now, and the blow a heavier non-quick-action engine would strike on a train with these valves in operation not all [illegible] for, and at present it seems to me as though in an emergency all brakes should go on alike, from pilot to rear of train. If there was any trouble, it could be overcome in a special valve working in accordance with its proximity to fountain head. While I may be considered a heretic in this matter, I am personally in favor of straight air for switch engines and quick action for train service.

In same number, page 415, friend Gable mentions rotary valve as setting brakes on service application without letting air out of service exhaust port, and which was in good order, with the exception of some small holes drilled in rotary-valve. Would suggest that he take a piece of paper, cut a hole in it for center pin in rotary-valve to go through, then, after cutting out all ports and drilled holes, place it on that valve-seat in service stop, and see if some of these holes do not just hit the edge of emergency port, or are very close to it, and leak either in the valve or seat from recess c, Fig. 4, Plate D 5, to emergency port. That is where the trouble is likely to be.

The automatic pressure-retaining valve in October number is very interesting, but it looks as if there would be some difficulty in getting prompt and certain release, unless the valve was large enough to work in unison with the triple-valve pistons and when brakes were applied would there not be a considerable leakage from the auxiliary reservoir out by this valve.

As for Mr. Armstrong's brake-valve, would state that here we scrape them in, and use usually the oil and grit off a soft

oil-stone to set the grain. My style is to get a pair of templates, one for the valve-seat and one for the rotary-valve; use a scraper made out of tool steel dipped in a can of bromide of potash and black oil when cherry red; do not draw the temper; and it sometimes improves them to reheat and dip again in the same medicine. To sharpen, use one of those ordinary razor hones, called petrified hickory, that costs 40 cents in hardware stores, one side is black, the other white—the grit from either side will finish the valve after scraping. Before this was used I tried everything I could hear of, found grindstone grit embedded itself in the brass, then, when pressure was applied, caused the valve to hang or drag; also find after a brake-valve is in use awhile the top cap No. 2 Plate D 8, will wear off on one side, as the engineer usually bears on handle when using it, and in that case if the top cap is trued up in a lathe it will help matters. This road does not use the oil in air pumps recommended by the W. A. B. Co., and sometimes on account of boiler heat, oil will gum on seat and make valve stick; as to washer No. 12, Plate D 8, getting so thin as to let the key No. 11 drag, as our Kansas friend points out, a piece of old bacon rind made into washer No. 12, and put in with meat side next to top cap No. 2 will relieve the engineer's mind to a large degree, and Mr. Wescott must have had something wrong with the air space above piston 17, perhaps the small reservoir under running board had a cock in it that had been left open.

As to the brake valve Plate D 5 not setting in service stop, last month something a little different made its appearance here. An engine came in on a train with only 40 lbs. of air, but when brought to roundhouse showed 70 lbs. Now, as all were, I thought, posted in the repair shops, as to all the tricks this valve could play, and as it had been worked on and not benefited, I concluded to go over the valve myself. I examined gasket No. 61, Plate D 5; not very good; put in new one, looked at rotary valve, it was O. K. Had the gasket been leaking, the black hand would have crept up with the handle on lap. Feed valve case gasket was not very good; put in new one; found feed-valve No. 63 had been leaking; unscrewed spring-box No. 69, and with a feed-valve cap nut No. 65 with hole drilled through top (which is used to set air gauges with, the space occupied by spring 64 being filled with solder to keep center true) scraped this valve to its seat; put it together and told the man taking instructions, to see how the valve cut off, and the black hand stopped at the pressure the piston spring No. 68 was set at; he saw that the valve cut off all right, also saw black hand creep round just as it did before, and I saw there was more in the valve than was dreamed of.

After some time lost in fooling around, the adjusting nut No. 70 was run down till it was free, and I found the pin on lower end of feed-valve was resting on top of piston 66, and could not shut off the air from main reservoir entirely; investigation revealed the fact that the piston barely cleared the end of feed-valve when both were down, and everything in order, and that the gum diaphragm No. 72 had become swollen or thickened with age and would not let piston No. 66 seat on spring box No. 69, which it should do to clear feed-valve stem. After putting in new diaphragms once more, I told the man to see if the black hand stopped, and it did so. In case this trouble occurs on the road, if the spring box is unscrewed a little it will help matters till the trip is finished, but keep an eye on it when you screw it up; on long trains this valve may possibly be a disadvantage, but it is in great favor among the engineers here for the reason that it does not pump up with handle on lap.

In Mr. Pratt's case, if the drivers had not slid, and the brakes were holding as they should (which is not always the case), the train should have stopped before it did, but it should be ascertained if the driving-brakes were reliable, and the man posted. I usually find discipline needed at the other end of the string. Could you have done with this brake what the man in charge failed to do? I believe all engineers should be thoroughly posted on the brakes; then, if he is a competent engineer, as he should be, and knows the engine, his judgment certainly ought to go for something, especially as his is the life at stake in a crisis.

The disease our Scranton friend mentions is apparently universal, costs lots of money and would apply in the following: Since I heard Mr. Hedendahl point out the danger of angle-cocks closing automatically, as mentioned in the editorial on page 480, I have been experimenting, and find by striking short, sharp blows with a hammer on top of handle or key No. 2, Fig 7, Plate D 24, every angle-cock could be closed in a train, also found every one that closed had the spring No. 4 wound right handed, the same as a screw, in one old cock I found a left hand spring, which was put in on a cock at rear of tender, and securing a man who knew nothing of what was wanted, had him use the hammer on the cock which was half closed; it gradually *opened*; then took out the left hand spring and put in a right hand one, and as soon as he began to hammer, the cock began to *close* again. This was repeated on another engine with the same results. Also found if the hose-clamp presented the proper angle to the handle, if loose, would ride and have a tendency to close the cock. Am now satisfied that a right handed spring in an angle cock is an element of danger that cannot be removed too speedily.

I once planned a valve or cock in place of the angle-cock, which I yet believe would overcome the difficulties under consideration; but seeing that it would look very clumsy and probably cost more than the angle-cock, besides being reluctant to believe that cocks would be closed purposely, I let it drop. The present outcry against tramps, accusing them of closing angle-cocks, appears to me to be largely sentimental, and I believe no more of it is done (if as much) than other attempts to wreck trains by placing obstructions on track, and if an impartial investigation were made in cases where angle-cocks were closed, nearly every case could be traced to improper inspection or defective apparatus, and the tramp cry used as a loophole. Meantime, if the springs under the key in angle-cock are changed to left-hand ones, and the holes drilled in angle-cocks, as recommended on page 411, September number, the danger will be lessened to such an extent that it will pay to wait for the remedy that always turns up in the course of time.

*Roanoke, Va.* GEORGE HOLMES.

## Another Signal Whistle Puzzle.

*Editors:*

Here is a report of defect in air-whistle from one of our engineers "Can't blow air-whistle only once" I put on my "tester" and found that the pressure was about right, and then opened the little cock on the end of the "tester" to blow the whistle. Well, it did blow, but it took a long time for the pipe to recharge. I knew right away there must be something wrong with the reducing valve, so I took off the cap and found that a new diaphragm had recently been put in. I then pressed on the feed-valve and turned it around with a screw-driver and found that air got through it all right. I put it together again, but it worked just the same as before. Now, all air passages were open full, and there was no obstruction in the pipes and the same pressure-reducing valve had been on the drum since the engine was built, still the trouble was in the pressure-reducing valve. What was it?

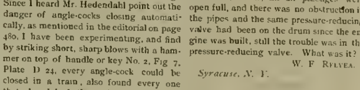
W. F. RELYEA.

*Syracuse, N. Y.*

## Painter's Portable Platform.

*Editors:*

Any one who has been obliged to work on locomotives while on blocking in the back shop at the same time the painters are trying to *get there* with all of their paraphernalia, such as high horses, ladders, empty oil barrels, long planks, and a host of blocking, with which to elevate themselves high enough to paint, sand-paper or varnish a cab, will appreciate the platform shown in sketch.




Some six years ago the writer conceived the idea that a platform of this kind would be a good thing to have, and forthwith had one made at a trifling cost, and it proved to be a very useful appliance. When the platform is in position it leaves the floor space around the locomotive clear of obstructions permitting free access to all parts below the running boards, so that machinists can work on frames, shoes and wedges and spring rigging, and the boiler-makers can get at the bottom of firebox to do their work.

The platform can be carried by one man, and put up in position in a few minutes. It will suit any ordinary cab, and permits the painter to reach all parts of a cab to be painted. The details show the number of parts required.

This platform has been in the C., M. & St. P. Dubuque shops for the past six years, and is still in good condition, being in use a great share of the time and is highly appreciated. J. C. MILLER,

*Dubuque, Ia.* General Foreman.

## The Invention of the Link Motion.

*Editors:*

With reference to the letter of Mr. James Hedley and the editorial note, page 493, I may point out that the question of Howe *versus* Williams is quite a side issue. The main question which is engaging so much attention over here is the "invention of the link." Does it belong to England or America?

Of course, Englishmen have believed that it was an English invention, but from the most careful and impartial examination of facts I can come to no other conclusion but that it was invented by James, of New York, in 1832. In the year 1833 details of the James gear were sent over to Forrester & Co., engineers, of Liverpool, and they, in 1834, adopted the "four eccentrics," which was an important part of the James invention.

Since seeing the model at the World's Fair, and investigating the matter most carefully upon my return home, I am convinced that the link was invented by James, and the fact that drawings were sent over to England in 1833 must prove to all impartial minds that the credit for this important invention belongs to America. CLEMENT E. STRETTON, C. E.

*Leicester, Eng., Nov. 10, '93.*

## Mr. Wescott's Problem.

*Editors:*

In reading November LOCOMOTIVE ENGINEERING, I came across Mr. Wescott's statement. I happened to be in the same predicament, and I found that the cause of the air blowing through the train-pipe exhaust port was due to a hole being in the small reservoir right under the running board. The reason it would not show any pressure is because there wasn't sufficient compressed air to hold piston 17 on its seat. ROBERT HENNINGS,

*Algiers, La.* South Pac. Shops.

*Editors:*

The trouble complained of by W. C. Wescott air blowing through train-pipe exhaust port while handle was on release or running position, and could get no pressure, will say that cock in small air-drum under cab was open.

*Aurora, Neb.* L. F. WESSMAN.

*Editors:*

In answer to W. C. Wescott's air-brake problem in November number of LOCOMOTIVE ENGINEERING, will say if friend Wescott had examined drain-cock on small reservoir before taking down his engineer's valve he would have saved himself quite a job, saying nothing about the detention to his train, as he undoubtedly found it open when he located the trouble.

*Elmira, N. Y.* T. H. GOSWARD.

*Editors:*

In Vol. VI, No. 11, page 499, I notice inquiry of W. C. Wescott (Where did Air Come From?). He states upon arriving at engine he found air-pump running, and air escaping through train-pipe exhaust port, and said he could stop it only by putting valve on lap. Examined piston No. 17, and found it O. K. What was the matter? Will say there could be but one thing, which was a lack of pressure on top of equalizing-valve or piston No. 17, caused by drain-cock in equalizing cylinder being open, or leak in some of connections to cylinder. J. D. MEKEMS.

*Wellington, Kansas.*

THE ANSWER.

*Editors:*

Drain cock was open in equalizing drum, which would prevent pressure accumulating above piston 17 to keep it to its seat. W. C. WESCOTT.

*Albert Lea, Minn.*

## An Improvement in Case-Hardening Furnaces.

*Editors:*

In a letter published in your September issue I described some cheap furnaces for case-hardening and tempering—railroads think they must have everything cheap.

Once in a while you run across a shop where they appreciate a first-class thing, even if the first cost is higher. Here is a furnace of that kind, and I venture to say that 25 per cent. more work can be done with it, besides that it requires less fuel and less labor and insures even heating and prevents burning.

You can see by Fig. 1, which is a sec-

…tional view, that the usual form is used, but that the table where material is laid is arranged to be revolved about six turns per minute.

You cannot help getting a uniform heat, the fire being on one side of the furnace the heat has got to travel over the table and down the flue on the other side.

In opening the valve at *B*, you can regulate your fire, as you have to have a stronger blast to start your fire and get

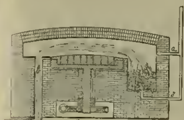


Fig 1

your furnace hot than you will need after you get the furnace to the proper temperature for the class of work you are going to do.

The valve at *A* is used to force the heat over the table, and takes the place of a hot blast to a certain extent. You can get a welding heat, if necessary, by the use of this valve.

C, Fig. 2, represents the firebox door, and *D* the door that opens in line with the center of your table, and is used to put in and take out your material, *e*, the

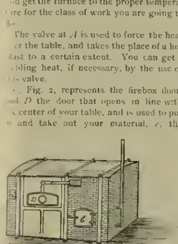


Fig 2

little door to the left is used in cases where some of your material is crowded off from the table and drops down the flue *b*.

This furnace can be built of ordinary brick and lined with fire brick. You can also use different kinds of fuel for tempering. The scrap wood from the wood-shop does very well, especially for shaping such things as spring leaves, as there is little danger of overheating.

*Rochester, Minn.* W. G. Lottes.

## Some Dimensions of Those Swiss Engines.

*Editors*:

I write to give you a little information about the general dimensions of the Swiss locomotives illustrated on pages 476 and 477 of your November number. The six-wheel connected engine, No 108, is a compound engine with a hand-brake operating on the tender wheels and the Westinghouse on the drivers. She has driving-wheels 5 ft. 3⅛ in. in diameter, cylinders 17¾ and 25¼ in., and 25⅝ in. stroke. Her boiler carries a steam pressure of 180 pounds. She has a firebox heating surface of 84 square feet, and a total heating surface of 1,489 square feet. There are 184 tubes 14 ft 7¼ in. long, and a grate area of 18 4/10 square feet.

The total weight of engine, empty, is 98,100 pounds, and ready for service, 108,170 pounds. The weight on the drivers is 82,000 pounds. The empty tender weighs 23,400 pounds, and has a water capacity of 2,100 gallons, and 7,500 pounds of coal. The engine and tender are 43 ft 10½ in. in length over all, and the top of the smokestack is 14 ft. 7¼ in. above the rail, the fixed wheel base being 11 ft. 6½ in. The total wheel base of engine is 19 ft. 8¼ in., while the total wheel base of engine and tender is 34 ft. 10⅞ in. The engine was designed for a maximum speed of 46.5 miles per hour.

The four-coupled engine, No 52, is a simple engine also designed for passenger service, having driving-wheels 5 feet 2¾ inches in diameter, with cylinders 15¾ x 23⅝ inches. Her boiler carries a steam pressure of 165 pounds. She has a firebox heating surface of 70 square feet, and a total heating surface of 1,054 square feet. There are 159 tubes, 12 feet in length, and a grate area of 16.1 square feet. Total weight of engine, empty, is 69,526, and ready for service 78,000 pounds. The empty tender weighs 19,400 pounds, and has a water capacity of 1,980 gallons and a coal capacity of 6,600 pounds. The engine and tender is 42 feet 10¼ inches over all, and the top of the smokestack is 13 feet 7¼ inches above the rail. The fixed wheel base is 9 feet 2⅜ inches, the total wheel base of the engine being 17 feet 4⅝ inches, and of the engine and tender 32 feet 4⅞ inches. This engine was also designed for a maximum speed of 46.5 miles per hour.

Both engines are equipped with steam-heating apparatus, Westinghouse air-brakes, with hand-brakes for engine and tender. Henry Gretner.

*Philadelphia, Pa.*

## Testing for Leaks in Engineer's Valve.

*Editors*:

For the benefit of your numberless readers, please let me give my views of what I think is a good way to test for a leak in rotary-valve. First turn stop-cock in train line under brake-valve, place handle in lap position, then start pump. If there is a leak in rotary-valve, air must leak in train line above stop-cock. After red hand has reached the point it is intended to stop at, and pump has stopped, turn stop-cock back and you can hear the air above cock rush in train line below. Another way: If your brakes are leaking off, and you are in doubt if it is caused by leak in rotary-valve or leak in brake-cylinder, after train line is charged and brakes are ready for operation, reduce the pressure in train line, place handle in lap position, and if the brakes leak off put handle in release position again and charge train line, then reduce pressure and turn stop-cock; if the brakes don't release blame it to rotary, if they do, blame it to something below the stop cock.

C. Reilleis.

*East Albany, N. Y.*

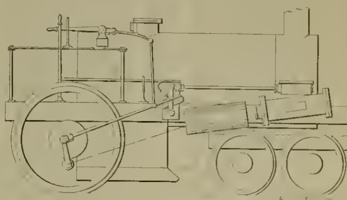
## The Seth Boyden Locomotive "Orange."

*Editors*:

In the descriptive article of the Boyden locomotive, illustrated in the October issue of your paper, you say the engraving was made from the original drawing. I do not think the original drawing was strictly adhered to, as I can see where changes must have been made, as I remember the engine. You say the wheels were cast with flanges, no tires. My father, the late Samuel D. Harris, who did the forging for all the locomotives built by Boyden, told me that when he made the tires that Mr. Boyden came in the shop, and, taking a travel, ran it around the inside of one of the tires, and said "Damn it! Sam, you have spoilt it," thinking that there was not sufficient stock to turn out to make a fit to the wheel. On being told to run the travel around the other way, it showed the tire was right. The truck wheels, as well as drivers, had tires. During my school days, which ended in 1855, I was one day around the engine-house and heard a sharp report. On going to where the workmen had congregated, I saw that a tire while being shrunk on her right hand driver had burst, leaving a crack of not less than ¼ inch wide. The truck wheels were also tired, one pair of which were under the engine as long as she was in use.

On one of her trial trips, after having run to the top of the Newark hill, with Mr. Boyden acting as engineer, he stopped to take aboard some of the officials of the road, and while talking to them he placed his hand on the safety-valve to stop the noise of escaping steam, and, as father described it, there was a sudden shock and tremor to the boiler, after which, on starting, she would hardly move. Taking her back to the shop, it was found the dry-pipe had collapsed, leaving only space on each side to insert a pencil. The "Orange" was in passenger service at the time of being burned, February, 1863.

The *American Machinist* of October —, 1883, gives an account of a twist drill made by Mr. Harris, and used for drilling the stub ends of the rods of the "Orange," which is the earliest history of that indispensable tool.



Seth Boyden's "Orange."

There were three engines built by Boyden. The "Comet" was built for a Cuban

Hook Blocks of the "Orange."

railroad, the man who took her out having lived until about two years ago.

The "Essex" was sold to some road in Ohio early in the fifties, and was lost overboard crossing Lake Erie. I never heard that she was raised.

D. M. Harris.

*Newark, N. J.*

## What to Do in Case a Rear End Looms Up.

*Editors*:

In the November issue I notice an article in regard to handling driver-brakes in case of an emergency from Mr. Pratt, of the C. & N. W.

In the case engineer applied brakes on engine and train, and as he was about to have an accident, reversed engine, which caused drivers to slide flat. If the engineer had released brakes and cut driving-brakes out, then applied air and reversed engine on sand, he would not have slid driving-wheels, but undoubtedly would have struck caboose harder and made accident more serious, blocking main line longer. In an emergency, all engineers do everything in their power to avert an accident; that is perfectly natural and right. This engineer did his duty by reversing engine.

The gentleman in charge of air-brakes on the C. & N. W. is partly to blame for the flat spots on those driving-wheels. Suppose the air-brake man would have a pipe connected to air-pipe which leads to driver-brake cylinders, and this pipe run up in cab where engineer could reach it, and in the top end of this pipe have a plug-cock. When engineer saw drivers about to slide, he could turn plug and allow all air in driving-brake cylinders to escape and still hold brakes on train. An engine in back motion on sand will hold more and quicker and stop sooner. I have seen a 6-wheel connected engine stop a train of sixteen cars of stock running thirty miles an hour in 400 yards, no brakes set, sand running on both sides. All driving-brakes on engines should have a pipe to release them by. There are a great many times when wheels are liable to slide, when it would be dangerous to release all brakes. I have had drivers slide with 10 pounds application down hill, and would have to release and cut them out. As sand pipes are liable to stop up in five minutes in a wet night, would like to ask some of the older engineers what they would do if they were to apply brakes and drivers would slide in a close place when to release would cause accident. I notice the argument in regard to handling brakes in an emergency. One correspondent, and also Locomotive Engineering, recommend to go immediately to emergency position if you are flagged or want to stop quick.

Well, suppose you had a train, all air, with long piston travel and not in good shape—as a great many are—you are coming down a long, steep hill, you commence to make a stop, and altogether draw off twenty or twenty-five pounds in service position, and then you want to stop quick and throw valve in emergency position, what do you gain? Suppose train-line pressure is less than brake cylinder pressure, when you go into emergency position you may get the quick-action valve to move; if so, what is to keep the highest pressure in cylinders from flowing back in train-line until it equalizes, which weakens or releases brakes. If I am wrong correct me. I am here to learn.

Wald. M. Perkins,

*Dennison, Tex.* M. K. & T.

[We fear our correspondent would have a hard time to get the quick action valve to work under the circumstances he states, and a harder time yet to get air from the brake-cylinder to get back into train-pipe through emergency-valve and check. It could not be done.]

When the New York Central twenty-hour flyer was put on between New York and Chicago, it was expected that the train would prove so popular that it would be continued permanently. It has been popular and a great public convenience, but the opposition of rival lines has been too great. The train made its last run on November 18.

A very sensible suggestion is made by Mr. De Sanno in a letter published in another part of this paper in regard to making provisions for cooling the air end of air-pumps instead of lagging them to keep in the heat, the present practice. Compressing the air heats it up considerably, and to this is added the heat that comes from the boiler to which the pump is attached. The volume of air increases very much by rise of temperature, so that there is less effective braking power in air that is heated in passing through the air-pump than there would be if it was kept near the temperature of the atmosphere. We heartily commend the suggestions for keeping air-pumps cool to all persons interested in the efficiency of air-brake apparatus.

# ? A. What You Want to Know. ? A.

**Don't ask questions that simply require a little figuring to determine; make each question separate. No notice taken of anonymous questions.**

(106) Robt. Flodo, City of Mexico, writes

Kindly inform me through the columns of your valuable paper, the best and most accurate manner of setting eccentrics on a locomotive before wheels are put under engine. *A.*—See LOCOMOTIVE ENGINEERING for March of this year.

(107) Shopman, Topeka, Kan., writes

Has anything ever been done to apply power to the calking tool? Do you think it would pay to take out a patent on a way of using air or steam to work a calking tool? *A.*—There is a power-calking tool on the market, but the proprietors have so little to say about it, that they seem afraid the public will hear about it. We believe it would pay to patent a new invention of this kind.

(108) R. J. H., Helensville, Australia, writes

Can you give me some information through your columns about capillary attraction, so far as it applies to the locomotive? *A.*—Capillary attraction figures very little in American locomotives, but in the locomotives used in Australia the bearings are nearly all lubricated by means of worsted feeders. In that case the oil passes up the worsted by capillary attraction. The packing in an oil cellar also carries the oil to the journals by the same force.

(109) W. B. M., Boston, writes

In figuring up heating surface of a boiler, which is the proper way to calculate, the inside or the outside surface of the flue? *A.*—The rule is to figure the outside surface of the flue. We understand that the inside surface is sometimes made the basis of measurement, which makes a boiler appear to have smaller heating surface than it actually has when compared with others. The practice ought to be uniform, and figuring the outside surface has enough adherents to entitle it to be considered the rule.

(110) Inspector, Bombay, India, writes:

I see frequent reference in your paper to the standard train rules. What are they? Who has made them standard? Where can they be procured? What do they cost? *A.*—1. They are rules for controlling the safe movement of trains. They define the kind of signals to be used and the form of order for train movement to be given. 2. They were made standard by the American Railway Association, which is composed of the leading railroad managers in America. 3. From the Engineering Literature Co., East Orange, N. J., price, $1.00.

(111) R. C., Sedalia, Mo., writes:

There have been some disputes among the men in the shop about the weight of locomotives and their parts. We have decided to refer the thing to you. We want to know: 1. How many engines were there in the World's Fair over one hundred tons weight? *A.*—None. 2. Where is the heaviest engine ever built, how heavy is she, and who was the builder? *A.*—Working the Grand Trunk business in the tunnel under the St. Clair River, near Detroit. About one hundred tons. Baldwin Locomotive Works. 3. What is the weight of a boiler with say 230 2-inch flues? *A.*—From 23,000 to 25,000 pounds.

(112) J. C. B., Memphis, Tenn., writes

I have often seen mention of steel made by the Coffin process, but no explanation of what the process is. You would favor several readers by explaining the process. *A.*—The Coffin treatment is a process to which steel is subjected after being made for toughening the material. The piece to be treated is heated uniformly to a cherry red and then it is dipped in cold depending upon the size of the article. It is then taken out of the water, and the water for a few seconds, the length of time internal heat of the article is sufficient to bring it back to a low red heat. From this temperature it is permitted to cool gradually. The process is said to cause a molecular change in the steel which makes it exceedingly tough.

(113) S. W., Portland, Me., asks

1. Will you please tell me what an intercepting valve is for. *A.*—An intercepting valve is used only on two-cylinder compound locomotives. It is a valve that automatically shuts off live steam from the low-pressure chest and opens it to the exhaust steam from the high-pressure cylinder. 2. What is the best way to cramp a valve-stem where metallic packing is used? *A.*—You cannot "cramp" the gland on valve-stem of an engine equipped with metallic packing. The Jerome has a set screw through the side, take this out and remove the washer under head and screw it down on to the stem. With the other kinds always carry a piece of sheet metal that can be fastened to one of the studs and reach back to the keyway in the stem, having a slot to match this keyway.

(114) D. McInnes, Philadelphia, Pa., writes:

A friend of mine (a marine engineer) and myself, had an argument lately, and the subject was, "The bevel on locomotive wheels." This subject was brought up by one asking the question, why was it, if a locomotive was set on a circular track, at a certain part, and started to go right around to the starting place, why was it that the wheels came to the same place and position as when they were started, the inside rail being so much shorter than the outside one? His argument was that the inside wheel slipped or skidded on the rail, and I, failing to convince him that the bevel on the wheel was for the purpose of allowing locomotives and cars to round curves, would like you to explain the matter in your December number. *A.*—When wheels are beveled, there is no doubt that it helps on a curve, but after short service they are often beveled the wrong way, yet they curve with little trouble. In this case the wheels on one rail must slip.

(115) No One, Erie, Pa., says

There is a dispute among men here as to who holds the more responsible position—the engineer of a locomotive, or the engineer in charge of a marine engine? We want you to settle the question. *A.*—That depends upon circumstances. The engineers on a passenger steamer must be able to do machinist, blacksmith and boilermaker work in case of necessity; they must know something about electrical machinery, a great deal about pumps of various kinds, and be familiar with the working of complex marine engines. Men for this position must have a good mechanical training. Many of the best locomotive engineers could not do any work on their engines requiring mechanical skill. Their knowledge is confined mostly to the handling of the engine. The marine engineer has a particularly responsible position when anything unusual happens to the machinery, and he must have knowledge and training to deal with emergencies. The locomotive engineer has a more responsible position than the marine engineer in the ordinary routine of his duties. He is responsible for the safety of his train as well as for the working of his engine.

(116) C. R., Little Rock, Ark., says

A discussion took place at the dinner hour yesterday about steam. P said that a locomotive used saturated steam. B said that saturated steam was mixed with water, and that the engine was priming when that kind of steam was going from the boiler. C, who pretends to know more things than other people, tried to ridicule what was said, and talked about anhydrous, saturated and dry steam till my mind was muddled. Please say who was right about saturated steam, and explain the meaning of the terms used. *A.*—Saturated steam is the kind of steam used by most engines, and it does not contain water in the shape that causes priming. If any heat is taken away from it, part of the steam will instantly turn to water. Saturated steam is sometimes called dry steam and sometimes anhydrous steam. Steam is called saturated when it exists in the presence of the water from which it was evaporated. It represents the amount of steam that can be held in a given space at a given pressure. If more steam is evaporated the pressure will increase, if any heat is taken away from the steam, part of it will return to water and the pressure will fall. When steam, not in presence of water, receives additional heat it becomes superheated, which increases the temperature and the pressure.

### Another.

The speed of railway traveling is to be nearly doubled when the new express locomotive, now in course of construction at Wolverhampton, is placed upon the track. The horse-power is 2,000, and the speed 100 miles per hour, the driving-wheels are 12 feet in diameter, and there are three cylinders of 40, 28 and 18 inches in diameter, with a 30-inch stroke. The boiler pressure is 200 pounds. It is proposed to run from London to Edinburgh in six hours.—*English paper.*

### A Jury on the Battle Creek Wreck.

On Nov. 15th the Grand Jury empaneled to inquire into the causes of the disastrous wreck at Battle Creek, on the Chicago & Grand Trunk, on Oct. 20th, rendered the following verdict:

"We find that the said collision was caused by gross disobedience of orders given by train despatchers. We also find that Engineer Harry Wooley, of train No. 6, eastbound, and Conductor Bertram N. Scott, are guilty of criminal negligence in running past their meeting point, at which they had positive orders to stop."

The jury reported that the Grand Trunk Railroad Company had done all that could be done in the way of first-class equipments for the safety of its patrons, and the road was exonerated from all blame.

The latter statement is doubted by many men who know, as the equipment of this train was not of the best, but the verdict among railroad men seems to be that the crews were to blame, as stated in the indictment.

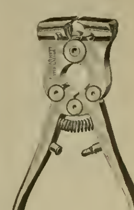
Our neighbor Van is disgusted with our Ananias Column. This is hard on us, but the yarns which our correspondents tell do not violate the spirit of truth half so much as Van's claim of having got 8,000 subscribers in one year, without intimating that this was in 1883, and that he lost the last one of them the following year—which is a fact.

In a performance sheet summary of the work done by locomotives on the Santa Fé for the month of September, we note that the average mileage was 3,329 which does not indicate greatly depressed business. From other sources, we now learn that they are very busy on the road and complaints are heard of shortness of power, and scarcity of cars.

### A New Adjustable Jaw Cutnipper.

This tool was designed to supply the demand for a better thing in its line than has been heretofore obtainable. A brief examination will convince any mechanic that it does so.

The jaws are detachable, so that they can be removed, ground and adjusted when they have become worn. Each jaw can be ground away to the extent of ¼



No.1.

inch, remaining as good as new for practical use, and when used up, if ever, new jaws can be procured.

These jaws have a dovetailed slot in their under side to receive a spline which extends into a slot in the frame. A tapering screw through the frame and spline draws the jaw firmly down to a toothed seat in the frame, holding it securely.

Another improved feature in this cutnipper is a flat spring below the cutting edges, and over the joint, forming a yielding seat for the end of the wire to press against while being cut. This obviates the danger of breaking the jaws as often happens with the other styles of cutnippers which allow the wire to be inserted against a solid surface, thereby creating a pushing out strain on the jaws when they are pressed together.

The head and handles are of drop forged steel, finely finished. All the parts are case-hardened except the jaws, which are made from a high grade of steel, nicely tempered. They are made by L. S. Starrett, Athol, Mass.

### Kiley's Automatic Relief Valve.

The illustration herewith shows the valve invented by Mr. Daniel Kiley, a locomotive engineer on one of the Brooklyn

Fig: 1.

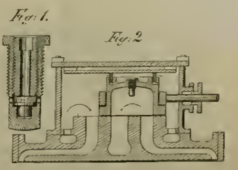
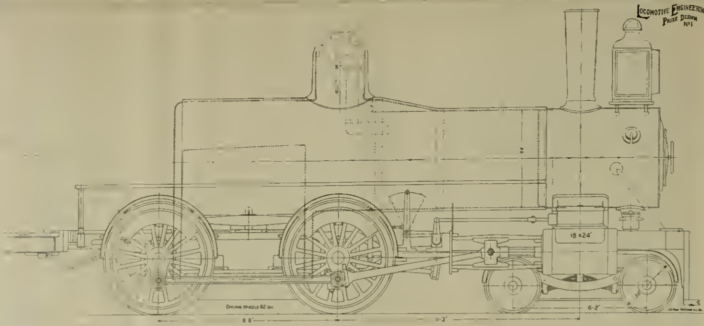
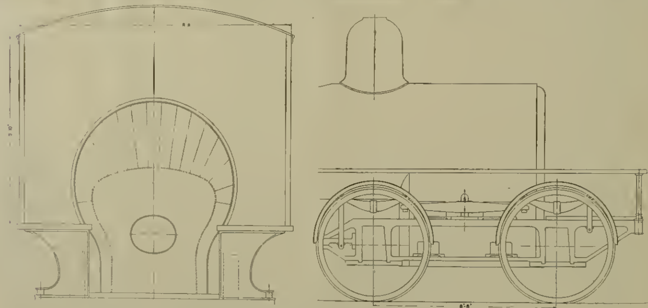


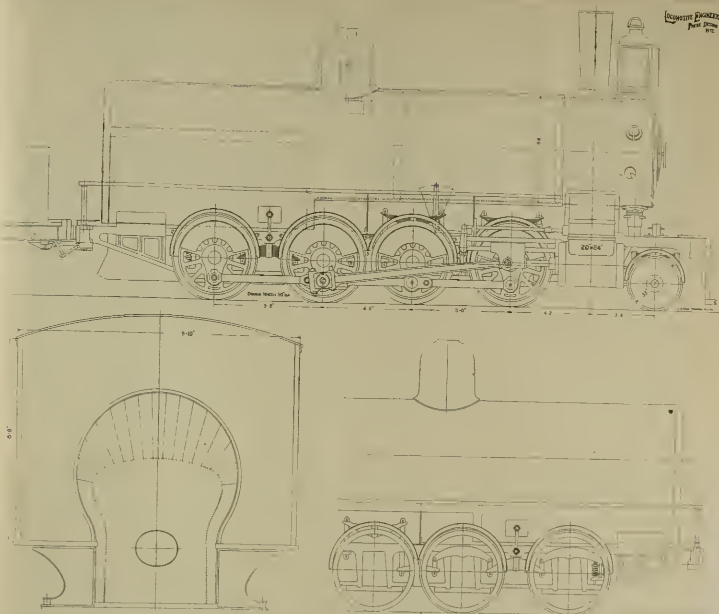
Fig: 2

elevated roads. He does away with relief valves in the chest and puts a small relief valve in the top of the valve, taking the place of the vent or leakage hole in ordinary balanced valves. The B. & O., the D., L. & W. and several other roads are using this device and report good results. The inventor claims that by the use of this valve all the advantages of the balanced slide valve is had as long as steam is used, but that when steam is shut off the valve practically becomes a plain D valve.



Chance to Earn $100, $50 or $25. See Particulars on Page 557.




$175.00 in Prizes to Finish this Design. See page 557.

# THE WESTINGHOUSE AIR-BRAKE CO.

# LOCOMOTIVE ENGINEERING PRIZE DESIGNS.

# $350

## In Rewards for Best Designs in Cab and Boiler Fittings.

SEE DRAWINGS ON PAGES 554 AND 555.

THE number of men scalded and cooked to death in wrecks is so great that little notice is taken of it. Practically nothing at all has been done, or attempted, to make Locomotive Boiler Fittings safer for those who handle them. The details of some of these wrecks are heart-rending. Instances are on record, and are common, where men have been held down by wreckage, but uninjured, until slowly cooked by escaping steam—one fireman was found with steam pouring out of his mouth and nose, the small pipe to the steam gauge had broken off and the end had partly penetrated his side (a wound of little consequences had there been no steam there). This is only a sample.

Nor does this danger exist for enginemen alone. Only last year a locomotive on the Colorado Midland Road struck the side of a loaded passenger car. The check broke off and killed the passengers—the force of the collision was not enough in itself to overturn the car. The Quincy wreck on the Old Colony was so frightful because the victims were imprisoned in a car crushed over the wrecked locomotive. Half the fatalities of railroad wrecks, and more than half the tortures can be prevented if the steam can be kept in the boiler.

Many locomotives are extremely uncomfortable and unhandy: boiler fittings are located in places where they are liable to be broken, are hard to handle or to pack; seats are poor and located where men cannot use them and handle the engine properly. Brake valves are located where they get hot and stick: where they are hard to reach, etc. Those who ride the engines day after day know how uncomfortable many of them are. All this can be made better.

The running repairs are troublesome and expensive. Grinding in valves takes time; takes the engine out of service, and is long neglected on that account. Is it necessary to grind in valves? Half the repairs of injectors is to the priming apparatus. Are primers necessary? Half the steam pipes in a cab are where they will be touched in handling some valve, where some of them are sure to be broken off in a wreck, and are in the way of the crew. Are they all necessary or can't they be shortened? There are a thousand reasons for improvement—life-saving reasons, comfort-promoting reasons; time-saving and money-saving reasons.

For all of these reasons LOCOMOTIVE ENGINEERING opens a **prize contest** to see if the brains of American railroad men can't be employed to make a bad thing better than it is.

### THE ENDS SOUGHT.

The above amount, $350, will be paid in prizes for the best design of Boiler and Cab Fittings for two classes of Locomotives — freight and passenger — showing the greatest improvement over present practice, tending to:
1st. Greater safety for the lives of the engine crews under any and all circumstances—especially in wrecks.
2d. Convenience in handling the locomotive, comfort of crew—consistent with best road service.
3d. Economy of time and money in keeping up running repairs.

### THE PRIZES.

**Design No. 1.** One Hundred Dollars ($100) cash for the best design for the Eight-Wheeled Passenger Engine. Fifty Dollars ($50) cash for the second best design. Twenty-five Dollars ($25) cash for the third best design.

**Design No. 2.** One Hundred Dollars ($100) cash for the best design for the Consolidation Freight Engine. Fifty Dollars ($50) cash for the second best design. Twenty-five Dollars ($25) cash for the third best design. Five Dollars ($5) cash to be paid for each design published that has not taken a prize.

### THE JUDGES

will be selected by lot from the following callings. One Superintendent of a Locomotive Works, One Superintendent of Motive Power, from a road having over 300 locomotives; One Chief Draughtsman of a locomotive works or general railroad shop; One Traveling Engineer, selected from the membership of the Traveling Engineers' Association; One Locomotive Engineer in actual service, from a list of the most prominent B. of L. E. men in this country. The names of the members of this Committee will be announced in the January number of LOCOMOTIVE ENGINEERING. They will meet at the Master Mechanics' Convention at Saratoga Springs, N. Y., in June and award the prizes, and the cash will be paid on or before July 4th. In case there is an absentee in the Committee, the remainder of them will elect a man from the same employment, if possible, as the absentee.

### CONDITIONS.

Separate designs and written descriptions must be submitted for each class of engine. Persons submitting design must place on the drawing some distinguishing mark (such as initials, *nom de plume* or device), and no name must appear on the drawings or in the written description of same. Drawings for one class only, together with written description, must be sent in one package and a sealed letter stating the name of the person or persons who submit the drawings marked as described. This letter will not be opened until after the judges have made the awards — they will judge on the merits of the designs alone. Nicety of drawing will not secure the reward, though it is to be commended: it is the *idea* that is wanted—the suggestion that can be used by railroads and by locomotive builders for the improvement of locomotives in the three lines we have laid down, namely safety of crew under all circumstances; convenience in handling, and economy in keeping up running repairs.

One person may submit as many designs as he cares to, but each must be separate, and use a different distinguishing mark. More than one person can have an interest in one design if desired. Drawings must be on white paper with black ink — no other will be considered. The printed drawings may be finished out, or new and larger ones submitted, but in each case they must be complete, and the same as printed design. Written description must briefly point out the intended improvement in each device and explain the working of same, but the intention is that the drawings shall tell the whole story. Unusual or new devices may be shown in sectional sketches on margin of drawings, but be it remembered that this is not a contest of merits of engine devices; the rewards will be given on the merits of the whole arrangement. The cab must be limited in width to the height and width marked on drawings. It can be made as long as desired and placed on engine in any position wanted.

### WHAT WILL BE FURNISHED.

Drawings of a complete locomotive, except cab and operating handles, lubricators, injectors, air brakes, etc. The throttle valve stem is left ready to connect. Designer can put on any kind of a throttle he thinks best and bring it out wherever he likes.

The tumbling shaft arm extends up the usual height ready to connect to the reach rod.

### WHAT TO DO.

Take either of the incomplete drawings and finish them. Put on everything necessary that is not shown. Everything above the running boards.

The passenger locomotive must be equipped with automatic air brakes, sight feed lubricators, steam heat connection and whistle signals.

The freight locomotive will have air brakes, sight feed lubricators and all modern improvements.

Locate and draw in the main drum, engine air brake equipment complete, throttle, reverse lever, gauge cocks, steam and air gauges, blower, cab light, etc. Decide on kind of injector and valves and locate all of them, arrange all hose connections between engine and tender. Locate whistle lever or cord, lay out windows of cab and arrange to handle and fasten them, choose design of check valves and all piping and boiler connections. Locate tank hand brake, either in sketch or description, locate shake levers, dampers and slide pullers, sand lever, cylinder cock lever, seats, arm rests, etc.—in fact, everything used to handle the locomotive.

### WHO MAY SUBMIT DESIGNS.

This contest is open to the world. There is absolutely no limit as to who may take part. Large prints of the drawings, in tubes (not folded), will be sent free, on request to any regular subscriber of LOCOMOTIVE ENGINEERING, or those who send subscriptions for a year with the request. We will have to ask others to send 20 cents for postage.

**All the Announcements as to Prize Winners and Engravings of Successful Designs will be printed only in LOCOMOTIVE ENGINEERING.**

# BALDWIN ✦ LOCOMOTIVE ✦ WORKS.

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ANNUAL CAPACITY **1,000 LOCOMOTIVE ENGINES.**

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# Pittsburgh Locomotive Works.

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FURNISHED AT SHORT NOTICE.

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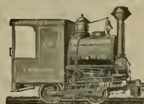

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POP SAFETY VALVES.

MUFFLED AND PLAIN.

IMPROVED

STEAM GAGES.

Single Bell

CHIME WHISTLES.

A perfect equipment for a locomotive, giving noiseless relief, accuracy and steadiness, agreeable tone. *Specify these goods when ordering locomotives*

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And Other Railroad Machinery.

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# LOCOMOTIVES OF ALL TYPES.

STANDARD OR NARROW GAUGE FOR ANY SERVICE FROM OUR OWN OR TO RAILROAD CO.'S SPECIFICATION.

**Freight Cars, Derrick Cars, Push Cars and Car Wheels,**

**Boilers of Locomotive, Horizontal, Tubular and Vertical Type**

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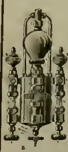
**THE DETROIT**

No. 2 and 3

SIGHT-FEED CYLINDER LUBRICATORS



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ARE THE BEST.

This Lubricator discharges oil to cylinders accompanied only by dry steam, consequently full effect of oil is obtained.

Cannot cross-feed.

No broken glasses by wear of steam and water.

DETROIT LUBRICATOR CO., Detroit, Mich.

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# Richmond Locomotive
AND MACHINE WORKS,

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Locomotives for Every Service.

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New York Office, 45 BROADWAY. H. A. ALLEN, Agent.

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NEW YORK OFFICE,

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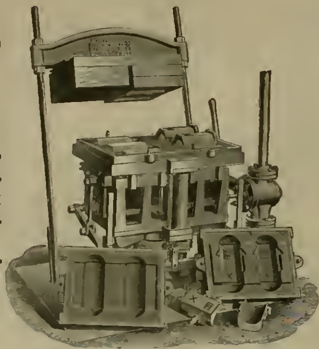

DUPLEX.

Our system produces better and cheaper castings than any other.

# Automatic ✣ Molding ✣ Machines

**Especially adapted for CAR BRASSES, BOXES and BRAKE SHOES.**

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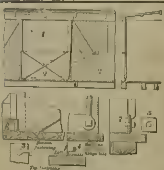

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**COMPARISON.**

Loss of Doors in Two Years:

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| 500 cars equipped with steel doors lost two doors. | 500 cars equipped with wooden doors lost 80 per cent. in the same time. |

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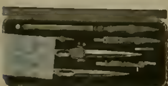

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For Steam or Joint Packing has no superior. It is manufactured in all thicknesses. It is not loaded to increase weight. Does not Rot or Break the [illegible] Every sheet is stamped with Trade Mark like cut.

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FOR RAILROAD WORK.

Vreeland's Transfer Jack

Will remove and replace Drivers or Trucks without jacking up

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**Over 50 Railroads.**
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Builders of Machine Tools for Railroad Shops

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## Ross Regulator Valve FOR CAR HEATING.

Low in price and always reliable. No complicated parts. Easily understood. Durable. Has no equal.

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## RICHARDSON & ALLEN-RICHARDSON,

**BALANCED SLIDE VALVES.**

New Patent, April, 1891.

6,000 Locomotives Equipped. In Use on 175 Railroads.

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